W. C. MILES.

DEVICE FOR WINDING AND REWINDING MOTORS.

APPLICATION FILED NOV. 15, 1917.

1,327,567.

Patented Jan. 6, 1920.

2 SHEETS—SHEET 1.

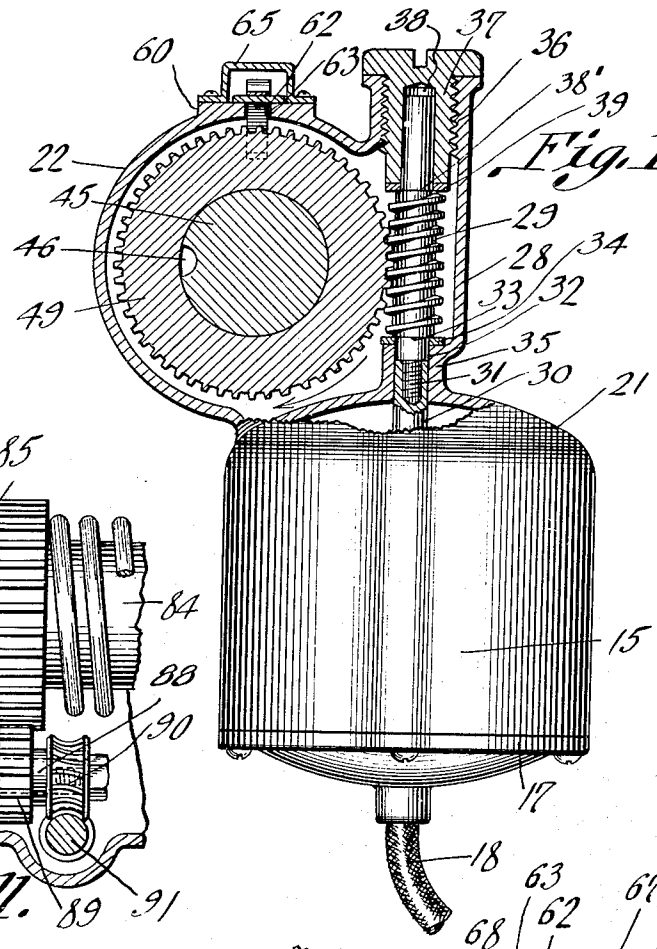


Fig. 1.

Fig. 11.

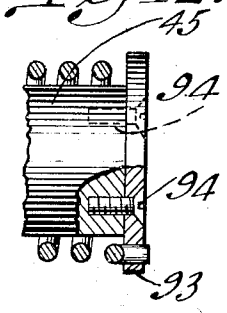


Fig. 12.

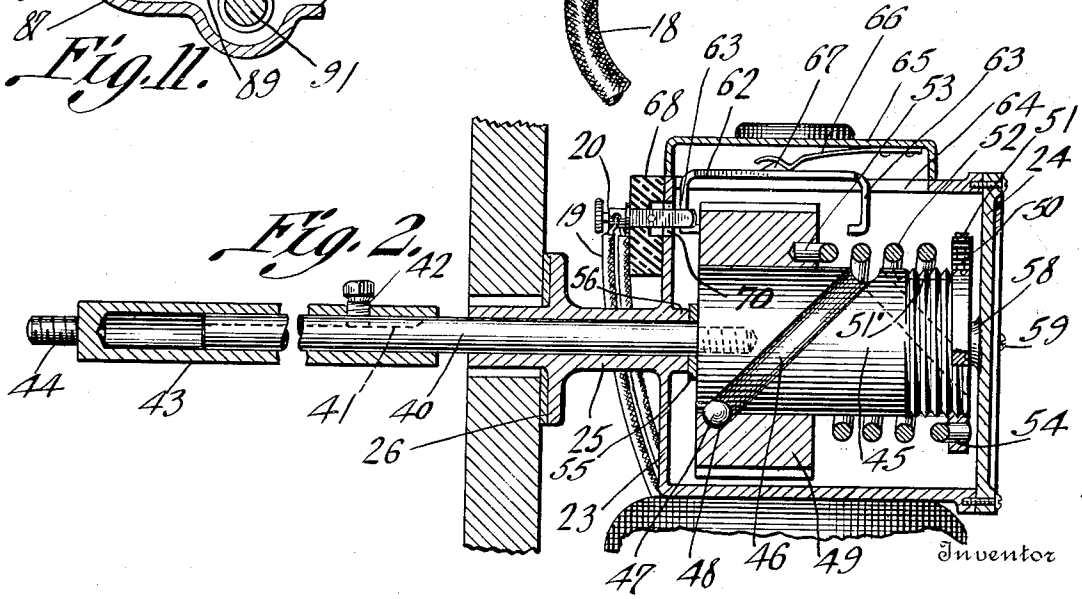


Fig. 2.

