Feb. 1, 1938. J. B. SUOMALA 2,106,773

POWER TRANSMISSION DEVICE

Filed Aug. 30, 1932

Fig.1.

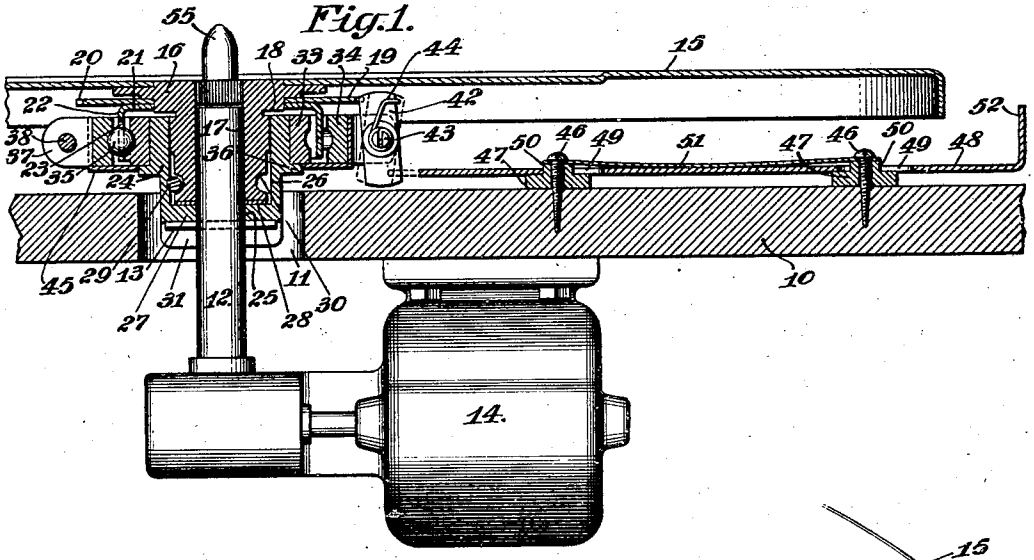


Fig.2.

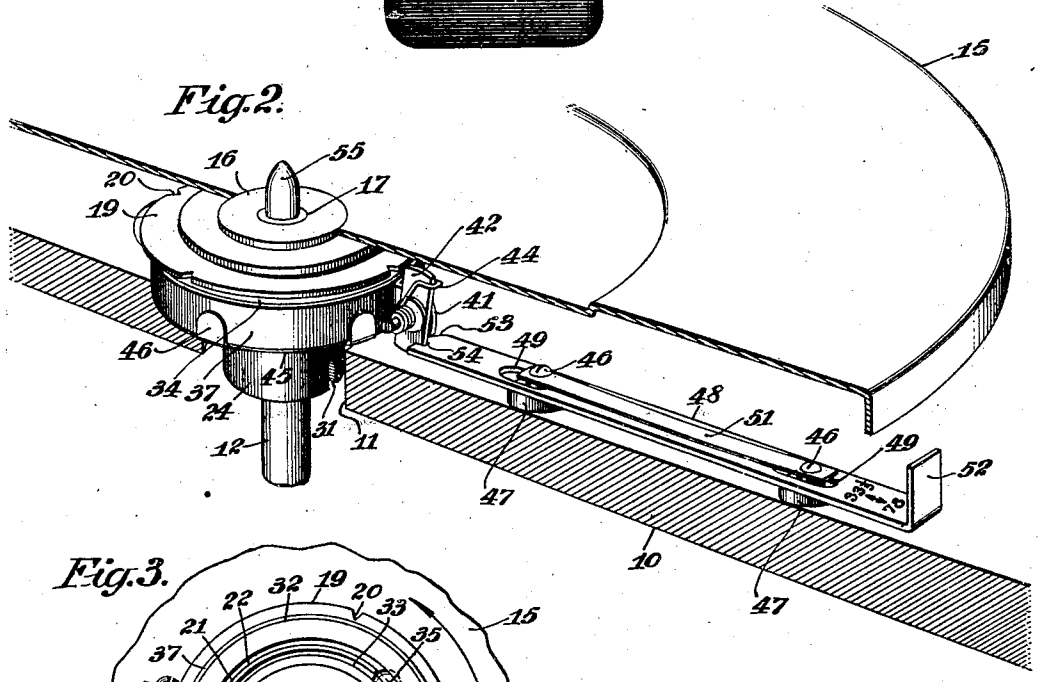
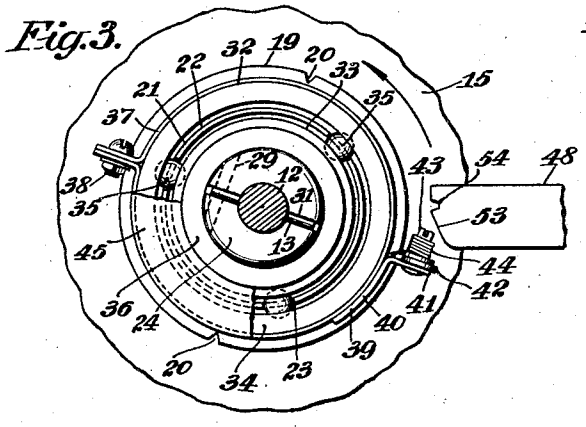


