G. OULTON, C. ABLETT & W. E. LIGHTFOOT.

SOUND RECORDING AND REPRODUCING MACHINE.

APPLICATION FILED JULY 19, 1909.

971,068. Patented Sept. 27, 1910.

3 SHEETS—SHEET 1.

FIG. 1.

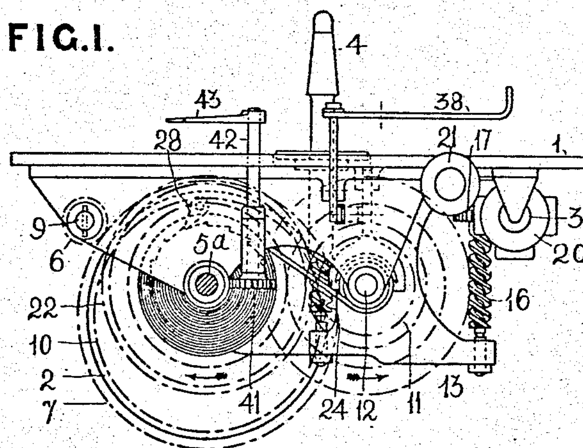
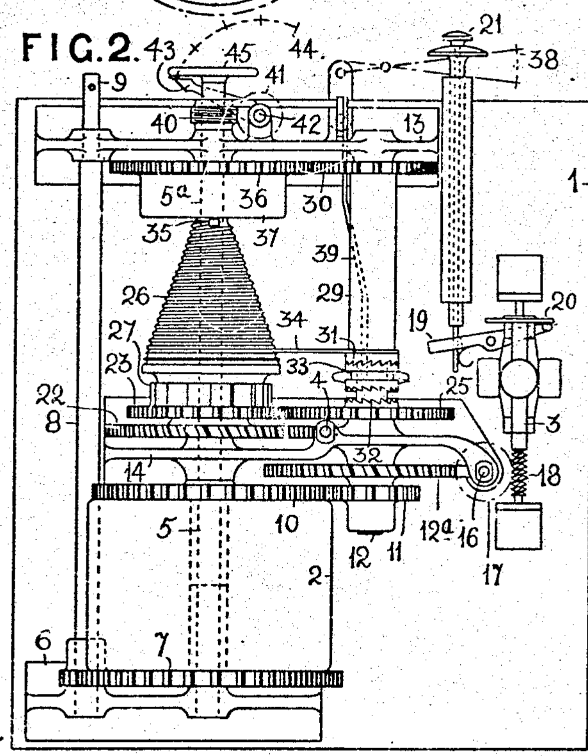


FIG. 2.



Witnesses:

H C Hungsberger

C. Heysmann

Inventors

George Oulton

Charles Ablett

William Edward Lightfoot

by B. Singer atty

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3 SHEETS—SHEET 2.

FIG. 3.

