Aug. 25, 1942. B. W. CARRINGTON 2,294,280

RESILIENT DRIVE TURNTABLE SHAFT

Filed March 27, 1940 2 Sheets-Sheet 1

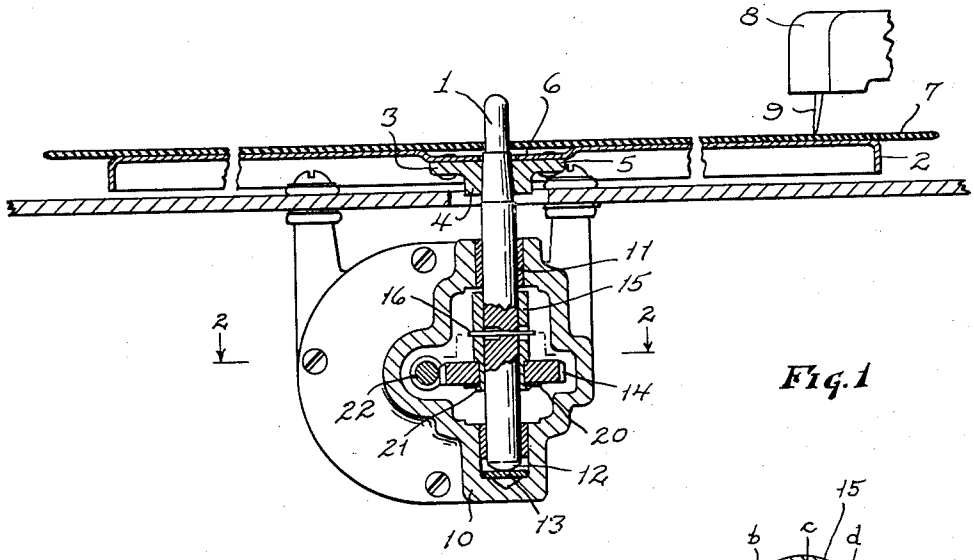


Fig. 1

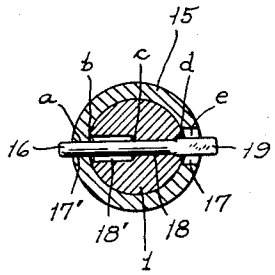


Fig. 3

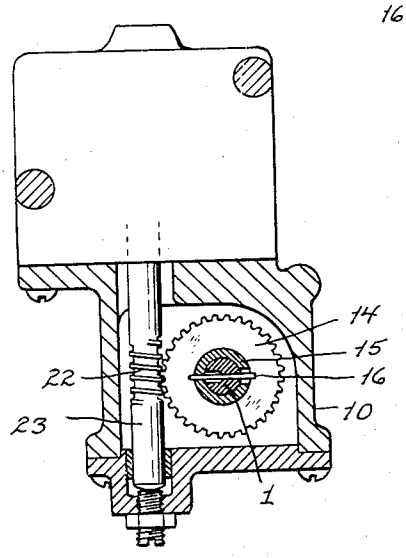


Fig. 2

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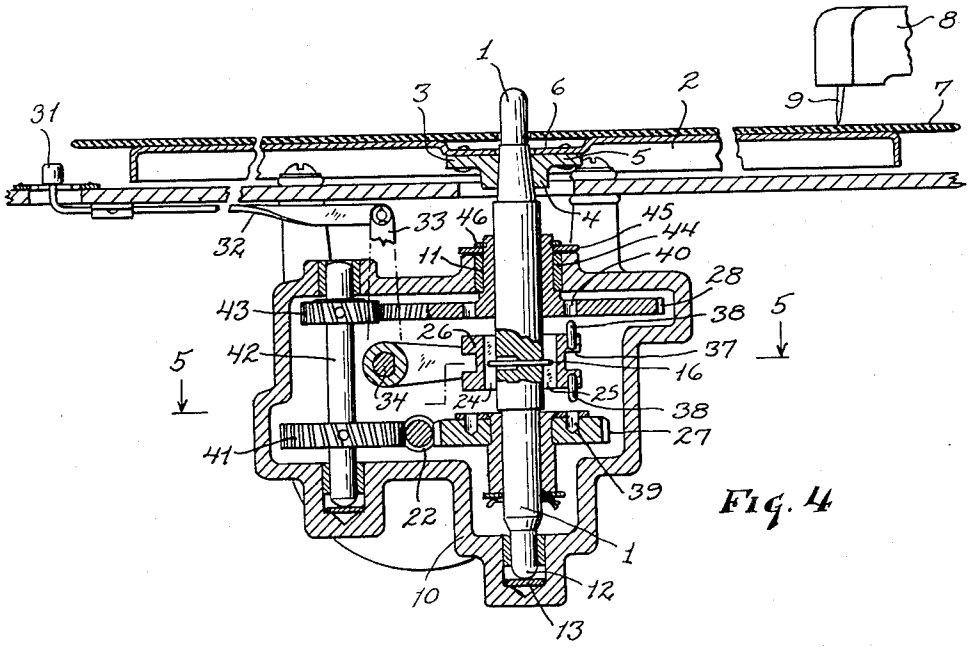