Fig.3.



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UNITED STATES PATENT OFFICE

2,106,773

POWER TRANSMISSION DEVICE

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Application August 30, 1932, Serial No. 630,985

9 Claims. (Cl. 274—9)

My invention relates to power transmission devices and, more particularly, to devices of this character which are advantageously applicable to phonograph turntables and the like.

Specifically, my invention is in the nature of an improvement over the devices disclosed in the co-pending application of Frederick C. Barton, Serial No. 592,704, filed February 13, 1932, and the co-pending application of John J. Hoehn, Serial No. 595,458, filed February 27, 1932, both of said applications being assigned to Radio Corporation of America. Both of the aforementioned applications disclose the use of planetary gearing of the ball type for the purpose of driving a phonograph turntable at a speed lower than that of the customary turntable supporting spindle. In neither application, however, is there disclosed simplified commercially practicable means for shifting from one turntable speed to another.

The application of devices of the above noted character to existing types of phonographs has not been found entirely satisfactory heretofore due to structural variations therein, such, for example, as the size of the opening in the motorboard through which the turntable supporting spindle usually projects. In some cases, the opening is so large that no surface is available immediately adjacent the turntable spindle for contact of a pronged restraining member, as in the case of the device shown in the above-identified co-pending application, S. N. 595,458. In other cases, where the turntable spindle opening in the motorboard is of a suitable size, the repeated contact of such a restraining element with the motorboard surface is also objectionable due to the damaging action thereof on the highly finished surface of the motorboard.

Furthermore, the construction of a manually actuable control or change-over device as a part of the turntable, as shown in the aforementioned co-pending application, S. N. 595,458, is also objectionable because the turntable, when rotating, must first be brought to rest before a change-over from one speed to another can be effected or, if the turntable is at rest with a record tablet thereon, the removal of the record is necessary before the control member can be actuated.

It is, accordingly, an object of my invention to provide an improved control mechanism for plural speed power transmission devices whereby the change-over from one speed to another may be made smoothly and gradually.

A further object of my invention is to provide an improved control mechanism for a plural speed power transmission device whereby the change-over from one speed to another may be effected while the device is in operation.

Another object of my invention is to provide an improved control mechanism for a plural speed phonograph turntable drive mechanism which is of simple, inexpensive construction and which is readily attachable to existing phonographs without altering the turntable spindle, the normal driving speed of the driving unit thereof, the motorboard, or the cabinet of the phonograph.

A further object of my invention is to provide an improved control mechanism for a plural speed phonograph turntable drive mechanism whereby the speed of the turntable may conveniently be caused, from a point adjacent to the turntable, to gradually accelerate or decelerate.

Another object of my invention is to provide an improved control mechanism for a plural speed phonograph turntable drive mechanism which may be controlled without removal of a record already on the turntable.

Still another object of my invention is to provide an improved control mechanism for a plural speed phonograph turntable drive mechanism which is positive in action, efficient in use, and which readily lends itself to low cost quantity production.

The novel features characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when read in connection with the accompanying drawing, in which

Fig. 1 is a sectional assembly view of a plural speed turntable carrying an improved selective speed changing mechanism in accordance with my invention and mounted on the turntable supporting spindle and the motorboard of a disc phonograph of conventional type, the parts being shown in position for operating the turntable at the same speed as that of the spindle.