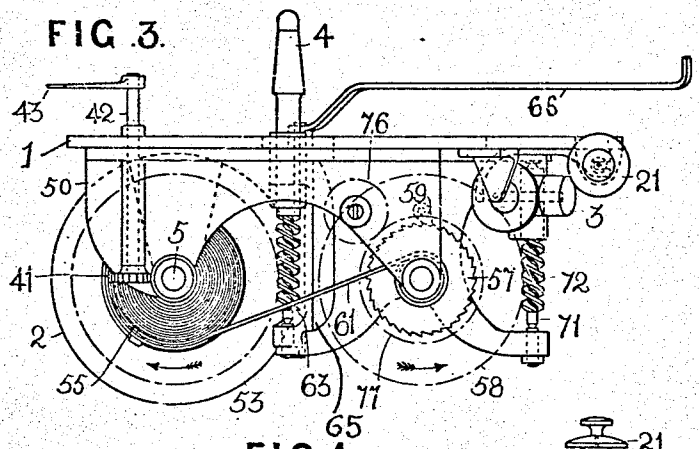
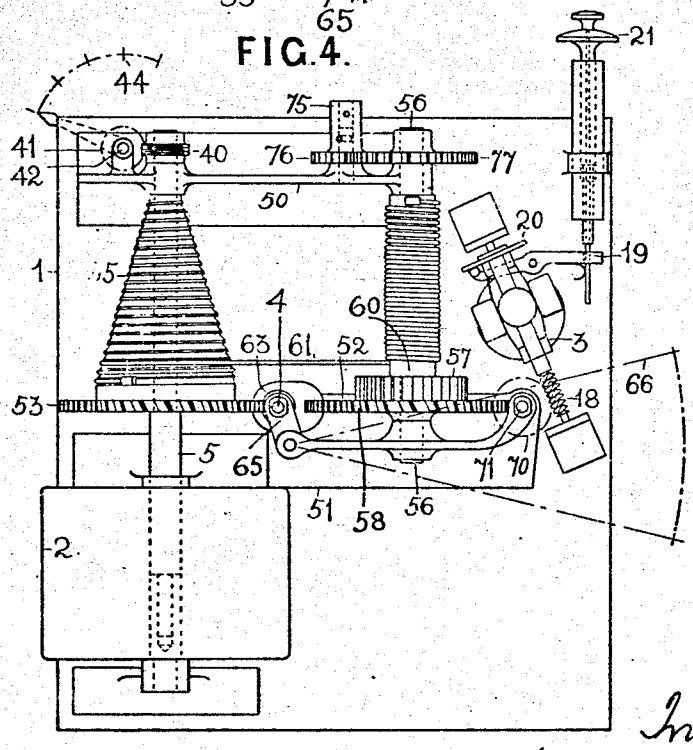


FIG. 4.



Witnesses:
H. C. Hunsberger
C. Heymann

Inventors:
George Oulton
Charles Ablett
William Edward Lightfoot
by B. Singer atty

G. OULTON, C. ABLETT & W. E. LIGHTFOOT.

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3 SHEETS—SHEET 3.

FIG. 5.

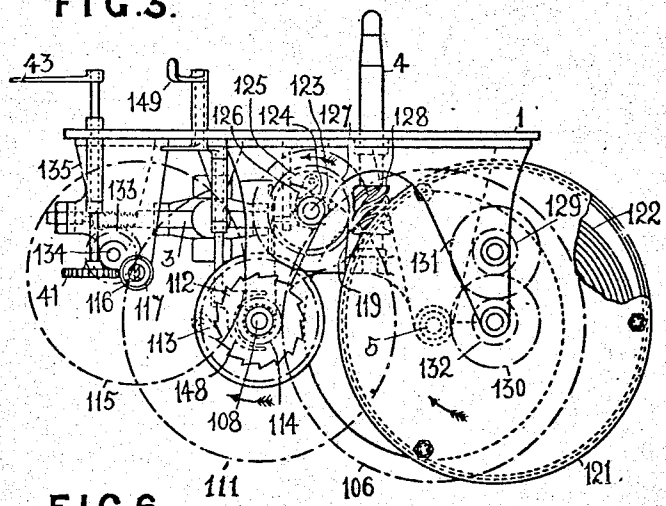
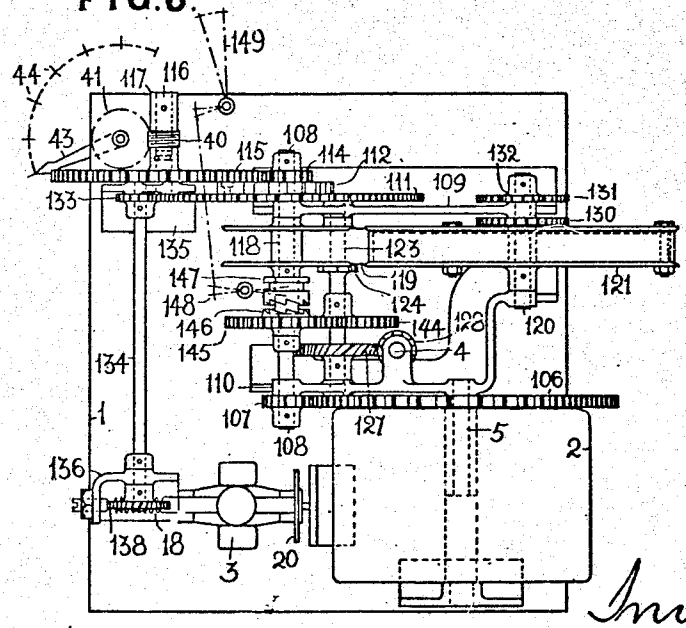


FIG. 6.



