H. K. SANDELL.

PHONOGRAPH.

APPLICATION FILED NOV. 13, 1916.

1,331,214.

Patented Feb. 17, 1920.

4 SHEETS—SHEET 1.

Fig. 1.

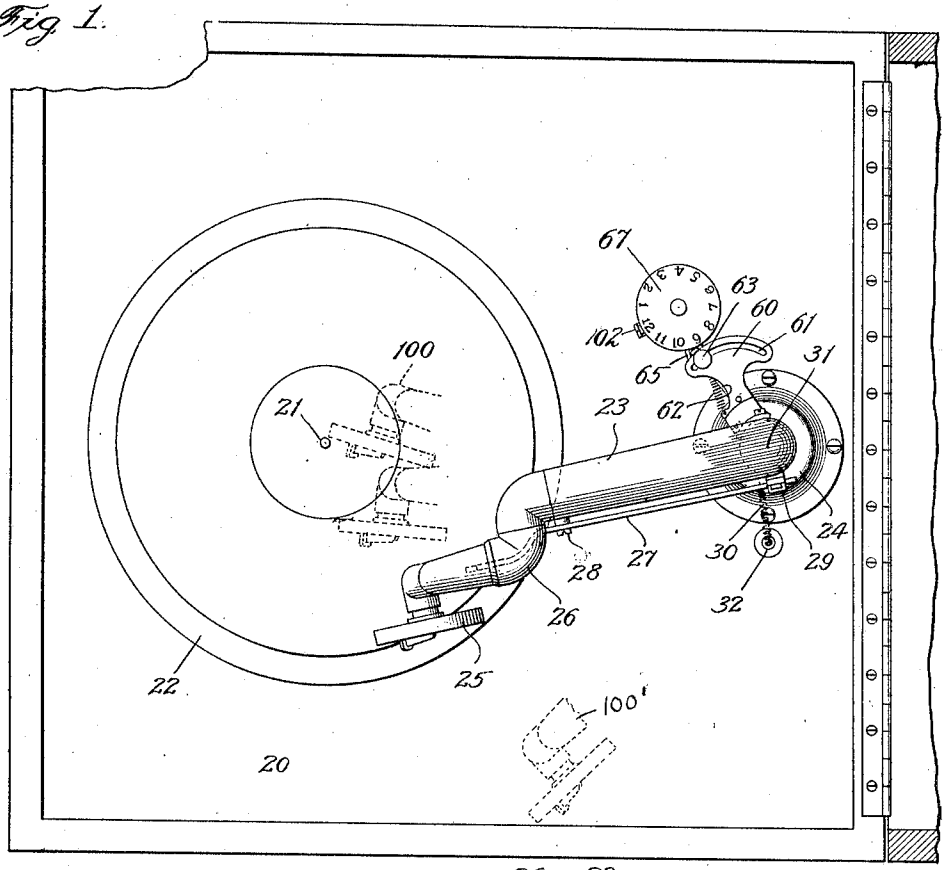
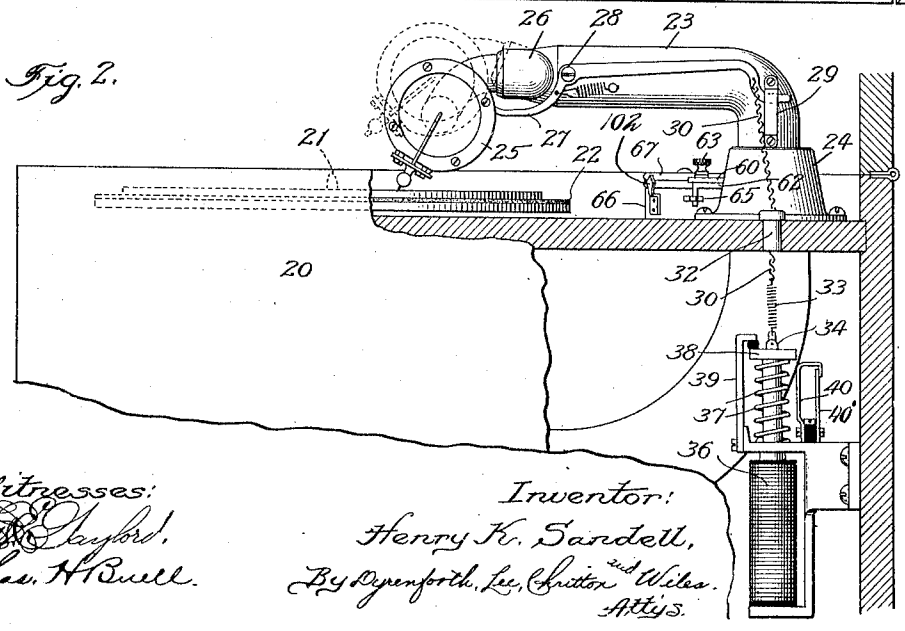


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 3.

