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2,106,733

SPEED CHANGING MECHANISM

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Fig. 1.

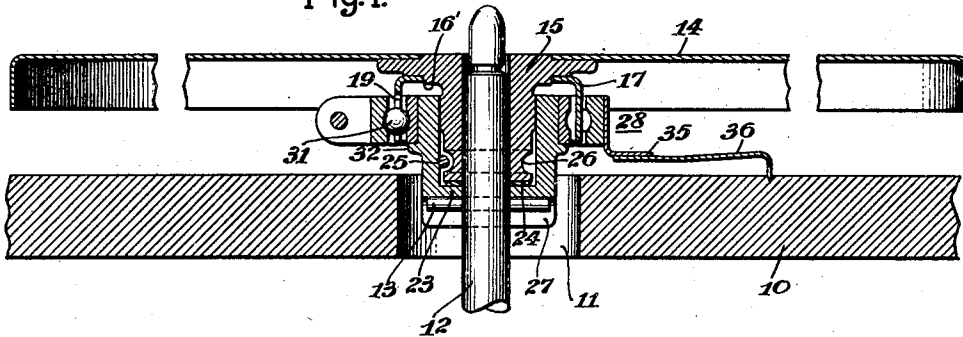


Fig. 2.

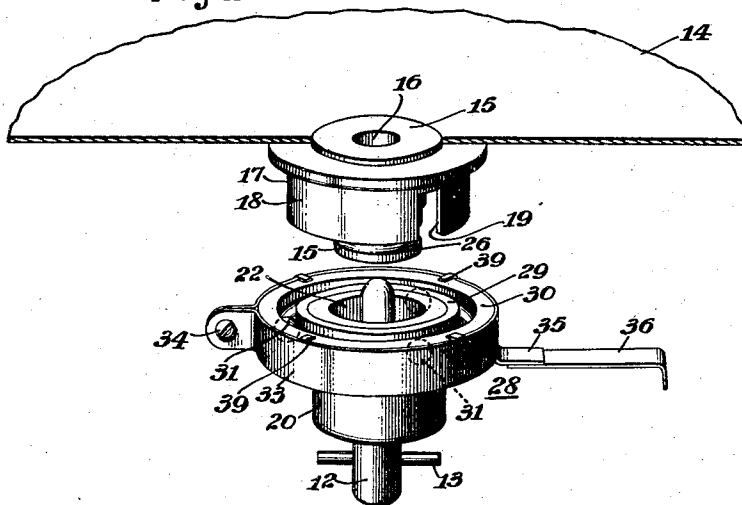
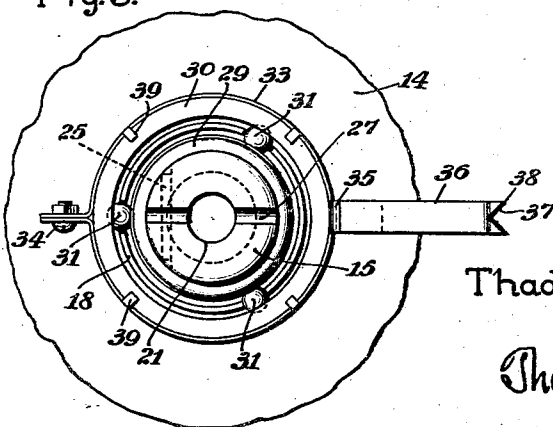


Fig. 3.



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SPEED CHANGING MECHANISM

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2 Claims. (Cl. 274—9)

My invention relates to power transmission mechanism, and, more particularly to mechanism for transmitting power from a phonograph driving shaft or spindle, operating at one speed, to a record support, operating at another speed.

Until recently, substantially all phonographs of the disc-record type have been so designed that the turntables or record supports thereof rotate at 78 revolutions per minute. By reason of improved recording and reproducing methods, however, phonograph records requiring a much lower angular speed as, for example, 33 $\frac{1}{3}$ revolutions per minute during sound reproduction, are now available. Obviously, such records cannot, satisfactorily, be reproduced on the majority of existing phonographs since the speed regulating mechanisms thereof cannot be adjusted to maintain the extreme constancy of angular velocity required by the new slow-speed records, better known as long-playing records.