Fig. 2 is a perspective view of the speed change mechanism embodying my invention with the turntable in section to illustrate the control means set in position for operating the turntable relatively to the spindle, i. e., at a speed different than the speed of the spindle.

Fig. 3 is a fragmentary bottom plan view of the selective speed change mechanism associated with the turntable in accordance with my invention,

with the dust cap for the bearing assembly partly broken away.

Referring more particularly to the drawing, wherein similar reference characters indicate corresponding parts throughout, a motorboard or other cabinet partition 10 having a central clearance opening 11 therein, and a turntable supporting spindle 12 extending vertically through the opening 11 and including a driving pin 13, form parts of a conventional type of disc phonograph and are shown to illustrate the application of my invention thereto. The spindle 12 may be driven from a motor 14 of any desired type.

In accordance with my invention, a record supporting platen 15, forming a turntable of conventional design, is provided with a centrally depending hub or boss 16 having a central bore 17 which extends through the hub 16 for the free passage therethrough of the spindle 12, as clearly shown in Fig. 1.

Formed concentrically with the hub 16, adjacent the under-side of the turntable 15, is a shoulder 18 on which a relatively large disc 19, having a plurality of equally spaced, substantially V-shape notches 20 formed in the periphery thereof, and an annular ball cage or driving member 21, is suitably staked, welded, or otherwise secured, with the annular wall 22 of the member 21 depending from the shoulder 18 in spaced relation to the periphery of the hub 16. In the annular wall 22 of the member are formed a plurality of equally spaced, vertically arranged slots 23 which extend inwardly from the lowermost peripheral edge of the wall 22 to a point substantially intermediate the length of the driving member 21.

Rotatably mounted on the lower end portion of the turntable hub 16 is a counter-bored sleeve 24 having a relatively smaller bore 25 in the lowermost end thereof in axial alignment with the larger uppermost bore 26, the bore 25 being of the same size as the bore 17 so that the bores 17 and 25 will register for the sliding passage therethrough of the spindle 12. A shoulder 27, formed in the sleeve 24 by the differing diameters of the axially aligned bores 17 and 26, is provided with a suitable washer 28 upon which the bottom face of the hub 16 seats.

Longitudinal movement of the counter-bored sleeve 24 on the hub 16 is prevented, after placement thereon, by means of an offset locking pin 29 which so extends transversely through the sleeve 20 that the intermediate portion of the pin 29 will register with an annular groove 30 formed in the periphery of the hub 16 adjacent its lower free end, as clearly shown in Fig. 1. The counter-bored sleeve 24 is further provided with a transverse slot 31 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 24 is rotated in response to the spindle 13 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 24, as by means of a "press fit" thereon, is a bearing assembly 32 comprising an inner raceway 33, an outer raceway 34, and a plurality of balls or rollers 35 disposed between said raceways. The inner diameter of the raceway 33 and the outer diameter of the sleeve 24 are such that the bearing assembly, generally indicated at 32, may be pressed thereon to the depth of the shoulder 36 on the sleeve 24 to insure rotation of the inner raceway 33 with the sleeve 24. The annular driving member 21 depends in the space between the inner and outer raceways 33 and 34, respectively, which space is maintained by the balls or rollers 35. The spaced, vertical slots 23 formed in the annular wall of the driving member 21 are of a size sufficient to receive the balls 35 therein, to maintain the said balls in equally spaced relation, and to transmit motion from the sleeve 24 to the driving member 21 and the turntable 15.

In order that the turntable 15 may be rotated relatively to the spindle 12, or at a speed different than the speed of the spindle, the outer raceway 34 of the bearing assembly 32 must be restrained against rotation. To this end, a split collar 37 is suitably clamped about the periphery of the outer raceway 34 by means of a bolt 38. An L-shape member 39, having its long end 40 curved to match the periphery of the collar 37, is spot-welded or otherwise attached thereto so that the short end 41 of the member 38 projects laterally from the collar 37 at a point diametrically opposite to its split ends. A latch member 42 is pivoted intermediate its ends to the laterally projecting end 41 of the member 39 by means of a suitable pivot pin 43 carried by the end 41 of the member 38. The latch member 42 is normally urged in a counter-clockwise direction by means of a spring 44 carried by the pin 43, one end of the spring being anchored to the pin 43 and the other end to the latch member 42, whereby the latch member 42 is maintained in co-operative relation with the disc 19 and the outer raceway 34 thereby locked to the turntable 15.