Witnesses:
H. C. Hunsberger
C. Hugmann

Inventors:
George Oulton
Charles Ablett
William Edward Lightfoot
by P. J. Singer atty.

UNITED STATES PATENT OFFICE.

GEORGE OULTON, CHARLES ABLETT, AND WILLIAM EDWARD LIGHTFOOT, OF LIVERPOOL, ENGLAND.

SOUND RECORDING AND REPRODUCING MACHINE.

971,068. Specification of Letters Patent. Patented Sept. 27, 1910.

Application filed July 19, 1909. Serial No. 508,519.

To all whom it may concern:

Be it known that we, GEORGE OULTON, CHARLES ABLETT, and WILLIAM EDWARD LIGHTFOOT, subjects of the King of Great Britain and Ireland, residing at Liverpool, in the county of Lancaster, England, have invented new and useful Improvements in Sound Recording and Reproducing Machines, of which the following is a specification.

This invention relates to improvements in or connected with machines for recording and reproducing sounds on flat disks.

The improvements refer to such machines in which the relative surface speed between the stylus and the spiral record line is intended to remain constant so that a symmetrically progressive angular speed of the table in machines in which the record commences at the periphery of the disk, and a symmetrically retrogressive angular speed when the record commences near to the center of the disk is necessary. Hitherto in machines characterized as above stated, the differential speed of the table has been obtained by continuously varying the speed of the centrifugal governor through a friction device or brake in some cases and in others by using a variable speed friction driving gear with a constant speed motor. Neither of these methods has given satisfactory results in practice for a reasonable length of time owing chiefly perhaps to the tendency of surfaces in frictional contact only to slip, especially, as they become worn.

The object of our invention is to overcome the defects of machines in which friction is relied upon to obtain differential driving. As machines both for recording and reproducing only require to work without stopping for a period of time equal to that which is necessary for the longest record, we take advantage of this fact and employ a method of driving which would be unsuitable if the machine had to be continuously driven for an indefinite time without stopping. According to our invention the number of turns of the table and the speed thereof are governed by the length and surface speed of a flexible driving band fixed at one end to a shaft controlled to turn at a constant angular speed and wound thereon with convolutions of symmetrically increasing sizes, the surface speed and motion of the band when being wound on or off the constant speed shaft being transmitted to another shaft which turns the table directly on through gearing.

The accompanying drawings show our improvements embodied in three differently constructed machines for reproducing purposes, the machines being provided with spring motors of the usual kind. Alternatively an electric motor may be used. The attachment for recording purposes is not shown in the drawings as it does not form part of our invention.

Figures 1 and 2 of the drawings represent in elevation and plan looking from underneath, respectively, the mechanism of a sound reproducing machine embodying our improvements. Figs. 3 and 4 represent similar views of a modified construction of the improved machine. Figs. 5 and 6 also represent similar views of another modified construction of the improved machine.

In the several machines illustrated the speed of the table is controlled by the surface speed of a flexible band coiled at one end upon a shaft with convolutions of symmetrically progressing sizes, which band while being coiled or uncoiled with the shaft rotating at a constant speed, travels with a symmetrically varying speed, the variable motion thus obtained being transmitted to the table spindle. Each machine illustrated is also provided with additional gearing so as to enable the table to turn at a constant angular speed and reproduce records made in the ordinary way for a constant speed machine. This additional gearing is provided with suitable clutch mechanism so that it can be thrown in or out at will and the table be driven at a differential or a constant angular speed.