Witness

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Inventor

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W. C. MILES.

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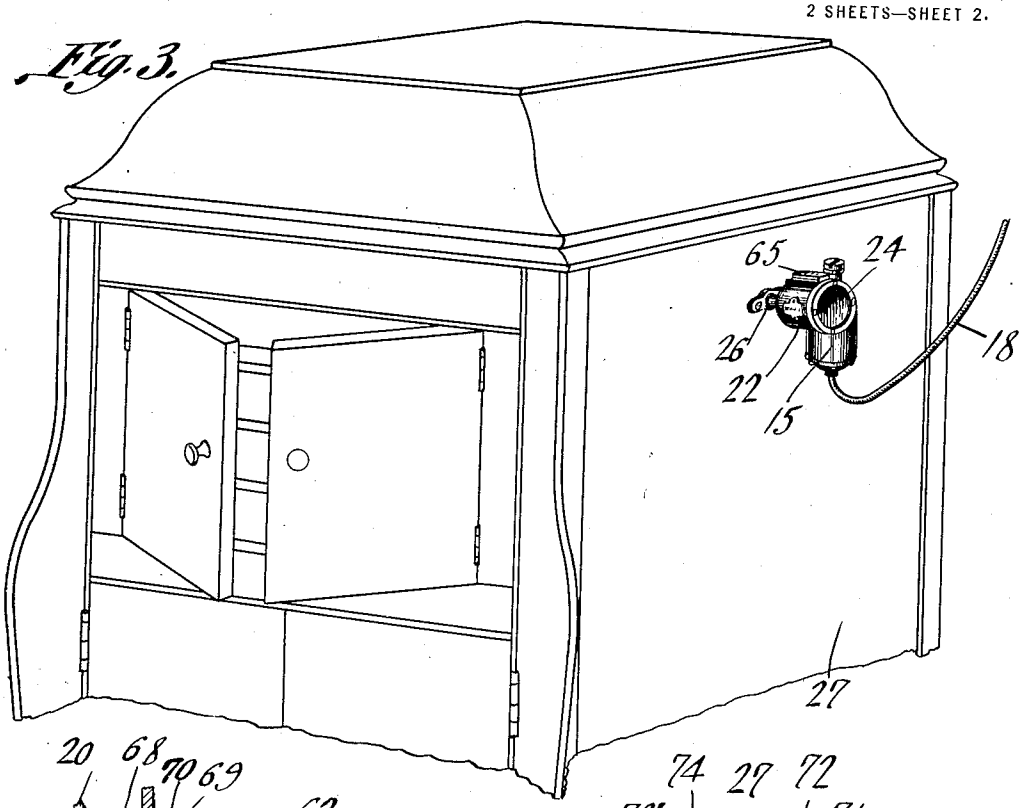
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2 SHEETS—SHEET 2.

Fig. 3.



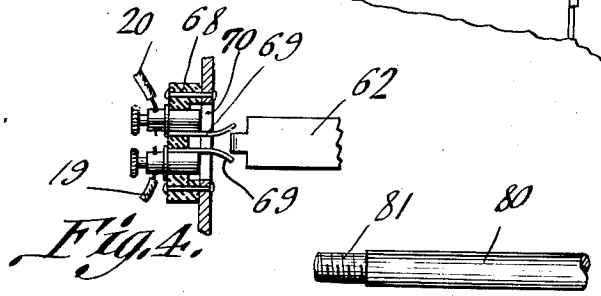


Fig. 4.

Fig. 10.

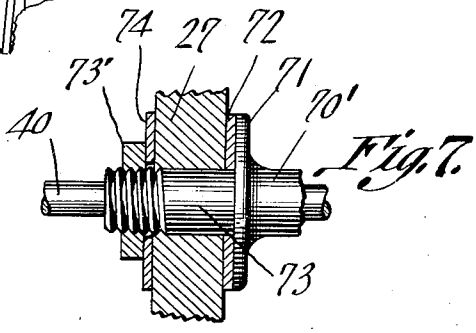


Fig. 7.

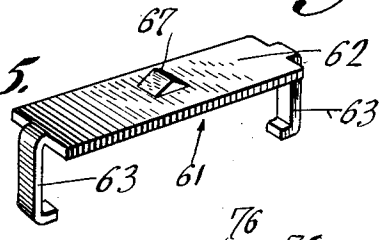


Fig. 5.

