

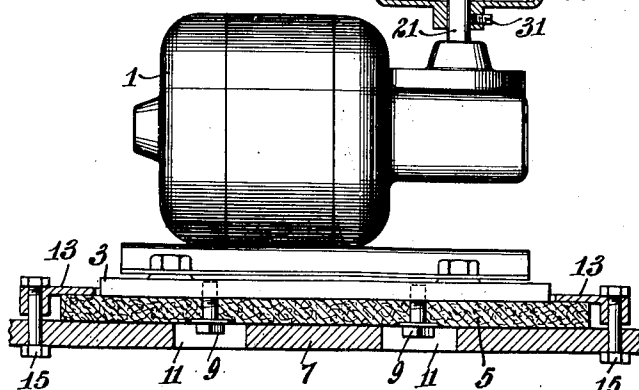
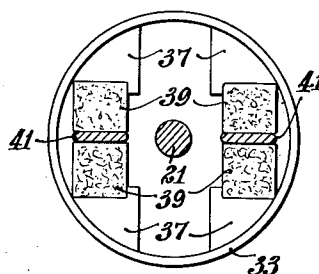
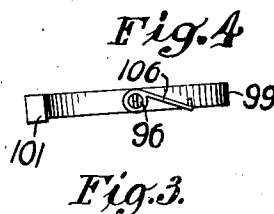
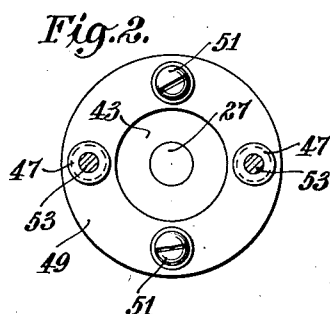
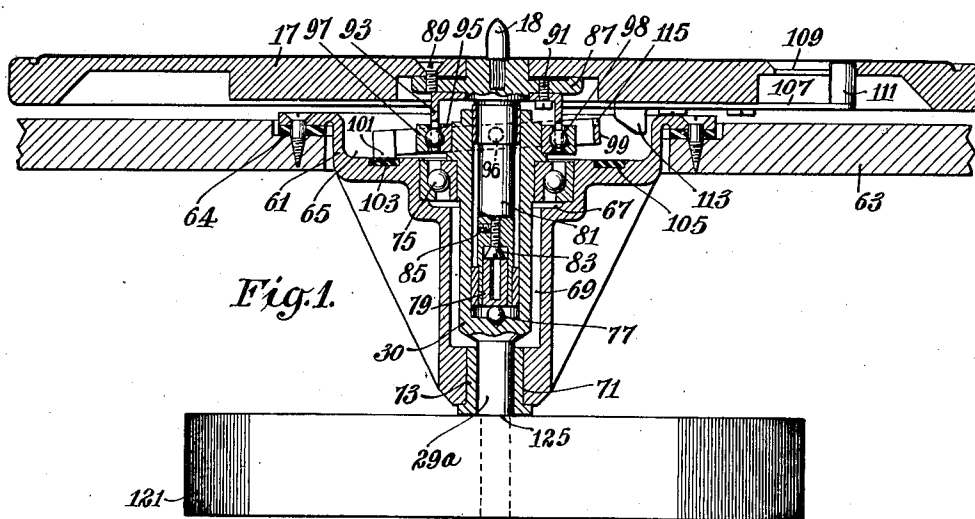
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SOUND REPRODUCING APPARATUS

Original Filed March 30, 1935



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2,106,718

SOUND REPRODUCING APPARATUS

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6 Claims. (Cl. 274—9)

This invention relates to sound reproducing apparatus, and more particularly to the means, in such apparatus, for driving the record supporting turntable, the present application being a division of our copending application Serial No. 13,796, filed March 30, 1935.

It is well known that, in order to obtain satisfactory reproduction of sound, the turntable should rotate at a uniform speed, since variations in the speed thereof result in obnoxious variations in pitch of the reproduced sound. This need is particularly great in connection with transcription work in radio broadcasting, and various forms of turntable drive mechanisms for transcription phonographs have been suggested.