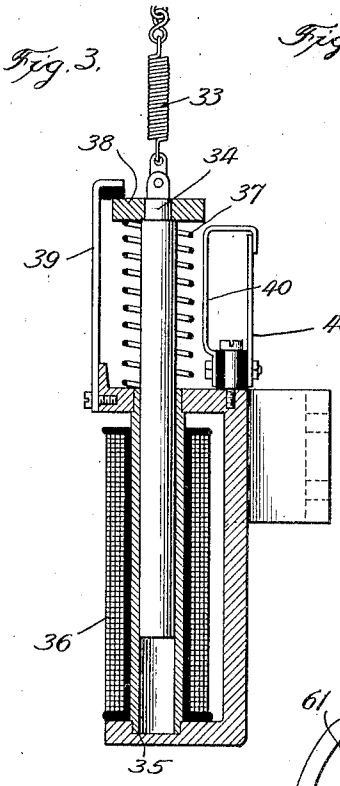


Fig. 7.

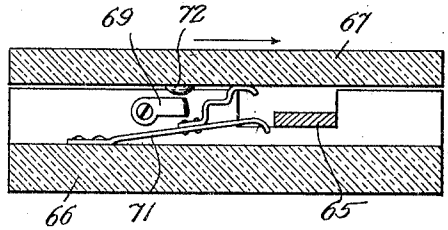


Fig. 6.

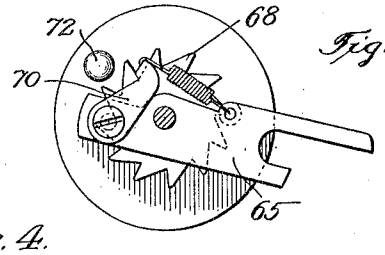


Fig. 4.

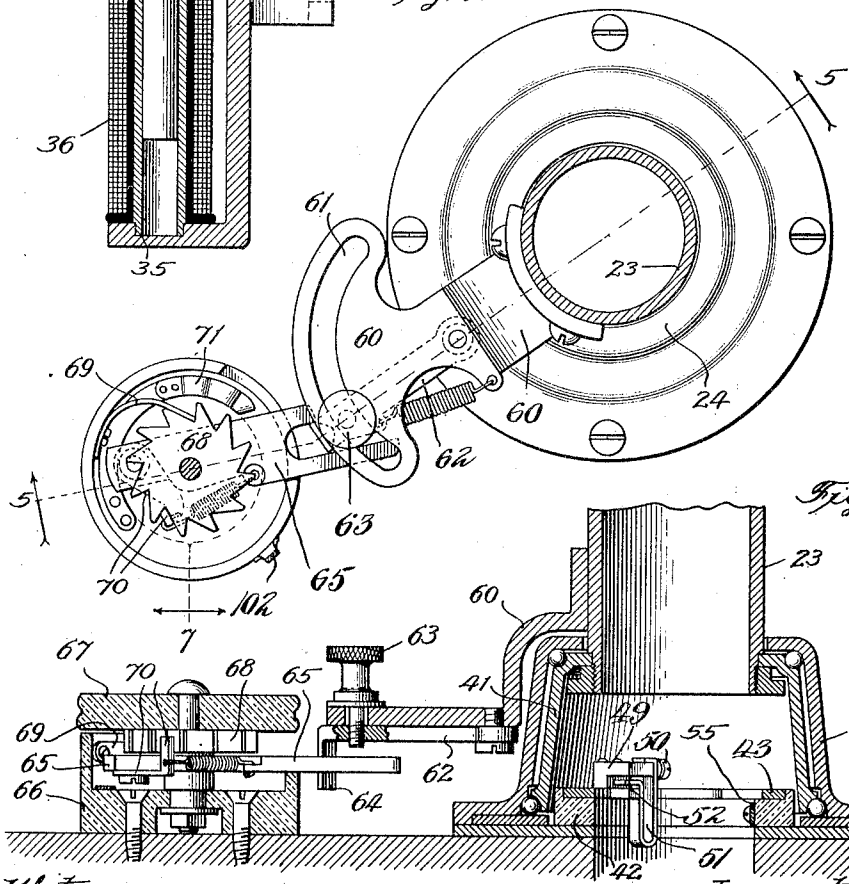


Fig. 5.

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4 SHEETS—SHEET 3.

Fig. 8.