Referring first to Figs. 1 and 2. The motor is governed to turn at a constant speed, and normally, in accordance with our invention it drives the table through the flexible band. The bed plate of the mechanism is represented by 1 the spring box of the motor by 2, the centrifugal governor by 3, the table spindle by 4 and the arbor of the motor or spring box by 5. The motor is wound up through the gear wheels 6 and 7 and the shaft 8, which is adapted at its end 9 to receive a crank (not shown). A spur wheel 10 is fixed on the arbor 5, and this gears into another spur wheel 11 fixed on a shaft 12 mounted in the standards 13 and

14. On the shaft 12 is also fixed a worm wheel 12^a and this gears with a worm spindle 16 carried in the standard 14. A small worm wheel 17 is fixed on the spindle 16, and this gears with a worm 18 formed on the spindle of the centrifugal governor 3. The speed of the moter is regulated in the known way by means of a lever 19 carrying a brake shoe which presses upon the friction disk 20 of the governor, a regulating handle 21 being provided. On a shaft 5^a, eccentrically mounted, in relation to the arbor 5 is loosely mounted a worm wheel 22 and fixed to the wheel 22 is a spur wheel 23. The worm wheel 22 gears with a worm 24 fixed on the table spindle 4 and the spur wheel 23 gears with another spur wheel 25 loose on the shaft 12. Fixed to the shaft 5^a is a fusee or grooved cone 26, to the large end of which is fixed a ratchet wheel 27 which is engaged by a spring pressed pawl 28, pivoted to the wheel 23. A barrel 29, is loosely mounted on shaft 12 and is provided with a spur wheel 30 fixed at one end and a clutch member 31 at the other end. The spur wheel 25 has also a similar clutch member 32 formed on its boss. On the shaft 12 is a sliding clutch member 33 adapted to engage with either members 31 or 32 so that either the wheel 25 or the barrel 29 can be turned by the shaft 12. One end of a flexible band 34 is fixed to the barrel, and the rest of the band is wound around the fusee 26, the other end of the band being fixed to the latter at 35. Fixed on the shaft 5^a is a spur wheel 36 which is geared with the wheel 30, and a spring box 37 is formed on the wheel 36 and carries a coil spring not shown in the drawing, one end of the spring being fixed to the shaft 5^a and the other to the box 37. The clutch sliding member 33 is actuated by a lever 38 and rod 39.

An indicating device to insure the correct starting speed for records of different diameters consists of a worm 40 fixed at the end of the shaft 5^a and this gears into a worm wheel 41 fixed on a vertical spindle 42 carrying a pointer 43. A dial plate not shown in the drawing, is marked as shown, at 44, to indicate different sizes of records. When the band 34 is fully wound on the fusee 26, as shown in the drawing, the pointer indicates the largest sized record that the machine will reproduce. For lesser sizes of records, the band would be wound on to the fusee up to the point indicated on the dial plate by the pointer and representing the particular size of record. As the record is being reproduced, the pointer recedes on the dial plate. When the band is all wound upon the drum, in order to reproduce another record, it is necessary to rewind the band on to the fusee. A small hand wheel 45 fixed on the end of the shaft 5^a is provided for this purpose.

When the machine is being used with records which require a differential speed of the table, the clutch member 33 is engaged with the barrel 29 and the motor winds the band 34 on to the barrel 29 from off the fusee 26 turning this around at a symmetrically progressive speed. The pawl 28 being engaged with the ratchet wheel 27 the wheel 23 turns this wheel 25 around idly and the worm wheel 22 drives the table spindle 4 through the worm 24. The coil spring in the spring box 37 keeps an even tension on the band 34 by braking the fusee 26. When the clutch member 33 is engaged with the wheel 25, the table spindle 4 is driven at a constant angular speed by the motor through the shaft 12, wheels 25 and 23 and the worm wheel 22 and worm 24. When the machine is not intended also for ordinary records, the wheels 23 and 25 and the clutch 33 are dispensed with. The pawl 28 would then be pivoted to the screw wheel 22.