To prevent the entry of foreign matter between the balls or rollers 35 and the inner and outer raceways 33 and 34, respectively, or to prevent a lubricant therefor from dropping onto the motorboard, a suitable disc 45, which is provided with a plurality of turned-up ears 46, is fitted about the periphery of the collar 37 from the underside of the bearing assembly 32, as clearly shown in Figs. 1 and 2.

Mounted on the motorboard 10, as by means of the screws 46, and spaced from the motorboard 10, by means of washers 47, is a manually actuable slide bar 48 for controlling the latch member 42. The slide bar 48 is provided with a pair of spaced, elongated slots 49 within which the reduced end portions 50 of the washers 47 project a distance slightly beyond the upper surface of the slide bar 48, whereby the slide bar 48 is supported for free sliding movement on the washers 47.

In order that the slide bar 48 may be held in either one of its two extreme positions, a curved spring blade 51 is so positioned with its free ends under the heads of the screws 46 that the intermediate portion of the spring blade 51 exerts a downward pressure on the upper surface of the slide bar 48. The frictional contact thus set up between the underside of the spring blade 51 and the upper surface of the slide bar 48 maintains the slide bar in either one of its two extreme positions. The outer free end portion of the slide bar 48 is bent to provide an upstanding finger piece or grip 52, while the opposite free end of the slide bar 48 has a portion of its edge beveled to provide a cam-like surface 53, whereby the latch member 42 is adapted to be urged in a clockwise direction to withdraw the latch member 42 from the disc 19.

A substantially V-shape notch or recess 54 is

formed in the edge of the slide bar 48 adjacent to the cam surface 53 for maintaining the latch member 42 in the position to which it may be moved by its engagement with the cam surface 53 and to thereby hold the outer raceway 34 against rotation when the slide bar 48 is moved toward the spindle 12, or to the position shown in Fig. 2.

In cases where it is desirable that the record centering pin rotate at the same speed as that of the turntable, the centering pin may take the form of a separate pin plug 55 which is pressed into the upper end of the bore 17 in the turntable hub 16. In such cases, the spindle 12 extends into the bore 17 a distance short of the inner end of the pin plug 55. Where it is desirable that the record centering pin rotate at the same speed as that of the spindle 12, the free end of the spindle projects through the bore 17 in the turntable hub 16 and acts as the record centering pin in a manner well known in the art.

Operation

In considering the operation of my invention, it is to be noted that the spindle 12 and the inner raceway 33 constitute a driving member; the turntable or record supporting platen 15 is, of course, the driven member; while motion is transmitted from the driving member to the driven member or turntable by the co-operation of the outer raceway 34, the balls 35, and the ball cage 21, which latter three are associated with the turntable 15 in the manner heretofore described and constitute the motion or power transmitting mechanism.

Assuming, now, that the turntable shown in Fig. 1 with the slide bar 48 in the position shown in full lines is being rotated and the outer raceway 34 locked to the turntable 15 by the engagement of the latch member 42 with the notched disc 19, the turntable 15 will rotate at the same speed as that of the spindle 12, by reason of the fact that the turntable is driven by the spindle 12 operating through the sleeve 24 and the ball cage 21 while the balls 35 and the inner and outer raceways 33 and 34, respectively, are rotating as a unit.

Assume, now, that it is desired that the turntable 15 rotate relatively to the spindle 12. The slide bar 48 is moved from the position shown in full lines in Fig. 1 to the position shown in Fig. 2. This movement places the inner free end of the slide bar 48 in the path of the latch member 42 carried by the outer raceway 34. As soon as the latch member 42 engages the cam edge 53 and continues on into the notch 54 upon rotation of the turntable 15, the latch member will be withdrawn from one of the notches 20 in the periphery of the disc 19 and the outer raceway 34 subsequently held against rotation when the latch member 42 is seated in the notch 54.

It is to be observed that, when the slide bar 48 is moved from the position shown in Fig. 2 to that shown in Fig. 1, the mechanism functions to accelerate the speed of the turntable from 33⅓ R. P. M. to 78 R. P. M. In the course of the movement of the slide bar 48, as above noted, the latch member 42 is released for co-operative engagement with the disc 19 to lock the outer raceway 34 to the turntable 15. When the outer raceway 34 and the latch member 42 are released from the restraining action of the slide bar 48, the outer raceway 34 and latch member 42 accelerate substantially instantaneously. Such being the case, the latch member 42 would have to assume the burden of accelerating the slowly rotating turntable rapidly, if the latch member 42 were to remain seated in the first notch 20 passing the latch member 42.