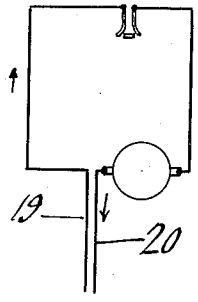


Fig. 6.

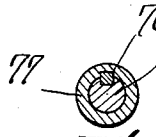


Fig. 8.

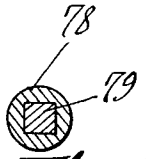


Fig. 9.

Witness

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UNITED STATES PATENT OFFICE.

WILLIAM C. MILES, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR OF ONE-FOURTH TO NORMAN T. WHITAKER, OF WASHINGTON, DISTRICT OF COLUMBIA.

DEVICE FOR WINDING AND REWINDING MOTORS.

1,327,567. Specification of Letters Patent. **Patented Jan. 6, 1920.**

Application filed November 15, 1917. Serial No. 202,188.

To all whom it may concern:

Be it known that I, WILLIAM C. MILES, a citizen of the United States, and a resident of Washington, in the District of Columbia, have invented new and useful Improvements in Devices for Winding and Rewinding Motors, of which the following is a specification.

My invention relates to devices for winding and rewinding motors particularly of the spring actuated types.

An important object of the invention is to provide a device of the above mentioned character which is adapted for attachment with a phonograph and to be used for winding the spring motor employed therein.

A further object of the invention is to provide in a device of the above mentioned character a means whereby the device may be readily attached to a phonograph.

A further object of the invention is to provide in a device of the above mentioned character a means whereby the several working elements employed therein may be operated with the least possible amount of friction.

A further object of the invention is to provide in a device of the above mentioned character a means whereby a maximum degree of silence may be attained in the operation of the device as a whole.

A further object of the invention is to provide in a device of the above mentioned character a means whereby any one or all of the several functioning elements employed in the device may be easily removed to permit the substitution of new elements for the old.

A further object of the invention is to provide in a device of the above mentioned character a means whereby perfect lubrication of the several working elements may be maintained.

A further object of the invention is to provide in a device of the above mentioned character a means whereby a lubricant may be confined to only such elements of the device as are deemed necessary to be supplied therewith.

A further object of the invention is to provide in a device of the above mentioned character a means whereby certain desired adjustments of certain elements of the device may be readily made to meet various conditions under which the device will be required to operate.

A further object of the invention is to provide a device of the above mentioned character which is simple in construction, inexpensive to manufacture, strong, durable, and reliable in operation.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a view showing the device, embodying my invention, partly in elevation and partly in section,

Fig. 2 is a sectional view of the same,

Fig. 3 is a perspective view of a phonograph showing the device attached thereto,

Fig. 4 is a detail view of a circuit closure,

Fig. 5 is a perspective view of a reciprocatory switch,

Fig. 6 is a diagrammatical view of a wiring system,

Fig. 7 is a view showing a modified form of a clamp,

Fig. 8 is a view showing a modified form of an adjustable shaft,

Fig. 9 is a view showing another modified form of an adjustable shaft,

Fig. 10 is an elevation of a portion of a shaft,

Fig. 11 is a modified form of a transmission, and,

Fig. 12 is an edge elevation of a plate showing the same secured to a drum.

In the drawings, attention being called to Figs. 1 to 5 inclusive wherein is shown a preferred embodiment of the invention, the numeral 15 indicates a housing carrying therein an electric motor, not shown. This housing is provided at one end thereof with a detachable cap or closure 17 through which a conduit 18, carrying electrical conductors 19 and 20, is adapted to be passed. Upon the closed end 21 of the housing 15 there is disposed, and preferably cast integral therewith, a transmission casing 22, one end of which is closed as shown at 23,

while the other end is provided with a detachable plate or closure 24 adapted to be secured thereon by means of screws or the like as shown. To the closed end of the transmission casing 22 there is secured a bearing shank 25, provided with a flange or plate 26 adapted for attachment to a phonograph 27 by means of screws, or the like, as shown. Upon one side of the transmission casing 22 there is disposed, and preferably formed integral therewith, a barrel 28, the interior of which communicates with the interior of the transmission casing 22 as shown.