Referring now to Figs. 3 and 4. In the machine hereby illustrated, the motor is geared directly to the table spindle and is controlled to turn at a differential speed by a governed constant speed shaft, and the surface speed of a flexible band spirally wound thereon when being drawn off or uncoiled. In the Figs. 3 and 4 the bed plate of the mechanism is represented by 1, the spring box of the motor by 2, the centrifugal governor by 3, the table spindle by 4, and the arbor of the motor or spring box by 5. On the arbor 5, which is carried in bearings in the standards 50 and 51, is fixed a screw wheel 53 and a cone or fusee 55 having a spiral groove running around from one end to the other. Parallel with the arbor 5, another shaft 56 is mounted in bearings in the standards and has a ratchet wheel 57 fixed thereto. Another screw wheel 58 is loosely mounted on the shaft 56 and provided with a pawl 59 pivoted thereto and engaging with the teeth of the ratchet wheel 57. To the ratchet wheel 57 is fixed a drum or barrel 60 opposite to the fusee 55. To the large end of the fusee is fixed one end of a cord or chain preferably a thin wire cable represented by 61, the other end of the cable being fixed to the barrel 60 opposite to the small end of the fusee and the cable being long enough to wrap around the fusee for its full length and pass over to the barrel as well. When the motor is wound up fully, or when the largest sized record the machine can accommodate is to be used, the fusee is empty and all the cable is wound up on the barrel. The gear employed in this machine between the motor and the table spindle and through which the latter is turned, preferably consists of a screw or worm 63 fixed to the table spindle 4 and this may engage with either the screw wheel 53 or 58. The table spindle 4 is mounted in a bracket 65 which is adapt-

ed to swivel so that the worm 63 may be disengaged at will from the wheel 53 and be engaged with the wheel 58, a lever such as 66 being provided for this purpose. The table spindle 4 may alternatively be mounted in a fixed bearing in gear only with the wheel 53. In this case ordinary records could not be used. The shaft 56 being a constant speed shaft, when the worm 63 is engaged with the wheel 58, the table spindle will turn at a constant angular speed and thus ordinary records can be used. The shaft 56 is controlled so as to rotate at a constant speed by means of the centrifugal governor 3 and this is driven by screw gearing from the wheel 58. The governor spindle has a worm 18 cut thereon with which engages a worm wheel 70 fixed on a spindle 71. The latter has also a worm 72 cut thereon and this engages with the wheel 58. The ordinary speed regulator acting upon the governor disk 20 is represented by the lever 19 and the handle 21. The motor is wound up by turning the shaft 56. The handle is preferably fitted to a separate spindle 75 on which is fixed a gear wheel 76. The latter gears into another gear wheel 77 fixed to the shaft 56.

An indicator is provided to enable the correct starting speed for a record of any given diameter to be assured. This consists preferably of a dial plate and a pointer geared to the motor so as to make not more than a revolution while the machine is running through the largest record. On the end of the fusee we fix a worm 40 and on a vertical spindle 42 a worm wheel 41, the pointer 43 being fixed to the spindle 42. The dial plate is marked as indicated at 44 to correspond with the different sized records which may be used, and when the machine has been run down and a record of a certain size is required to be used next, the machine is wound up until the pointer comes opposite the mark referring to the particular size of record.

In the machine illustrated in Figs. 5 and 6, the motor shaft is geared to the table spindle and controlled by a centrifugal governor to work at a constant speed and a flat flexible band is employed in which the convolutions are formed one over the other.