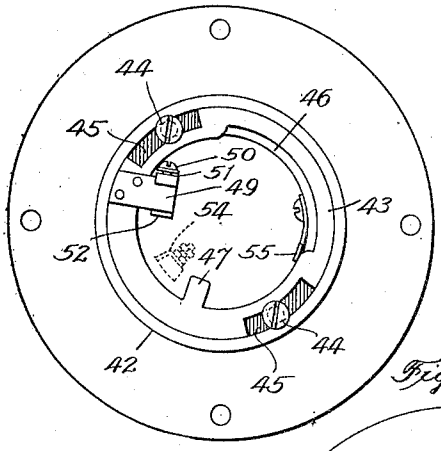


Fig. 9.

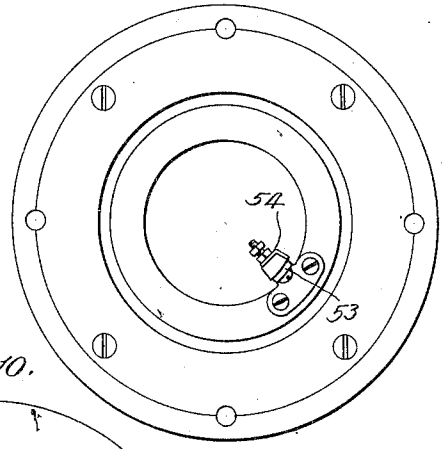


Fig. 10.

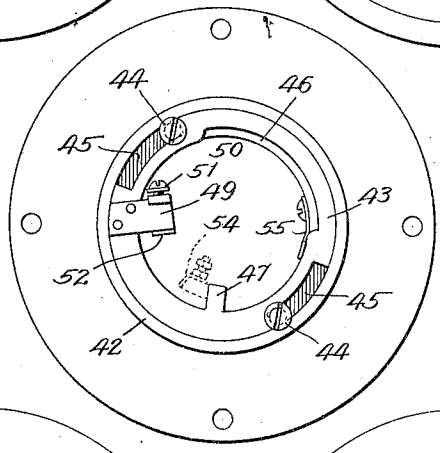


Fig. 11.

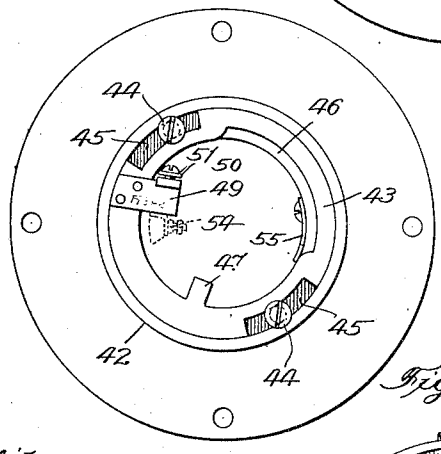


Fig. 12.

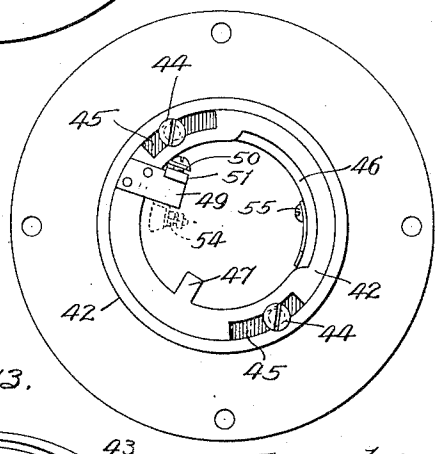
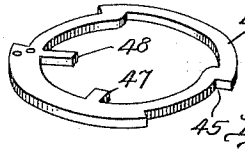


Fig. 13.