Fig. 4

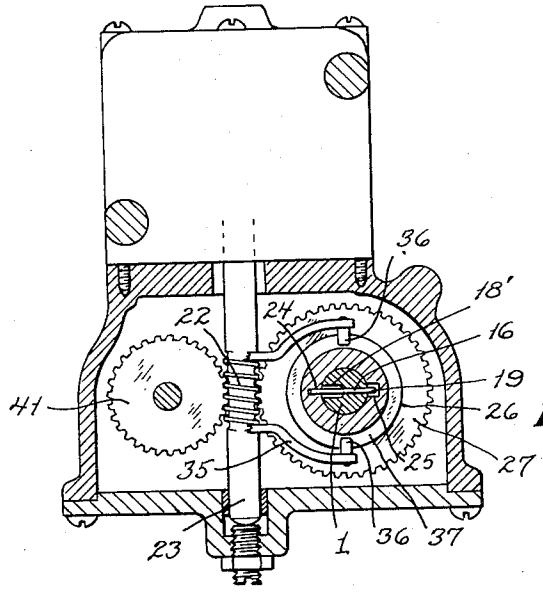


Fig. 5

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UNITED STATES PATENT OFFICE

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RESILIENT DRIVE TURNTABLE SHAFT

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Application March 27, 1940, Serial No. 326,205

4 Claims. (Cl. 64—27)

This invention relates to phonographs and relates particularly to improved means for supporting and driving the turntable thereof.

My invention is applicable to phonographs provided with either single speed or multi-speed drives and relates more particularly to improved means interposed between the driving gear and the driven shaft of a turntable whereby vibrations of the driving mechanism created by vibration in the motor mechanism or by pulsations occurring by reason of irregularities in the worm gear means are not transmitted to the turntable shaft.

Where a turntable has been rigidly connected to the turntable shaft, as with a taper fit or a grooved turntable hub in conjunction with the cross pin in the turntable shaft, the motor pulsations or pulsations because of the effect of irregularities in the contact surfaces of the worm and gear become transmitted to the record and result in a high frequency "flutter" which is very noticeable and very objectionable, particularly in certain reproductions, as for example, the higher notes of a clarinet or flute.

Various means have been proposed for overcoming or damping out such distorting vibrations and among these, patents to Wm. A. Schmittgen, No. 2,083,037, dated June 8, 1938, and No. 1,979,350, dated November 6, 1924, are to be noted.

My invention relates to improved resilient means associated with the turntable shaft for use as described.

Another object of my invention is to provide a resilient drive turntable shaft of the type described wherein any sudden load applied to the turntable will be accommodated without resulting in a large angular displacement between the gear and the turntable.

Another object of my invention is to provide a resilient drive turntable shaft of the type described which is efficient for use particularly in connection with overcoming drags on the turntable, such as are encountered in recording motor turntables and in record changer turntables when they are loaded with several records.

Other objects of my invention and the invention itself will become increasingly apparent by reference to the drawings and the following description, in which drawings:

Fig. 1 is a cross sectional view of a mechanism embodying my invention with parts thereof in elevation;

Fig. 2 is a view taken from the offset plane 2—2 of Fig. 1;

Fig. 3 is an enlarged view of parts of Fig. 2;

Fig. 4 is a cross sectional view of another embodiment of my invention with parts thereof in elevation, said embodiment being particularly directed to the use of a two-speed drive in connection with my invention; and

Fig. 5 is a view taken from the offset plane 5—5 of Fig. 4.

Referring now to the different figures of the drawings in all of which like parts are designated by like reference characters, I have shown at 1 a turntable driving shaft generally vertically disposed, secured to a turntable 2, for example, by being riveted thereto by means of a collar 3, disposed on the shaft 1, having a hub portion 4 and a flange portion 5, the flange portion underlying and being riveted to a central depressed portion 6 of the turntable 2. In Figs. 1 and 4, a record 7 is shown resting on the turntable and a portion of a tone arm 8 and needle 9 associated therewith is further shown resting on such record.