The bed plate of the mechanism is represented by 1, the spring box of the motor by 2, the centrifugal governor by 3, the table spindle by 4, and the arbor of the motor or spring box by 5. On the arbor 5 is fixed a spur wheel 106 which gears into a pinion 107 fixed on a shaft 108 mounted in bearings in the standards 109 and 110. The shaft 108 also carries a large spur wheel 111 loose thereon and close to it a ratchet wheel 112 fixed on the shaft. On the wheel 111 is pivoted a pawl 113 and this engages with the ratchet teeth of the wheel 112 a spring, not shown, pressing the pawl into engagement with the teeth. There is also a pinion 114 fixed on the end of the shaft 108 and into this gears a spur wheel 115 mounted on a stud 116, the boss 117 of the wheel being adapted to receive a crank for winding up the motor. While the motor is being wound up, the spur wheel 111 remains stationary owing to the pawl 113 riding over the teeth of the ratchet wheel 112, the direction of the winding being opposite to that indicated by the arrows.

Upon the shaft 108 is fixed a spool or drum 118 to which one end of the flexible band 119 is fixed and upon which it is wound as the motor turns the table. On another shaft 120 carried by the standards 109 and 110 is fixed another spool or drum 121 to which the other end of the band 119 is fixed and upon which it is wound before a record is commenced. Inside the spool 121 is a coil tension spring 122 against the resistance of which the band is uncoiled from the spool and by which the band is rewound on the spool when the motor is being wound up and the possibility of the band becoming slack while being drawn off is obviated. Upon a shaft 123, also carried by the standards 109 and 110, is fixed a ratchet wheel 124 and loose upon the shaft 123 is mounted a driving pulley wheel 125 pivoted to which is a spring pressed pawl 126. The pulley is in line with the spools 118 and 121 and the band 119 passes partly round the pulley from one spool to the other. Upon the shaft 123 is also fixed a worm wheel 127 which gears with a worm 128 fixed on the table spindle 4. Thus the band 119 can be wound back on to the spool 121 from the spool 118 without turning the shaft 123 or the table spindle 4 as the pawl 126 will ride over the teeth of the ratchet wheel 124. As the spring 122 requires only about one fourth the number of turns to wind it up that spool 121 makes, a reducing gearing of known construction is interposed between the spindle of the spring 122 and the spool 121. This gear is indicated by the wheels 129, 130, 131 and 132.

The centrifugal governor 3 is driven from the motor through the spur wheel 111 which gears into a pinion 133 fixed on a shaft 134 carried in brackets 135 and 136. The governor 3 has a worm 18 fixed on its spindle into which gears the worm wheel 138 fixed on the shaft 134. While the motor is being wound up, owing to the wheel 111 being free to turn idly in one direction, the governor remains stationary.

Assuming that this machine starts at the proper speed for any given size of record, the indicator provided for this purpose consists of the pointer 43 and a dial plate marked, as indicated at 44, each mark representing a record of a certain diameter, the

pointer 43 being geared in this case to the wheel 115 by means of a worm 40 fixed on the boss thereof which gears into a worm wheel 41 fixed on the spindle 42 of the pointer. The pointer in the position indicated represents that the spool 121 is wound up for the largest size record that the machine will play. If the record to be used is a smaller one, the boss 117 will be turned around by the handle so as to wind off the spool 118 a sufficient length of the band for and to turn the pointer around until it indicates the mark corresponding to the size of the record to be used.

For the purpose of enabling the table in this machine to turn at a constant speed so that records made in the ordinary way can be used, we arrange that the table spindle 4 can be directly coupled up to the motor without the band 119 effectively acting, the latter merely running idly during the time. This adjustment can be obtained by fixing a spur wheel 144 on the shaft 123 and loosely mounting another spur wheel 145 on the shaft 108 gearing with the wheel 144. The wheel 145 is provided with a clutch jaw 146 and a sliding clutch jaw 147 is fixed so as to turn with and on the shaft 108. A shipping lever 148 is provided to close these jaws together or to separate them as required and a handle indicated by 149 may be mounted in any suitable position to actuate the lever 148.

The clutch is preferably provided with inclined toothed jaws so that it would force itself out of engagement in the event of the machine being run beyond a certain limit when the speed of the band would more than equal the surface speed of the pulley 125 owing to the convolutions of the band on the spool 118 increasing in size.

The retarding or stopping device in the form of a brake acting on the friction disk 20 of the governor in the known way is not shown in the drawing.