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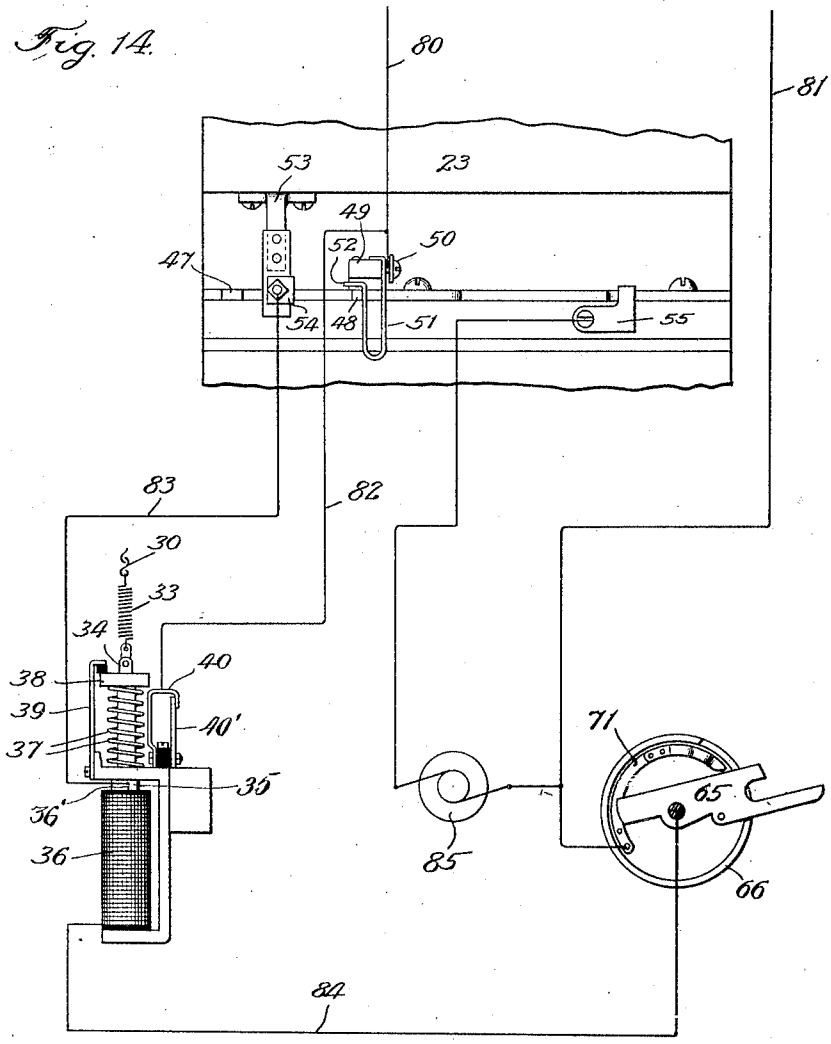
APPLICATION FILED NOV. 13, 1916.

1,331,214.

Patented Feb. 17, 1920.

4 SHEETS—SHEET 4.

Fig. 14.



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UNITED STATES PATENT OFFICE.

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PHONOGRAPH.

1,331,214. Specification of Letters Patent. Patented Feb. 17, 1920.

Application filed November 13, 1916. Serial No. 131,018.

To all whom it may concern:

Be it known that I, HENRY K. SANDELL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Phonographs, of which the following is a specification.

My invention relates to improvements in phonographs, and more particularly to a motor control mechanism for the same. The principal objects of the invention are to provide electrically-operated means for moving the reproducer-arm to cause a record to be repeated one or more times and means for automatically stopping the motor. The invention will be fully understood from the following detailed description of a specific embodiment thereof, taken in connection with the accompanying drawings, in which—

Figure 1 is a plan view of a phonograph constructed in accordance with my invention; Fig. 2 is a side elevation, partly in section, and showing the operating solenoid for the reproducer-arm; Fig. 3 is an enlarged sectional view through the solenoid; Fig. 4 is an enlarged horizontal section through the base of the reproducer-arm showing in plan view the repeat adjustment mechanism; Fig. 5 is a section on the line 5 of Fig. 4; Fig. 6 is a bottom plan view of the adjustment dial of the repeat mechanism; Fig. 7 is an enlarged section of the repeat switch taken on the line 7 of Fig. 4; Figs. 8, 10, 11 and 12 are top plan views of the reproducer-arm switch; Fig. 9 is a bottom plan view of the same; Fig. 13, is a perspective view of the movable ring of the reproducer-arm switch; and Fig. 14 is a diagram of the electrical connections of the phonograph.

Reproducer-arm and operating means therefor.

Referring more particularly to the drawing, the numeral 20 designates the cabinet or housing within which the phonograph is mounted. This housing incloses an electrical motor which may be of any design and which drives through suitable gearing a table-shaft 21 carrying a record-table 22. A reproducer-arm, designated as a whole by 23, is carried in ball-bearings in a base 24 (Fig. 5), the arm being adapted to swing across the face of the record-table in a well-understood manner. The reproducer proper of the arm 23 is designated 25 and is pivotally supported upon the arm by a double elbow-joint 26 (Fig. 1). The pivoted end-section of the arm, which carries the reproducer, has connected thereto the end of a light horizontal lever 27 journaled upon a screw 28 in the body of the arm and extending rearwardly along the arm, its free end working in a vertical guide 29 secured near the base of the arm, by which guide the movement of the lever 27 is limited. A chain or other flexible connector 30 has its upper end caught in the lever 27 a short distance in front of the pivotal axis 31 (Fig. 1) of the reproducer-arm. The chain 30 passes downwardly through an aperture 32 in the upper face of the casing, this aperture being suitably located with reference to the pivotal axis of the arm, as will later appear, and at its lower end is connected with a tension-spring 33 which, in turn, is caught in the end of a solenoid-plunger 34 (Fig. 3). The plunger 34 has a working-fit within a brass sleeve 35 to form with the latter a dash-pot or damper. The solenoid is provided with a coil 36, and the plunger thereof is normally held in the outward position by a spring 37 abutting against a collar 38 on the upper end of the plunger. This collar which also serves as a contact-device, normally bears against a stop-finger 39 attached to the frame of the solenoid. A coöperating contact is provided by a spring 40 insulated from the frame of the solenoid and extending parallel with the plunger thereof to constantly bear against the collar 38 during the travel of the latter, but to free the collar in the normal position of the same, the movement of 40 toward 38 when out of contact therewith being limited by a stop finger 40′ with which it coacts.