A main frame 10 is shown in each of these Figures 1 and 4 having rotatably mounted in a generally vertical bore 11 thereof, the shaft 1, supported by an end thrust bearing 12 formed by the end of said shaft being rounded and adapted to have point contact only with the flat surface 13 disposed in the main frame adjacent thereto.

Figs. 1 to 3, as noted in the general description of the drawings herein, illustrate the improved means of my invention as embodied in a single speed drive and in these figures, it is to be noted the shaft 1 is provided with a gear 14 having a hub 15 rotatably mounted on the shaft 1 and the shaft 1 is secured to said hub 15 by means of a pin 16 which is projected through aligned openings 17—17' in the hub and 18—18' in the shaft. The end 19 of the pin may be flattened as shown in Fig. 3 so as to be more readily engaged by an assembling tool.

It is to be noted that the perforation 17 is relatively larger than the widest portion of the pin 16 and the perforation 17' corresponds in shape and size to the cylindrical end of the pin whereby the cylindrical end of the pin is adapted to project therethrough and be securely retained therein. It is further to be noted that the bore 18 in the shaft is the same size as the bore 17' in the hub and that in that portion of the shaft adjacent the perforation 17' said bore is enlarged as shown at 18'.

It is to be noted that the pin 16 is projected first through the large perforation 17 in the

hub, the narrower portion of the bore 18 of the shaft, thence through the enlarged portion of the bore 18' and through the opposite perforation 17' of the hub, and that the pin 16 securely locks the gear 14 and shaft 1 together and at the same time permits, by reason of the differences of the bore and pin sizes at different parts of its projection therethrough and the inherent resiliency of the pin, a slight amount of relative rotation of the shaft and the gear, which is rigidly associated with the hub, so that any irregularities occurring in mating surfaces of the gear and worm, despite careful manufacture, will be compensated for, and also any vibrations transmitted to the gear by the motor are accommodated without transmitting the same to the truntable.

It is to be noted that the pin 16 is relatively tight in the gear hub at the point *a* but that there is clearance between the pin and the shaft from *b* to *c*. It is again to be noted that between the points *c* and *d* the pin is relatively tight in the shaft and that there is again clearance between the pin and the hub at *e*. I preferably form the gear 14 of fiber material and interpose a washer 20 between the underside of the gear and the spun over end 21 of the hub and preferably form the pin 16 of a resilient spring wire material.

The gear 14 is meshed with the worm thread 22 on the motor shaft 23 which is secured to the motor and driven thereby in the usual manner.

Figs. 4 and 5 illustrate the resilient drive of my invention as incorporated in an otherwise usual type of two-speed turntable drive mechanism employed in phonographs to accommodate records to be reproduced at different rotational speeds. In this embodiment, the resilient pin 16 is mounted in the turntable shaft 1, as before. The ends project into slots or keyways 24 and 25 in a slideable clutch member 26 which is adapted to engage either of two driving gears 27 or 28. As best seen in Fig. 5, the slot 24 which is adjacent the enlarged bore 18' in the shaft is of such width as to have a sliding fit with the pin 16, while the opposite slot 25 is sufficiently wide to give ample clearance to the tail 19 of the pin. Thus flexing of the pin allows a slight relative rotation of the shaft and clutch member, due to the enlarged bore 18' and the enlarged slot 25, and the pin furnishes a resilient drive therebetween while the clutch member is free for axial movement to either of its two operating positions.

The pin 16 will, of course, vary in thickness according to the torque load to be imposed upon it, and with reference to the drawings, the diameters of the pin are necessarily illustrated as being greater than would often be the practice, and in general it will be understood that the diameter of that portion of the pin which projects through the space 18', Fig. 3, is susceptible of variation according to the torque load and the degree of corrective resilient flexing required for any given set of conditions.

Manual shifting of the clutch is accomplished in the present embodiment by means of a shift button 31 which is linked by the rod 32 with an arm 33 secured to a rock shaft 34 journalled in the main frame 10. Within the housing the rock shaft carries a shifter fork 35 fitted with pins 36 which project radially into the circumferential groove 37 of the clutch member 26.

Projecting axially from the member 26 are pins 38 adapted to engage recesses 39 in the gear 27 or recesses 40 in the gear 28, thus providing a driving connection between either of these gears and the turntable shaft.