It is, of course, possible to so completely redesign or alter the mechanism of a phonograph that it will handle either standard records operable at 78 R. P. M. or long-playing records operable at 33 $\frac{1}{3}$ R. P. M., and, in fact, such phonographs already are commercially available. Many people, however, cannot afford to discard their present phonographs in favor of the new dual-speed machines and thus are deprived of the pleasure of owning and enjoying, on their own machines, the new long-playing records now available to the public.

It is, accordingly, an object of my invention to provide inexpensive means whereby slow-speed, long-playing records may be reproduced on existing phonographs designed for the standard high-speed records.

A further object of my invention is to provide an inexpensive attachment for existing phonographs whereby either standard or the new long-playing records may be reproduced at will.

Another object of my invention is to provide a record support or turntable which is interchangeable with the turntable of a standard phonograph whereby the new long-playing records may be reproduced on existing high speed phonographs.

A further object of my invention is to provide a turntable interchangeable with a standard turntable whereby the normal reproducing speed of standard phonographs may be changed to another predetermined speed without in any way altering the turntable spindle, the normal speed thereof, or the motor-board of such phonographs.

Another object of my invention is to provide a record support interchangeable with standard

record supports or turntables and having an automatic speed changing mechanism permanently attached thereto whereby, when said turntable is substituted for a standard record support operable at one predetermined constant speed, another predetermined constant speed is available.

A further object of my invention is to provide a turntable which is interchangeable with the turntable normally forming a part of a standard phonograph whereby the normal reproducing speed of said phonograph is changed to another predetermined reproducing speed without changing the speed of the phonograph motor or the turntable supporting spindle driven by the motor.

Another object of my invention is to change the normal reproducing speed of a standard type of phonograph to another predetermined reproducing speed by the simple expedient of substituting, for the conventional turntable of the phonograph, a special turntable which is adapted to rotate relatively to the turntable spindle thereof.

A further object of my invention is to provide a turntable or record support adapted to be substituted in place of the turntable of a conventional type of disc phonograph which is capable of automatically changing the normal reproducing speed of the phonograph to another reproducing speed without altering the speed of the turntable supporting spindle of the phonograph.

Another object of my invention is to provide a turntable interchangeable with the turntable of a standard type of disc phonograph whereby, when the said turntable is mounted on the turntable supporting spindle and the phonograph placed in operation, the new turntable will be rotated relatively to the spindle.

A further object of my invention is to transform standard phonographs having but a single operating speed into plural speed phonographs whereby the normal reproducing speed thereof may be changed to another reproducing speed by removing the turntable on the phonograph and substituting a turntable constructed in accordance with my invention in place thereof.

Other objects of my invention will become evident from the following detailed description taken in conjunction with the accompanying drawing, in which

Figure 1 is a sectional assembly view of a turntable carrying a speed reducing mechanism in accordance with my invention and mounted on the turntable spindle of a disc phonograph of a conventional type, and

Fig. 2 is a perspective view illustrating the various parts comprising the speed changing mechanism.

anism and turntable in detached, operative relation, and

Fig. 3 is a bottom plan view of the interchangeable turntable and speed changing mechanism forming a part thereof.

Referring more particularly to the drawing, wherein similar reference characters indicate corresponding parts throughout, a motor-board 10 having a central clearance opening 11 therein and a turntable supporting spindle 12 carrying a driving pin 13 and extending vertically through the opening 11, form parts of a conventional type of disc phonograph, and are shown to illustrate the application of my invention thereto.

In accordance with my invention, a record supporting disc or platen 14, forming a turntable of conventional design, is provided with a centrally depending hub or boss 15 having a central bore 16 which extends through the hub 15 for the free passage therethrough of the spindle 12, as clearly shown in Fig. 1.