It is the function of the solenoid-plunger 34 to elevate the reproducer 25 and to swing the reproducer-arm across the face of the record in the repeating operation of the machine. This mechanical result is accomplished by the arrangement of the aperture 32 in the casing 20 with reference to the axis 31 of the reproducer-arm. As shown in the drawings, the chain connector 30 is

caught in the lever 27 a short distance in front of the arm-axis 31, the chain extending from this point outwardly, downwardly and rearwardly to the aperture 32. Assuming the reproducer-arm to occupy any position near the center of the record-table, a pull upon the chain 30 will therefore serve to oscillate the lever 27, elevating the reproducer proper by movement of the latter on the elbow-joint, and simultaneously, or, rather, subsequently, to swing the arm 23 as a whole in a counter-clockwise direction, that is, toward the outside of the record-table. It will be noted that the rear arm of the lever 27 is much longer than the front arm thereof, and by reason of the great leverage thus afforded, and further by reason of the fact that the connection of the chain 30 to the lever is only an exceedingly short distance in front of the pivotal axis of the arm, I find that in the mechanical operation of the parts, the lever 27 will invariably be drawn downwardly to elevate the reproducer before there is any sensible swinging motion imparted to the reproducer-arm.

Reproducer-arm switch.

Referring again to Fig. 5, it will be seen that the base 24 which supports the bearing for the reproducer-arm is enlarged, the arm having secured to its end a frusto-conical nipple 41 which serves as the bearing-member proper. In the bottom of the cavity provided by the enlarged base and bearing-member there is secured an annular switch-structure comprising a stationary ring 42 formed of fiber or other insulating material having its upper face grooved to receive a rotatable or movable switch-ring or member 43 (Fig. 13) which is secured for limited movement in the groove of the stationary ring by screws 44 entering the latter and having their heads working in notches 45 in the periphery of the movable ring. The inner peripheral edge of the ring 42 is cut away at one portion, as indicated at 46 in the drawings, the cut-away portion extending over approximately 90° of the circumference. The inner periphery of the ring is further provided with radially-extending lugs 47—48 arranged substantially at the corners of the quadrant opposite the cut-away portion 46. There is riveted to the upper face of the ring 43 directly above the lug 48 an inwardly extending fiber-lug 49, to which is secured a binding-screw 50 in contact with a U-shaped spring-finger 51, which normally engages the adjacent face of the lug 48 (Fig. 14). The fiber-lug 49 is cut away on its lower surface to permit one end of the U-spring 51 to be turned outwardly, as indicated at 52, between the opposed faces of the fiber-lug 49 and metal-lug 48.

The end of the reproducer-arm 23 has secured thereto a depending foot 53, shown in full lines in Figs. 9 and 14, to which foot there is secured a fiber block which in turn carries a binding-screw and metallic contact-piece, designated 54, the said contact lying in the plane of and in the arcuate line of the lug 48 of the movable switch-ring 43, as is indicated by the dotted lines in Figs. 8, 10, 11 and 12. The contact-piece 54 lies only on one side of its supporting block, so as to engage the out-turned end of the U-spring 51, but not to engage the lug 47.

The switch construction is completed by an L-shaped contact-spring or stationary switch element 55 which is fastened to the inner periphery of the base-ring 42 and has its upturned end lying in the path of the movable ring 43, to engage and disengage the latter as the notched quadrant 46 moves toward and away from the spring.

The mechanism above described constitutes a switch controllable by the swinging movement of the reproducer-arm, the depending foot 53, which is attached to the arm, operating the switch in three ways, *i. e.*, revolving the ring 43 as a whole, to cause the latter to be engaged or disengaged by the L-shaped contact 55, closing the circuit between the foot-contact member 54 and the spring terminal 52 by engagement of these parts, and opening the circuit between the spring 51 and the metallic lug 48 of the switch-ring by pressure upon the out-turned extremity 52 of the spring.

Repeat mechanism.