Within the barrel 28 there is carried a worm shaft 29, one end of which is held in screw-thread engagement with the end of armature shaft 30 as shown at 31. This worm shaft 29 is provided with a shoulder 32 adapted to abut the end of armature shaft 30, as shown. In order to prevent an end thrust of the worm shaft upon the armature shaft 30 in the direction of the motor, there is provided a second shoulder 33 adapted to engage a washer 34 imposed upon an offset 35 carried within the barrel 28. One end of the barrel 28 is provided with internal screw-threads as shown at 36, which screw-threads are adapted for engagement with external screw-threads carried by a journal 37, having provided centrally therein a bore 38 designed to receive the outer end of the worm shaft 29 as shown. In order to prevent an end strain of the worm shaft 29 upon the armature shaft 30 in a direction toward the journal 37, there is provided by the shaft, relatively near the outer end thereof, a shoulder 38′ adapted to engage a washer 39 imposed upon the inner end of the journal 37, as shown. The washers 34 and 39 serve not only to prevent an end thrust in one direction and an end strain in the other direction upon the armature shaft 30 but also as a means whereby certain wear upon the worm shaft 29, due to constant and prolonged use of the device as a whole, may be compensated without necessitating the installation of a new one.

Within the shank 25 there is journaled a shaft 40, the outer end of which is provided with a groove 41, adapted to receive therein a set-screw 42 carried by a sleeve 43 slidably mounted upon the shaft and provided with an externally threaded end 44 adapted to engage the winding shaft of a spring motor not shown. The end of the shaft 40, extending into the transmission casing 22 is provided with screw-threads, and is adapted to receive thereon and in screw-thread engagement therewith a drum 45 provided with a spiral groove 46, receiving therein a ball 47 trapped with a socket 48 carried internally of a gear 49 which is slidably and rotatably mounted upon the drum. The spiral groove 46 terminates relatively near that end of the drum to which the shaft 40 is secured in order to impede the longitudinal movement of the gear, with respect to the drum, toward that end of the drum to which the shaft 40 is secured. An internally screw-threaded ring 50 is mounted upon the drum 45 and provided with a radially extending set screw 51, adapted to engage a groove 51′ and lock the ring in position with respect to the drum. The ring 50 serves both as a means for retaining a coil spring 52 upon the drum 45 and as a means for varying the tension of the same whereby the tensions, of the spring motor, at which the device as a whole will be rendered operative and inoperative may be varied. It will be noted that one end of the spring 52 is embedded into the face of the gear 49 as shown at 53 while the other end thereof is carried within an opening of the ring 50 as shown at 54. By securing the ends of the spring 52 to the gear 49 and ring 50 as shown at 53 and 54 respectively, I am enabled to utilize both the torsional and the thrust influence of the same as will be readily understood when considering the hereinafter described operation of the device as a whole. In order to relieve the end thrust of the drum 45 upon the shaft 40 there is provided a washer 55 interposed between the drum and a shoulder 56 carried upon the inner face of the closed end of the casing 22. As a means for preventing any longitudinal movement of the drum in the direction of the plate 24 there is provided a removable bearing 58 secured to the inner face thereof by means of a screw 59, as shown, the bearing being adapted to contact with the end of the drum 45 as shown.

The top of the transmission case 22 is provided with a seat 60, the upper face of which is machined to provide a smooth bearing surface for a reciprocatory switch 61 superimposed thereupon. This switch comprises a flat metal plate 62, preferably stamped from a sheet of suitable metal having a pair of depending arms 63 the ends of which are bent inwardly with respect to each other as shown. The arms 63 are adapted to extend downwardly into the transmission case through a slot 64 provided therein. Upon the seat 60 there is superimposed a cover or housing 65, carrying therein a spring 66 having its free end bent to engage the inclined faces of a lug 67 carried by the switch 61.

To the transmission casing there is secured a suitable insulating material 68, carrying a pair of electrical contacts 69 extending into the transmission casing 22 through an opening 70 provided therein and having connection with the electrical conductors 19 and 20. The electrical circuit between these two contacts is closed or opened through the instrumentality of one of the arms 63 carried

by the plate 62 of the switch 61. By utilizing the cam action between the spring 66 and lug 67 I am enabled to obtain an instantaneous make and break of the electric circuit, thereby eliminating what is commonly known as "arcing" between the contacts as a result of a slowly established circuit.