Formed concentrically with the hub 15 adjacent the underside of the disc or platen 14 is a shoulder 16' on which an annular driving member 17 is suitably staked, welded or otherwise secured, with the annular wall 18 of said driving member depending from the shoulder 16' in spaced relation to the periphery of the hub 15. Formed in the annular wall of the member 17 are a plurality of equally spaced, vertically arranged slots 19 which extend inwardly from the lowermost peripheral edge of the said wall to a point substantially intermediate the length of the said driving member.

Rotatably mounted on the lower end portion of the turntable boss or hub 15 is a counter-bored sleeve 20 having a relatively smaller bore 21 in the lowermost end thereof in axial alignment with the larger uppermost bore 22, the bore 21 being of the same size as the bore 16 so that the bore 16 and 22 will register for the sliding passage therethrough of the spindle 12. A shoulder 23, formed in the sleeve 20 by the differing diameters of the axially aligned bores 16 and 22, is provided with a suitable washer 24 upon which the bottom face of the hub 15 seats.

Longitudinal movement of the counter-bored sleeve 20 on the hub 15 is prevented after placement thereon by means of an offset locking pin 25 which so extends transversely through the sleeve 20 that the intermediate portion of the pin 25 will register with an annular groove 26 formed in the periphery of the hub 15 adjacent its lower free end, as clearly shown in Fig. 1. The counter-bored sleeve 20 is further provided with a transverse slot 27 which is cut centrally across the bottom face thereof and is adapted to receive the driving pin 13 carried by the spindle 12, whereby the sleeve 20 is rotated in response to the spindle 12 and is supported against further downward movement thereon in a manner well known to those skilled in the art.

Secured to the upper end portion of the counter-bored sleeve 20, as by means of a "press fit" thereon, is a bearing assembly 28 comprising an inner raceway 29, an outer raceway 30, and a plurality of balls or rollers 31 disposed between said raceways. The inner diameter of the raceway 29 and the outer diameter of the sleeve 20 are such that the assembly, generally indicated at 28, may be pressed thereon to the depth of the shoulder 32 on the sleeve 20 to insure the rotation of the inner raceway 29 with the sleeve 20. The annular driving member 17 depends in the space 75 between the inner and outer raceways 29 and 30,

respectively, which space is maintained by the balls or rollers 31. The spaced, vertical slots 19 formed in the annular wall of the driving member 17 are of a size sufficient to receive the balls 31 therein to maintain the said balls in equally spaced relation and to transmit motion from the sleeve 20 to the driving member 17 and the turntable or platen 14.

In order that the turntable 14 may be rotated relatively to the spindle 12, the outer raceway 30 of the bearing assembly 28 must be restrained against rotation. To this end, a split collar 33 may be suitably clamped about the periphery of the outer raceway 30 by means of a small screw bolt 34. A laterally extending ear or tab 35, formed on the split collar 33 at a point diametrically opposite to its split ends, is provided for spot welding or otherwise securing a resilient restraining member 36 thereto, as clearly shown in Figs. 1 and 2, the said member 36 having its free end bent downwardly for engagement with the top surface of the motor-board 10 when the turntable 14, together with the speed changing mechanism carried thereby, is placed on the spindle 12.

The bent portion of the member 36 which engages with the motor-board 10 may have a suitable notch 37 formed therein to provide a plurality of pointed ends or teeth 38 adapted to slightly dig into the surface of the motor-board, whereby the outer raceway 30 is securely held against rotation.

The split collar 33 may be further provided with a plurality of ears or tabs 39 which are formed integral with the collar on the upper and lower peripheral edges thereof, as clearly shown in Figs. 2 and 3. These tabs or ears 39 are adapted to be turned or bent over on the peripheral edges of the outer raceway 30 to prevent upward or downward movement of the collar 33 on the raceway. Preferably, although not necessarily, a washer of felt or other suitable material, not shown, may be held against the bottom face of the bearing assembly 28 by means of the tabs or ears 39 to close the space between the inner and outer raceways 29 and 30 occupied by the balls 31 and to prevent the entry of foreign matter between the balls and the raceways, and the dropping of a lubricant supplied to the balls, onto the surface of the motor-board.