The mechanism by which the phonograph is caused to automatically repeat any particular record a predetermined number of times is also operated by movement of the reproducer-arm, through a casting 60 secured to the same near its base and extending outwardly over the face of the cabinet-head. The outer end of the casting 60 is of arcuate form and is provided with a quadrant-slot 61, the arc of which is struck from the pivot-point of a lever 62 secured to the lower face of the casting. This lever has an adjustment-screw 63 which operates within the slot and by means of which the lever may be fixed in any adjusted position. The outer end of the lever is down-turned, as shown at 64 in Fig. 5, to engage the forked extremity of a ratchet-operating lever 65 journaled centrally in a case 66 mounted on the upper face of the cabinet-head. The journal-pin of the ratchet-lever 65 extends upward to rotatably support the casing-cover 67, which constitutes the adjustment dial for the repeat mechanism, this dial having numerals engraved upon its upper face, as shown in Fig. 1. Secured to the lower, or inner, face of the adjustment dial there is a ratchet-wheel 68, the teeth of which cor-

respond in number and position to the numerals on the face of the dial. The ratchet-wheel is held against rotation in one direction by a locking spring 69 secured to the casing 66, and is positively rotated in the other direction by a spring-held pawl 70 pivoted to the ratchet-operating lever 65.

Within the rabbeted-out portion of the casing 66 there is mounted a contact-spring 71 of generally arcuate form and having a bifurcated end, as shown in Fig. 7, the spring having a normal set which causes one of the bifurcations of the end to bear against the lower face of the cover or dial-disk 67. In this normal position of the contact-spring the lower bifurcation thereof engages the ratchet-operating lever 65 when the latter is moved toward the spring. The inner face of the cover-disk 67, however, carries a rivet head or other proturberance 72, which is adapted to engage the upper bifurcation of the contact-spring, and through this engagement to depress the spring as a whole, so that the ratchet-operating lever 65 may pass freely between the bifurcations without engaging either.

The mechanical operation of the repeat mechanism may be briefly described as follows: The lever 62 affixed to the casting 60, having been secured in proper operative adjusted position, will engage and oscillate the ratchet-operating lever 65 each time the reproducer-arm is swung in a counter-clockwise direction, and for each such swing of the arm the ratchet-wheel 68 will be rotated through the distance of one tooth, the wheel carrying with it the cover-disk or dial 67 in such movement. When the dial has thus been rotated through a certain angular distance, as predetermined by the initial adjustment of the dial, the protuberance 72 thereon will engage the contact-spring 71 to depress the latter out of the path of the ratchet-operating lever 65.

Electrical connections.

The electrical connections of the phonograph are shown diagrammatically in Fig. 14. In this view, the numerals 80 and 81 designate the two service lines by which power is supplied. The line 80 is connected directly with the binding-screw 50 of the contact 51. A shunt 82 from this line 80 is led to the insulated spring 40 mounted on the solenoid-frame. A second shunt 83 connects the contact-member 54 secured to the foot 53 on the reproducer-arm with the frame of the solenoid. One end of the winding of the latter is grounded on the solenoid frame as at 36′, while the other end is connected by a conductor 84 with the ratchet-operating lever 65. The contact 71 which the ratchet-operating lever engages is connected directly with the other service-line 81. The driving motor for the phonograph, designated 85, is connected between the line 81 and the contact-member 55 of the reproducer-arm switch.

Operation.

Save for the adjustment of the repeat mechanism mentioned, the operation of my phonograph is controlled entirely by the movement of the reproducer-arm. By swinging the arm to the approximate center of the record-table, as indicated by the dotted line figure of the reproducer, designated 100 in Fig. 1, the movable switch-ring 43 is turned so far that the recessed quadrant 46 lies opposite the spring contact 55. The energizing circuit of the phonograph-motor 85 is thereby interrupted, and this, therefore, is the normal or "off" position of the parts. As will later appear, however, the phonograph will, in ordinary usage, automatically stop itself without movement of the switch-ring 43. Let it be assumed that a record has been placed on the table and it is desired to play this record once and then to automatically stop the phonograph. The screw 63 will now be loosened, the reproducer lifted by hand, and the reproducer-arm swung to the extreme counter-clockwise position shown in dotted lines at 100′ on the drawing. In such movement the lever 62 will be swung to the far end of the slot 61, and owing to the curvature of this slot, the end of the lever will have been moved so far toward the pivotal center of the reproducer-arm as to free the shorter bifurcation in the end of the lever 65. The screw 63 will now be tightened to hold the lever 62 in this inoperative position. The switch-ring 43 having been moved to its extreme counterclockwise position by the above movement of the reproducer-arm by reason of the coaction of foot 53 with lug 47, the arm may now be moved inwardly to the inner end of the record, and in such movement the switch-ring will be adjusted in a clockwise direction by the depending foot 53 coacting with contact 52, so that the lug 48 and the overlying spring-contact 52 thereof will occupy a proper position relative to the radial extent of the playing surface of the record. The reproducer will then be moved to the outer end of the record, and, it being assumed that the service-lines are energized, the table will now be in rotation, the circuit of the motor 85, being closed through the spring 55, ring 43, lug 48, spring 51, and thence to the line 80. The reproducer being let down upon the record, the phonograph will function in the ordinary manner, the reproducer-arm being fed gradually across the face of the record. When the end of the record has been reached, the contact-member 54 of the reproducer-arm switch will engage the end 52 of the spring 51, closing the circuit at this point through the