In considering Fig. 7, wherein is shown a modified form of a clamp adapted to secure the device, as a whole, to the phonograph, the numeral 70′ indicates a portion of a shank similar to that indicated by the numeral 25. To the shank 70 there is secured a plate or flange 71 adapted to engage a, preferably fibrous, washer 72 imposed upon the side of the phonograph cabinet 27. To the shank 70 there is secured a nipple 73 extending through the wall of the phonograph 27 as shown. The inner end of this nipple is provided with external screw-threads adapted to engage internal screw-threads carried by a nut 73′ imposed thereupon. Between the nut 73′ and the wall of the phonograph casing 27 there is interposed a suitable washer indicated by the numeral 74.

In Fig. 8 I have shown a modified form of an adjustable shaft which comprises a shaft 75, similar to that shown in Fig. 2 and indicated by the numeral 40, which is provided with a longitudinal groove carrying therein a key 76, adapted to engage a groove provided internally of a longitudinally adjustable sleeve 77 carried by the shaft 75, the sleeve 77 being similar in construction to that shown in Fig. 2 and indicated by the numeral 43.

In Fig. 9 I have shown another modified form of an adjustable shaft comprising a sleeve 78 similar to that shown in Fig. 2 and indicated by the numeral 43, it differing however in that it is provided centrally with a square passage adapted to receive therein a correspondingly square end portion 79 of a shaft similar to that shown in Fig. 2 and indicated by the numeral 40. The sleeve 78 is, like the sleeve 77, longitudinally adjustable upon the end portion 79 of the shaft carrying the same.

In Fig. 10 I have shown an end portion 80 of a shaft similar to that shown in Fig. 2 and indicated by the numeral 40. By employing this particular designed shaft I am enabled to dispense with the adjustable sleeves described in connection with Figs. 2, 8 and 9, due to the fact that the screw-threads 81 carried by the end portion 80 are adapted for direct engagement with screw-threads carried by the winding shaft of a spring motor, not shown.

In Fig. 11 wherein is shown a modified form of transmission, the numeral 82 indicates a transmission casing similar to that shown in Fig. 1 and indicated by the numeral 22. Within the transmission casing 82 there is journaled a shaft 83 carrying a drum 84 having mounted thereupon a gear 85 which is adapted to partake of a longitudinal and rotary motion as described in connection with the gear 49, shown in Figs. 1 and 2. To the inner face of the casing 82, preferably formed integral therewith, there is secured an offset 86 adapted to receive therein the screw-thread end of a shaft 87 carrying a compound gear 88 comprising a spur gear 89 being adapted to mesh with the gear 85 while the worm gear 90 is adapted to engage a worm 91 similar to that shown in Fig. 1 and indicated by the numeral 29. Between the offset 86 and the face of the compound gear 88 adjacent thereto there is interposed a washer 92 which serves to protect the face of the offset 86 from wear thereupon as a result of the rotation of the gear.

In Fig. 12 I have shown a plate 93 disposed upon the drum 45 and secured thereto by means of screws 94 or the like. It will be noted that the spring 52 has a connection with the plate 93 similar to the connection shown at 54 of Fig. 2 and hereinbefore described. I wish to state here that the bearing 58 in this instance performs the same function as described in connection with Fig. 2 but that the same is adapted to contact with the face of the plate 93 rather than with the end of the drum 45 as hereinbefore described.

I wish it understood that a perfect lubrication of the several working elements included in the device as a whole may be afforded by partially filling the transmission casing 22 with oil or other suitable lubricant whereby the same as a result of the rotation of the gear 49 may be applied to the various elements requiring lubrication.

The preferred form of my device is, as a whole, attached to the phonograph, as shown in Fig. 3, by inserting the end of the shaft 40, carrying the sleeve 43, into and through an opening ordinarily used to receive the handle used in winding the spring motor of the phonograph. Before inserting the shaft 40 as above described the set-screw 42 is run down within the groove 41 and into engagement with the shaft 40, to permit relatively easy longitudinal movement of the sleeve 43 but at the same time allowing it to be manually moved thereupon. The thread end 44 of the sleeve 43 is then brought into screw-threaded engagement with the end of the winding shaft of a spring motor, not shown, and the plate 26 is then secured to the wall of the phonograph 27 by means of screws or the like, as shown.