To prevent such action, the notches 20, in the disc 19, are of such size and shape that the latch member 42 will only seat momentarily in each of the notches 20 immediately after the slide bar 48 has been moved from the position shown in Fig. 2 to that shown in full lines in Fig. 1, until the speed of the turntable 15 has been gradually accelerated to such an extent that the rotation of the latch member 42 and that of the turntable 15 is only slightly relative, whereupon the latch member 42 will remain seated in one of the notches 20 and the turntable rotated at the same speed as that of the spindle.

From the above description, taken in connection with the drawing, it will be readily apparent that, when the spindle 12 is being rotated at a predetermined, constant speed, either one of two turntable speeds is available for reproducing either the well known standard records operable substantially at an angular speed of 78 R. P. M., or the new so-called "long playing records" operable at an angular speed of 33⅓ R. P. M., by the selective shifting of the slide bar 48.

Although I have shown and described certain embodiments of my invention, I am fully aware that many modifications thereof are possible. 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 motorboard, a phonograph record supporting platen including a depending hub, a selective speed changing mechanism permanently journaled on said hub, means adapted to either restrain a portion of said mechanism from rotation or release said mechanism for rotation, and manually operable means slidably carried by said motorboard for selectively controlling said restraining means at will.

2. In combination, a motorboard, a phonograph turntable having a change-speed mechanism permanently attached thereto, and manually operable means slidably mounted on said motorboard for selectively controlling said mechanism.

3. In combination, a motorboard, a phonograph turntable having a change-speed mechanism permanently attached thereto, said mechanism including a member movable relative to said turntable, means for locking said member to said turntable, and manually operable means slidably mounted on said motorboard for selectively controlling said locking means.

4. In combination, a motorboard, a rotatable spindle operable at a predetermined speed, a record support rotatably mounted on said spindle, a speed changing device attached to said support as a unit and adapted to co-operate with said spindle to transmit motion from said spindle to said support whereby said support may be rotated either relatively to said spindle or at the speed of said spindle, means carried by said support in co-operative relation to said speed changing device adapted to selectively control said device, and means slidably mounted on said motorboard for controlling said last named means.

5. In combination, a motorboard, 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 car-

ried by said support and adapted to co-act with said balls whereby said support is rotated relatively to said spindle, means carried by said ball race whereby said ball race is adapted to be locked to said support, and manually operable means slidably mounted on said motorboard for selectively controlling said last-named means.

6. In combination, a motorboard, a record support, a spindle therefor operable at a predetermined speed, power transmitting means associated with said support and adapted to operate said support at another predetermined speed, means carried by said spindle for driving said transmitting means, means carried by said transmitting means adapted to be actuated to lock said transmitting means to said support whereby said support is rotated at the speed of said spindle, and manually operable means slidably mounted on said motorboard for selectively controlling the locking means carried by said transmitting means.

7. In combination, a motorboard, 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 support and adapted to co-act with said balls whereby said support is rotated relatively to said spindle, latch means associated with said ball race and adapted to normally lock said ball race to said support whereby said support is rotated at the same speed as that of said spindle, and means slidably mounted on said motorboard for releasing said latch means to permit said first named means to rotate said support relatively to said spindle.

8. In combination, a motorboard, a spindle operable at a predetermined speed, a record support rotatably mounted on said spindle, a change-speed mechanism carried by said support and comprising an inner and outer raceway having a plurality of balls disposed therebetween, a power transmitting member carried by said support and adapted to co-act with said balls whereby said support is rotated relatively to said spindle, a yieldable latch mechanism associated with said outer raceway and support whereby said change-speed mechanism is normally locked to said support and thereby rotated at the same speed as that of said spindle, a manually actuable control bar slidably mounted on said motorboard and adapted to release said latch mechanism whereby said outer raceway is held against rotation to permit said balls to drive said support relatively to said spindle, and means associated with said control bar to maintain the same in adjusted position.

9. In a phonograph provided with a motorboard, a turntable having a change-speed mechanism attached thereto, said mechanism including a rotatable latch member, and means movably mounted on said motorboard and movable into the path of movement of said latch member for controlling said mechanism.

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