coil of the solenoid. Owing to the fact that the repeater-switch is open between the lever 65 and contact 71, the solenoid will not be energized, however. The reproducer will therefore continue to feed past the end of the record, thereby forcing the spring contact 51 out of engagement with the lug 48. By this means the circuit through the motor 85 is automatically interrupted, and the phonograph stops.

Let it be assumed that it is desired to play the same record twice, and then to automatically stop the machine. The record will be placed on the table, the screw 63 loosened, and the reproducer-arm moved to its extreme outward position 100′ and then inwardly to the end of the record, for the purpose of properly setting the ring 43 relative to the radial extent of the playing surface of the record, as before described. The arm will now be moved back to the beginning of the record, and, the lever 62 being in engagement with the ratchet-operating lever 65, the screw 63 will be tightened. The adjustment dial 67 will then be set so that the numeral 2 coincides with the pointer 102 or other indicator for the dial, and in such setting the protuberance 72 on the inner face of the dial will be moved through the angular distance of one ratchet tooth away from the contact 71. The reproducer now being laid down upon the record, the phonograph will play in the usual way until the end of the record is reached. At that time the contacts 54 and 52 will engage, as heretofore described, and the solenoid-coil 36 will now be energized, the ratchet-operating lever 65 completing the circuit from the conductor 84 through the spring 71 to the service-line 81. As the solenoid is energized, the plunger thereof will be drawn downwardly to first elevate the reproducer above the record and then swing the reproducer-arm across the face of the record to the initial or starting position. It should be noted that, upon the initial swinging movement of the reproducer-arm, contact will be broken between the points 54 and 52, but by reason of the fact that its initial downward movement has caused the collar 34 on the upper end of the solenoid plunger to engage the spring 40, the solenoid will continue to be energized through the shunt-circuit 82, and will thereby effect the complete return movement of the reproducer-arm. At the limit of its return movement, as determined by the proper initial adjustment of the screw 63, the ratchet-operating lever 65 will be oscillated in a clockwise direction, as viewed in Fig. 4, to turn the ratchet and its dial through the angular distance of one tooth, and to simultaneously break the solenoid circuit between the lever 65 and contact 71. The solenoid being thus deënergized will slowly return to its normal position, permitting the reproducer to again come in contact with the record. By reason of the dash-pot construction of the solenoid-plunger, this lowering of the reproducer will be effected so slowly as to avoid all chance of injury to the record. It may here be noted that the spring 33 which is introduced between the solenoid-plunger and the operating-chain 30 insures the completion of the movement of the reproducer-arm. Thus, it will be understood that since the movement of this reproducer arm effects the opening of the solenoid-circuit (through the ratchet-operating lever 65) the solenoid must, in fact, be deënergized some short time before the reproducer-arm has reached the desired position. The spring 33 having been tensioned through the movement of the arm, will, however, continue to pull upon the arm after the solenoid-plunger has stopped moving, the time interval of the dash-pot being sufficient to permit the spring to positively draw the arm to the limit of its movement. The reproducer having been permitted to again engage the record, the latter will be played again, and the cycle of operations above described repeated, the ratchet-wheel and the connected dial being moved through the angular distance of one tooth at each such repetition. In the illustration chosen, one such movement of the ratchet-wheel will bring the protuberance 72 into engagement with the contact-spring 71, thereby moving the latter out of the path of the ratchet-operating lever. When the reproducer-arm then moves to the inner end of the record, the phonograph will be automatically stopped, as first described, the solenoid-circuit by which the repeating action is obtained having been opened by the last previous return movement of the reproducer-arm.

While I have shown and described in considerable detail one specific embodiment of my invention, it is to be understood that this is illustrative only and for the purpose of making the invention more clear, and that I do not regard the invention as limited to the details of construction illustrated or described, nor to any of them, except in so far as such limitations are included within the terms of the following claims, in which it is my intention to claim all novelty inherent in my invention as broadly as is possible in view of the prior art.