In use, the operation of the device is as follows: Assuming that the energy stored up within the spring employed as a prime mover for the phonograph to which the device is attached, has been spent, the gear 49

will maintain the position shown in Fig. 2 due to the energy exerted thereupon by the spring 52. Due to the maintenance of the gear 49 in this position, an arm 63 of the switch 61 is necessarily confined between the electric contacts 69, thereby establishing electrical communication one with the other, electrical energy being supplied to the motor carried within the housing 15, in the manner as diagrammatically shown in Fig. 6, thereby bringing the same into operation whereupon rotary motion is imparted to the gear 49 in the direction of the arrow shown thereupon. As a result of the rotary motion imparted to the gear 49 the ball 47 carried within the socket 48 acts upon the cam-surface of the groove 46 thereby rotating the drum 45 together with the shaft 40 in the direction indicated by the arrow in Fig. 1. The gear 49, during the period of rotation, tends to move upon the drum 45 toward the plate 50, but this tendency is counter-acted by the action of the coil spring 52 in an opposite direction upon the gear 49. Thus it is obvious that the gear 49 under normal conditions is substantially locked against a rotary and reciprocatory movement with respect to the drum 45. By continuing the rotary motion of the gear 49 together with the drum 45 mechanical energy is gradually stored up within the spring motor, not shown, of the phonograph. As a result of this storing up of energy a retarding influence is exerted upon the rotating shaft 40 and drum 45, which influence causes the gear 49 to gradually move against the influence of the spring 52, thereby bringing that face of the gear 49 which contacts with the spring 52 into engagement with the depending arm 63 adjacent thereto whereupon the switch 61 as a whole is gradually moved with the gear 49 in its longitudinal travel upon the drum 45. As the switch 61 moves together with gear 49 as above described the free end of the spring 66 rides upon the bevel face of the lug 67 and upon reaching the maximum point thereof the switch 61 as a whole is suddenly moved in the direction of the horizontal travel of the gear 47 upon the drum 45 as a result of the action of the spring 66 upon the opposite bevel of the lug 67. This sudden movement of the switch 61 as above described instantaneously moves the arm of the switch 61 confined between the contacts 69 out of engagement with the same thereby eliminating the possibility of what is commonly known as "arcing" as a result of slowly breaking an electrical circuit. When the electric circuit has been broken in the manner described the operation of the device as a whole is discontinued, leaving the spring of the spring motor, associated with the phonograph, under a predetermined tension. As this tension is gradually released the gear 49, acting under influence of the spring 52 gradually moves longitudinally with respect to the drum 45 in the direction of the contacts 69. This movement results, due to the fact that the gear 49 is held against rotary movement, by the worm 29 which is now rendered inoperative in a slight movement of the drum 45 in the direction indicated by the arrow shown in Fig. 1, through the action of the ball 47, carried by the gear 49, upon the cam-face of the groove 46. As the gear continues in its travel toward the contacts 69, the arm 63, in proximity to the contacts, is engaged by the adjacent face of the gear and the switch 61 is moved, as a whole, in the direction of the contacts. As the switch 61 travels in this direction the free end of the spring 66 rides upon a cam-face of the lug 67 and when the maximum point is reached the switch 61 suddenly moves forward bringing the arm 63, which is in proximity to the contacts 69, suddenly into engagement with the same, whereupon an electric circuit is established between the contacts 69, and the winding operation of the device as a whole is repeated.

In considering the modified form of transmission as shown in Fig. 11 the operation of the same is substantially the same as that described in connection with the preferred embodiment of my invention, there being only a slight change in construction, namely, instead of transmitting power directly from the worm shaft 91 to the gear 85 the power is transmitted indirectly, through the instrumentality of the compound gear 88, this transmission being readily understood after having considered the construction and operation of the preferred embodiment of my invention as set forth in the specification above.

While I have shown and described my invention as being used in connection with a phonograph, I wish it understood that the same may be equally as well adapted to use in connection with spring motors employed as prime movers in other instances, and I wish it further understood that various changes in the size, shape, and arrangement of parts may be resorted to without departing from the spirit of the invention.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent of the United States, is:

1. A winding device for spring motors including a prime motor, means for connecting it to the spring motor, said means comprising a rotatable element, a second element arranged co-axially with the first named element, the second named element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor, resilient means for opposing the movement of the sec-

ond named element with respect to the first named element, and a switch actuated upon the relative movement of the second named element with respect to the first named element to stop the prime motor.

2. A winding device for spring motors including a prime motor, means for connecting it to the spring motor, said means comprising a rotatable element, a second element arranged co-axially with the first named element, the second named element having a limited rotative movement with respect to the first named rotatable element during the winding operation of the prime motor, resilient means for opposing the movement of the second named element with respect to the first named element, a switch actuated upon the relative movement of the second named element with respect to the first named element to stop the prime motor, and means for varying the limit to which the spring motor may be wound.

3. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a second element arranged co-axially with the first named element, the second named element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor to stop the prime motor, and resilient means for opposing the movement of the second named element with respect to the first named element.

4. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a second element arranged co-axially with the first named element, the second named element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor to stop the prime motor, resilient means for opposing the movement of the second named element with respect to the first named element during the winding operation of the prime motor and rotating the first named element with respect to the second named element to start the prime motor, the first named element being rotated with respect to the second named element upon decrease tension of the spring motor spring.

5. A winding device for spring motors comprising an electric motor, means for connecting the electric motor to the spring motor, said means comprising a rotatable element, a second element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor, resilient means opposing the rotative movement of the second named element with respect to the first named element, and automatically operated means for stopping the electric motor upon the relative movement of the second named element with respect to the first named element.

6. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a second element arranged co-axially with the first named element, the second named element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor to stop the prime motor, and resilient means for opposing the movement of the second named element with respect to the first named element and moving the first named element with respect to the second named element to start the prime motor.

7. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a second element arranged co-axially with the first named element, the second named element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor, resilient means for opposing the movement of the second named element with respect to the first named element, the relative movement of the second named element with respect to the first named element being controlled by the varying resistance of the spring motor spring to stop the prime motor.

8. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a loosely mounted element arranged co-axially with the rotatable element, means for imparting a longitudinal and limited rotary movement with respect to the first named element during the winding operation of the prime motor, resilient means for opposing the movement of the second named element with respect to the first named element, the longitudinal and rotary movement of the last named element with respect to the first named element being controlled by the varying resistance of the spring motor spring to stop the prime motor.

9. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a loosely mounted element arranged co-axially with the rotatable element, and means for imparting a longitudinal and rotary movement with respect to the first named element during the winding operation of the prime motor, the longitudinal and rotary movement of the last named element with respect to the first named element being controlled by the varying resistance of the

spring motor spring to stop the prime motor, and means for rotating the first named element with respect to the second named element to start the prime motor.

10. A winding device for spring motors including a switch, an electric motor, means for connecting the electric motor to the spring motor comprising a rotatable element, a loosely mounted element arranged coaxially with the rotatable element, means for rotating the rotatable element with respect to the loosely mounted element upon the decrease in the spring motor tension whereby the switch may be closed to start the electric motor.

11. In an apparatus of the character described, rotatable elements one of which is adapted to be connected to the winding shaft of a spring-motor and provided with a spiral groove thereon; a gear loosely mounted upon the element having the spiral groove; a member carried by said gear and extending into the spiral groove; yielding means to oppose the longitudinal movement of the gear in one direction with respect to the element upon which said gear is mounted; an electric motor connected with the other rotatable element to drive the same; a circuit closer controlling the operation of the electric motor and adapted to be actuated by the gear; and driving means between the gear and the last named rotatable element.

12. In an apparatus of the character described, rotatable elements, one element having an inclined groove formed thereon and adapted for connection with the winding shaft of a spring-motor; a gear loosely mounted upon the element having the inclined groove; a member carried by said gear and extending into the inclined groove; yielding means to oppose the longitudinal movement of the gear in one direction with respect to the element upon which said gear is mounted; an electric motor connected with the other rotatable element to drive the same; automatic switch means controlling the operation of the electric motor and adapted to be actuated by the longitudinal movement of the gear; and driving means between the gear and the last named rotatable element.

13. In an apparatus of the character described, rotatable elements one of which is adapted for connection with the winding shaft of a spring motor; a gear carried by one rotatable element; means whereby the gear is shifted longitudinally of its rotatable element upon being turned with relation thereto; yielding means to oppose the movement of the gear with respect to its rotatable element; an electric motor connected with the other rotatable element to drive the same, switch means controlling the operation of the electric motor and adapted to be actuated by the longitudinal movement of the gear with respect to its rotatable element; and means whereby the last named rotatable element serves to drive the gear.

14. In an apparatus of the character described, rotatable elements one of which is adapted for connection with the winding shaft of a spring-motor; a gear carried by one rotatable element; means whereby the gear is shifted longitudinally of its rotatable element upon being turned with relation thereto, yielding means to oppose the movement of the gear with respect to its rotatable element; adjustable means to regulate the tension of the yielding means; an electric motor connected with the other rotatable element to drive the same; switch means controlling the operation of the electric motor and adapted to be actuated by the longitudinal movement of the gear with respect to its rotatable element; and means whereby the last named rotatable element serves to drive the gear.