What we claim as our invention and desire to secure by Letters Patent of the United States is:—

1. Driving mechanism for sound recording and reproducing machines comprising in combination, a record operating spindle, a motor, a constant speed shaft member, a revoluble body having convolutions of symmetrically increasing size for driving said spindle, and a flexible element trained about said body and shaft member whereby a symmetrically variable speed of a limited number of revolutions is imparted to said spindle.

2. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor, a constant speed shaft driven from said motor, a member having a gradually increasing peripheral surface geared to said spindle, and a flexible element trained about said member and constant speed shaft for imparting a limited number of revolutions to said spindle at a constantly varying speed.

3. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor, a constant speed shaft driven from said motor, a flexible element adapted to be wound and unwound on said shaft, and mechanisms operated by said element for imparting a limited number of revolutions to said spindle at a constantly varying speed.

4. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor, a constant speed shaft driven from said motor, a flexible element adapted to be wound and unwound on said shaft, mechanisms operated by said element for imparting a limited number of revolutions to said spindle at a constantly varying speed, and means for connecting said spindle with said motor for operating the former at a constant speed.

5. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor, a constant speed shaft driven from said motor, a member having a gradually increasing peripheral surface geared to said spindle, a flexible element trained about said member and constant speed shaft for imparting a limited number of revolutions to said spindle at a constantly varying speed, and means for connecting said spindle with said motor for driving the former at a constant speed.

6. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor geared to said spindle, a shaft, a governor for rendering the speed of said shaft constant, gearing connecting said shaft with said motor, and mechanism including a flexible element for operating said spindle, said element being wound about said shaft for operating and controlling the speed of said spindle through said mechanism.

7. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor geared to said spindle, a shaft driven from said motor, a governor for rendering the speed of said shaft constant, mechanism including a flexible element for operating said spindle, said element being wound about said shaft for operating the spindle through said mechanism, and means for connecting said spindle for direct operation from said motor and rendering said mechanism and element inoperative or rendering said mechanism and element operative and throwing said spindle out of direct driving connection with said motor.

8. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor, a shaft driven by said motor, a governor for rendering the speed of said shaft constant, and mechanism coacting with and including a flexible element connected with said shaft for imparting a limited number of revolutions to said spindle at a constantly and symmetrically varying speed.

9. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor, and two rotating members and a flexible element operatively connecting the same for driving said spindle, one member being driven from said motor and governed to rotate at a constant speed, the other of said members being constructed and arranged to receive said element about its periphery and impart a limited number of revolutions to said spindle at a varying speed during the travel of said element about said member.

10. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor, a constant speed shaft operated by said motor, a rotating member having a gradually and symmetrically reduced periphery and connected to drive said spindle, a cord or cable arranged to be wound and unwound on said member and shaft to impart a limited number of revolutions to said spindle at a constantly varying speed, and means for indicating the starting speed for records of different sizes.

11. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor, a constant speed shaft operated by said motor, a rotating member having a gradually and symmetrically reduced periphery and connected to drive said spindle, a cord or cable arranged to be wound and unwound on said member and shaft to impart a limited number of revolutions to said spindle at a constantly varying speed, and means operated by said member for indicating the starting speed for records of different sizes.

12. Driving mechanism for sound recording and reproducing machines comprising in combination, a record carrying spindle, a motor, a constant speed shaft operated by said motor, a rotating member having a gradually and symmetrically reduced periphery and connected to drive said spindle, a cord or cable arranged to be wound and unwound on said member and shaft to impart a limited number of revolutions to said spindle at a constantly varying speed, means for winding said cord or cable on said member prior to reproducing a record, and means operated by said member for indicating the starting speed for records of different sizes.

In testimony whereof we have signed our names in the presence of two subscribing witnesses.

GEORGE OULTON.
CHARLES ABLETT.
WILLIAM EDWARD LIGHTFOOT.

Witnesses:
THOMAS DUTTON EVANS,
RIDLEY JAMES URQUHART.