What I claim as new and desire to secure by Letters Patent, is:—

1. In a phonograph and, in combination, a record support, an electrical driving motor therefor, a reproducer arm mounted to travel across a face of a record carried by the said support, electrically operated means for effecting a return movement of the said arm, means operable by movement of said arm past the end of its playing travel to stop the said driving motor, and means operated by the movement of said arm to the

end of its playing travel to energize the said arm-returning means and including a manually-operated selector for controlling the operation of the said means to stop the motor or energize the arm-returning means.

2. In a phonograph and, in combination, a record support, a driving motor therefor, a reproducer arm mounted to travel across the face of a record carried by the said support, electrically controlled means for effecting a return movement of the said arm, coöperative switch mechanism operable by the movement of the arm past the end of its playing travel to stop the said driving motor and by its movement to the end of its playing travel to energize the said arm returning means, and a selector mechanism for selectively controlling the operation of said switch mechanism to stop the motor or energize the arm-returning means.

3. In a phonograph and, in combination, a record support, a driving motor therefor, a reproducer arm mounted to travel across the face of a record carried by the said support, electrically controlled means for effecting a return movement of the said reproducer arm, means operable by movement of said arm to the end of its playing travel for energizing said return mechanism, and by movement of the arm past the end of its playing travel for stopping said driving motor, a selector for throwing out of operation either the arm-return mechanism or the driving motor stopping mechanism, and means actuated upon each return movement of the arm for moving the said selector, whereby the final operative movement of said selector may be accomplished by a number of return movements of the arm predetermined by the initial setting of the said selector.

4. In a phonograph, a traveling reproducer arm, an electric motor for effecting the return movement thereof, means actuated by movement of said arm toward the end of its playing travel for closing the circuit of the said motor, and means actuated by the said motor for maintaining its own circuit closed during the return movement of the arm.

5. In a phonograph, a traveling reproducer arm, an electric motor for effecting the return movement thereof, means actuated by movement of said arm toward the end of its playing travel for closing the circuit of the said motor, means actuated by the said motor for maintaining its own circuit closed during the return movement of the arm, and means actuated by movement of said arm to the limit of its return stroke for opening the circuit of said motor.

6. In a phonograph and, in combination, a traveling reproducer arm, a switch element having a limited movement, a lost-motion connection between the reproducer arm and the switch element for adjusting the position of the latter by movement of the former and for permitting limited free movement of the arm independently of the said switch element, and contact devices carried by the said switch element and operable by movement of the arm within its limit of independent motion.

7. In a phonograph and, in combination, a driving motor, a traveling reproducer arm, a switch element having a limited movement and having a lost-motion connection with the reproducer arm for adjusting the position of the former by movement of the latter and for permitting limited free movement of the arm independently of the said switch element, contact means carried by the said switch element and operable by movement of the arm within its limit of free motion for controlling the circuit of said motor and an additional contact means operable by movement of the movable switch element for intially establishing said motor circuit.

8. In a control switch adapted for actuation by a phonograph reproducer arm and comprising a stationary switch element and a movable switch element coöperating therewith to establish a circuit, a lost-motion connection with the reproducer arm operable by the latter for adjusting the movable switch element while permitting a limited independent movement of the reproducer arm, and contact devices carried by the movable switch element for actuation by the reproducer arm in the independent movement of the latter for controlling said circuit.

9. In a phonograph having a record table, a traveling reproducer arm, arm-return means, a stationary switch element, a movable switch element adapted to engage and disengage the stationary element to establish a circuit for operating the table, lost-motion connections being provided between the movable element and the said reproducer arm for operating the former from the latter while permitting the latter to move independently, a movable contact member, means for closing a circuit for operating said arm-return means by coaction between said movable contact member and a member connected with the movable switch element by travel of the reproducer arm to the limit of its playing movement, the reproducer arm operating to open said table operating circuit by operation of the member connected with the movable switch element upon further travel of said reproducer arm in the same direction.

10. A control mechanism for repeating phonographs comprising a movable contact element forming a part of the circuit of an arm return motor and coöperating with a stationary contact, and a movable adjusting element adapted when in one position to pre-

vent operative contact of said elements, and mechanical connections between the movable contact element and the adjusting member for progressively moving the latter at each movement of the former.

11. In a phonograph and, in combination, a traveling reproducer arm, an electric motor for effecting the return movement of the arm, a cut-out device in circuit with the said motor and operable by the movement of the arm to the limit of its return stroke, a manually-set repeat-adjuster, connections between the cut-out device and the repeat-adjuster for cumulatively moving the latter by the intermittent movements of the former, and means carried by said repeat-adjuster for rendering inoperative the circuit-closing mechanism of the said cut-out device in a predetermined position of the repeat-adjuster.

12. In a phonograph and, in combination, a hollow base, a hollow reproducer support pivoted thereto, an annular switch mounted within the said base, and means extending within said base and connected with said reproducer support for operating the said switch by movement of the reproducer support.

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