15. In an apparatus of the character described, rotatable elements one of which is adapted for connection with the winding shaft of a spring-motor; a gear carried by one rotatable element; means whereby the gear is shifted longitudinally of its rotatable element upon being turned with relation thereto; a torsional coil spring to oppose the turning movement of the gear with relation to its rotatable element; an electric motor associated with the other rotatable element to drive the same; switch means controlling the operation of the electric motor and adapted to be actuated by the longitudinal movement of the gear with respect to its rotatable element; and means whereby the last named rotatable element serves to drive the gear.

16. In an apparatus of the character described, rotatable elements one of which is adapted for connection with the winding shaft of a spring-motor; a gear rotatable upon one element; switch means; means whereby the gear actuates the switch means upon being turned with relation to its rotatable element; yielding means to oppose the turning movement of the gear with respect to its rotatable element; an electric motor having its operation controlled by the switch means and serving to drive the other rotatable element; and means whereby the last named rotatable element serves to drive the gear.

17. In an apparatus of the character described, rotatable elements one of which is adapted for connection with the winding shaft of a spring-motor; a gear carried by one element; means whereby said gear moves longitudinally of its rotatable element when turned with relation thereto; yielding means to oppose the movement of the gear with relation to its rotatable element; an electric

motor serving to drive the other rotatable element; switch means for controlling the operation of the electric motor and including a plurality of elements arranged upon the opposite sides of the gear in the path of travel thereof to be shifted thereby; and means whereby the last named rotatable element serves to drive the gear.

18. In an apparatus of the character described, a rotatable element adapted for connection with the winding shaft of a spring-motor; a gear carried by the rotatable element; means whereby said gear moves longitudinally of its rotatable element when turned with relation thereto; means to oppose the movement of the gear with relation to the rotatable element; an electric motor to drive the gear; and switch means for controlling the operation of the motor and including a plurality of elements arranged upon the opposite sides of the gear in the path of travel thereof to be shifted thereby.

19. A winding device for spring motors comprising an electric motor, means for connecting the electric motor to the spring motor, said means comprising a rotatable element, a second element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor, resilient means for opposing the movement of the second named element with respect to the first named element during the winding operation and for imparting a limited rotative movement to the first named rotative element upon the decrease in the spring motor tension, and means automatically operated upon the relative movement of the first named element with respect to the second named element for starting the electric motor.

20. A winding device for spring motors including a prime motor, means for connecting it to the spring motor, said means comprising a rotatable element, a second element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor, resilient means for opposing the rotative movement of the second named element with respect to the first named element, and a switch actuated upon the relative movement of the second named element with respect to the first named element to stop the prime motor.

21. A winding device for spring motors including an electric motor, means for connecting the electric motor to the spring motor, said means comprising a rotatable element, a second element having a limited rotative movement with respect to the first named element during the winding operation of the electric motor, resilient means for opposing the rotative movement of the second named element with respect to the first named element, and means operated upon the movement of the second named element with respect to the first named element to stop the electric motor.

22. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a second element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor to stop the prime motor, resilient means for opposing the movement of the second named element with respect to the first named element during the winding operation of the prime motor and rotating the first named element with respect to the second named element to start the prime motor, the first named element being rotated with respect to the second named element upon decrease tension of the spring motor spring.

23. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a second element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor to stop the prime motor, and means for opposing the movement of the second named element with respect to the first named element and moving the first named element with respect to the second named element to start the prime motor.

24. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a second element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor, resilient means for opposing the rotative movement of the second named element with respect to the first named element, the relative movement of the second named element with respect to the first named element being controlled by the varying resistance of the spring motor spring to stop the prime motor.

25. In an apparatus of the character described, a rotatable element adapted for connection with the winding shaft of a spring motor, a gear rotatable upon said rotatable element, resilient means connecting said rotatable element and said gear for opposing the turning movement of the gear with respect to said rotatable element, an electric motor for driving said gear, and a switch automatically operated upon a predetermined movement of said gear with respect to said rotatable element to stop the electric motor.

26. A winding device for spring motors including a prime motor, means for connecting it to the spring motor, said means comprising a rotatable element, a second element having a limited rotative movement with respect to the first named rotatable element during the winding operation of the prime motor, resilient means for opposing the rotative movement of the second named element with respect to the first named element, a switch actuated upon the relative movement of the second named element with respect to the first named element to stop the prime motor, and means for varying the limit to which the spring motor may be wound.

27. A winding device for spring motors including a prime motor, means for connecting the prime motor to the spring motor, said means comprising a rotatable element, a second element having a limited rotative movement with respect to the first named element during the winding operation of the prime motor to stop the prime motor, and resilient means for opposing the rotative movement of the second named element with respect to the first named element.

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