The gear 27 corresponds to the worm gear 14 of Fig. 1, meshing directly with the worm 22 on the motor shaft 23, and thus furnishes the high speed drive to the turntable. Also, meshing with the worm is a worm gear 41 rigid with an idler shaft 42. A second and smaller gear 43, also rigid on the shaft 42, is constantly in mesh with the large gear 28, before mentioned, thus constituting a low speed drive to the turntable. The hub of the gear 28 is journalled in the bearing 44 in the main frame 10 and is supported by the washer 45 and split ring 46. The shaft 1 passes through the hub and is freely rotatable therein.

The worm gear 27, before mentioned, is freely rotatable on the shaft 1. Thus the gears 27 and 28 are constantly rotated by the motor, at different speeds, and the shaft can be driven by either through the agency of the clutch member 26. For high speed operation of the turntable, torque is transmitted from the motor shaft 23 and worm 22 through the worm gear 27 and clutch pin 38 to the clutch member 26 and thence through the spring pin 16 to the turntable shaft 1.

For low speed operation, torque is imparted from the worm 22 through the worm gear 41, idler shaft 42, gears 43 and 28, clutch pin 38, clutch member 26, and spring pin 16 to the shaft 1.

In operation of either the embodiment shown in Figs. 1 to 3 or that shown in Figs. 4 and 5, if it be assumed that the turntable and motor rotor are operating at constant angular velocity and irregular spots on the worm and gear are encountered, the tendency is to impart a torque impulse to the turntable. Since this impulse must be transmitted through spring pin means 16, due to the friction between the gear, hub and the shaft, some of the energy of the impulse is lost and the inertia of the table and record tends to absorb the rest of the energy since the angular velocity can not change immediately. When it does attempt to accelerate, due to the impulse imparted by the spring, some of the energy is absorbed by the friction as the angular velocity of the shafts tends to exceed that of the gear. Since the vibrations and pulsations which result in high frequency "flutter" are of high frequency and small amplitude, it has been found that a relatively stiff spring such as the pin means described herein will follow the small angular displacements between the shaft and gear and because of the high frequency, the relatively low friction between the shaft and gear hub is effective in dissipating the energy of the torque pulsations, which otherwise cause the so-called "wow" note of reproduced records.

My invention is not limited to the exact details of construction shown and described. Many modifications and changes may be made within the spirit of my invention and the scope of the appended claims.

I claim:

1. In a keying means for a phonograph turntable drive comprising a tubular element loosely telescoped over a turntable shaft and secured thereto by resilient spring means, said means being projected through aligned transverse bores provided in said tubular element and said shaft, the bore portions disposed in opposite sides of said tubular member being of different diam-

eters and a portion of the bore disposed throughout the shaft being of relatively greater transverse diameter than that disposed through the remaining portion.

2. In a keying means for a phonograph turntable drive comprising a tubular element loosely telescoped over a turntable shaft and secured thereto by resilient spring means, said means being projected through aligned transverse bores in said tubular element and said shaft, the bore portions disposed in opposite sides of said tubular member being of different diameters and a portion of the bore disposed throughout the shaft being of relatively greater transverse diameter than that disposed through the remaining portion, the bore portions having the relatively lesser diameter in said tubular element being disposed adjacent the bore portion of relatively greater diameter of the shaft.

3. In a keying means for a phonograph turntable drive, a tubular element loosely telescoped over a turntable shaft and resilient keying means disposed between said element and said shaft, said resilient keying means being in the form of a resilient pin projected through aligned transverse openings in said turntable shaft and said tubular element, a portion of said aligned openings being of relatively greater transverse dimensions than the diameter of the pin extending through said portion and the remainder of said openings being of substantially the same transverse dimensions as the diameter of the pin extending through said remaining portion, said tubular element adapted to be selectively engaged with either of a pair of different speed gears associated with said turntable drive whereby vibrations imparted thereto are damped.

4. In a keying means for a phonograph turntable drive consisting of a tubular element loosely telescoped over the turntable shaft associated with said turntable drive, said tubular element being provided with a pair of aligned openings through which resilient pin means are projected, said pin means being further projected through said turntable shaft, one of said openings in said tubular element being relatively larger than the other of said openings whereby a flattened end portion of said resilient pin means which is relatively smaller than said perforation is loosely mounted therein, said relatively smaller opening being of such size as to securely retain said other portion of the resilient pin means therein whereby the pin is adapted to flex to permit a slight amount of relative rotation between the turntable shaft and the tubular element.

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