Referring again to Fig. 1, it will be observed that the lower end portion of the hub 15 has its diameter slightly reduced to minimize friction between the hub 15 and the sleeve 20 since, in operation, the rotation of the turntable hub 15 is relative to that of the sleeve 20.

Operation

Assume that a standard disc phonograph of conventional design, adapted primarily for the reproduction of standard record tablets operable, for satisfactory reproduction, at 78 revolutions per minute is available. Assume, also, that it is now desired to reproduce sound from another record tablet which was recorded at a much slower angular speed and is commercially known as a long-playing record operable, for satisfactory reproduction, at $33\frac{1}{3}$ revolutions per minute. The turntable or record support normally forming a part of the phonograph is removed from the supporting spindle therefor and another turntable or record support, constructed in accordance with my invention as herein described, is then placed on the turntable spindle in place of the first mentioned turntable.

Assuming, now, that the phonograph is in op-

eration, the turntable spindle will rotate at its normal speed, namely 78 R. P. M. as before, but the turntable or record support now on the spindle will rotate relatively to the spindle, or at approximately 33 $\frac{1}{3}$ R. P. M. This difference in angular speed is caused by the counter-clockwise rotation of the balls 31, which are of a predetermined size, about their axes relative to the raceway 29, which is being rotated at 78 R. P. M., and clockwise relative to the stationary raceway 30. The difference in circumference between the outer diameter of the raceway 29 and the inner diameter of the raceway 30 governs the difference between the clockwise advance of the balls 31 relative to the clockwise advance of an imaginary fixed point on the raceway 29. It is obvious, of course, that in speaking of the inner and outer diameters of the raceways 29 and 30, respectively, reference is made to the diameters of the annular ball grooves therein.

While speed changing devices have been known and used for various purposes and in various machines including phonographs, such devices have heretofore been subject to a distinct disadvantage, particularly in sound reproducing machines, when constancy of speed is essential to prevent so called "wows", or variations in pitch of the reproduced sound. Variations of this sort are due, usually, to mechanical irregularities, such as irregularities in gear teeth, which cause momentary disturbances or variations in the angular speed of the record supporting member. It will be apparent, however, from a consideration of the foregoing description of my invention, that the possibilities of "wows" appearing in a machine equipped with my improved speed changing mechanism will be practically entirely eliminated because it contains no gear trains or other similar elements which are subject to mechanical irregularities, being made up of elements of which the accuracy of manufacture can be controlled.

Although I have shown and described a cer-

tain specific embodiment of my invention, I am fully aware that many modifications thereof are possible. Furthermore, although I have shown and described my invention as applied to a device for operating the turntable at a slower speed than the spindle, it is possible to apply my invention to devices for operating the turntable at a greater speed than that of the spindle. Further, it should be noted that in either case, the device comprising my invention changes the speed of the turntable to a speed different than that of the spindle, thereby constituting a true speed changing mechanism. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In combination, a spindle operable at a predetermined speed, a record support rotatably mounted on said spindle, an annular ball race carried by said support, a plurality of balls associated with said ball race, means carried by said spindle for transmitting motion to said ball race, and means carried by said support and adapted to co-act with said balls whereby said support may be rotated relatively to said spindle.

2. In combination, a record supporting platen provided with an axially depending hub having a central bore, a cup-shape member encircling the hub, means for substantially preventing relative axial movement of hub and cup-shape member, an inner ball race carried by the cup-shape member, an outer ball race encircling the inner race, a ball cage affixed to the platen and extending into the space between the several ball-races, a plurality of balls in the ball cage, means for preventing the outer race from rotating and means whereby, when the hub is mounted upon a phonograph spindle, motion may be imparted to said hub from the spindle and the platen caused to rotate at a speed less than the speed of the spindle.

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