There are also a number of other requirements for phonographs used in transcription broadcasting. For example, the turntable should be movable in either direction to enable the monitor to adjust it with reference to the starting point or points on a record in order to tie in with some other part of the broadcast. It is also essential that the drive mechanism be extremely rugged, since transcription phonographs are started and stopped many times a day. At the same time, however, the mechanism must be sufficiently flexible and responsive to produce constant speed of the turntable with minimum oscillation of the parts. Moreover, where records of both 78 R. P. M. and 33½ R. P. M. are to be employed, it is essential not only that the phonograph be adapted to reproduce both types of records, but each must be rotated at constant speed. As is well known, the slower the speed of a moving device, the more difficult it is to filter out oscillations therein.

Prior art machines with which we are acquainted have not satisfactorily met all of the foregoing requirements, and particularly the last, and they have, therefore, been found unsatisfactory for transcription broadcasting work.

The primary object of our invention is to provide an improved phonograph which is particularly adapted to use in broadcasting from phonograph records and which is not subject to the defects and disadvantages of prior art machines.

Another object of our invention is to provide an improved phonograph wherein the turntable will be driven with minimum variation from true constant speed regardless of the speed of rotation thereof.

Still another object of our invention is to provide an improved phonograph wherein a minimum of oscillation of the turntable and driving mechanism therefor will take place.

A further object of our invention is to provide an improved phonograph wherein the turntable is free, at any time, to be revolved in either direction without harm to the driving mechanism.

It is a further object of our invention to provide, in a phonograph of the type specified, improved means for controlling or selecting any one of a plurality of operating speeds for the turntable.

Another object of our invention is to provide an improved phonograph which can be easily and quickly started and which will be brought up to speed with minimum effort and substantially instantaneously.

Still a further object of our invention is to provide an improved phonograph for transcription broadcasting work which is extremely rugged in construction, the parts of which are readily accessible, and which is extremely efficient in use no matter what speed is chosen for the turntable.

In accordance with our invention, the drive shaft is divided into a plurality of separate, substantially axially aligned sections coupled together through a plurality of flexible couplings and a spring clutch, the former dismissing bearing slap and taking care of any misalignment of the shaft parts, and the latter permitting free rotation of the turntable in clockwise direction without harmful effects on the motor when the latter is stopped. The driving motor is mounted on a felt base to damp out oscillations or vibrations thereof and to prevent them from being transmitted to the cabinet, and it is coupled to the drive shaft through an oil soaked felt coupling which prevents oscillations of the motor or driving mechanism from passing on to the drive shaft. The turntable, made of aluminum or other light metal to lessen the load on the rotating parts and to permit quicker acceleration, is coupled to the drive shaft through a ball bearing type speed reduction mechanism which is controlled through the surface of the turntable. A fly wheel on one of the shaft parts which always rotates at 78 R. P. M. possesses the same inertia regardless of the speed for which the turntable is set, whereby any tendency of the moving parts to oscillate is effectively overcome.

The novel features that we consider characteristic of our invention are set forth with particularity in the appended claims. The invention itself, however, together with additional objects and advantages thereof, will best be understood from the following description of a specific em-

bodiment thereof, when read in connection with the accompanying drawing in which

Figure 1 is a central sectional view of a phonograph turntable and drive mechanism constructed in accordance with our invention.

Figure 2 is a view of one of the flexible couplings taken on a line corresponding to the line II—II of Figure 1.

Fig. 3 is a view of the damping coupling taken on a line corresponding to the line III—III of Figure 1, and

Figure 4 is a fragmentary detail of the holding ring of the transmission mechanism and mounting therefor.

Referring more specifically to the drawing, wherein similar reference characters indicate corresponding parts throughout, there is shown a motor 1 bolted or otherwise suitably secured to a relatively heavy metal block 3 supported on a felt pad 5 which is in turn supported on a frame or support 7 forming the base or other suitable part of a cabinet in which the mechanism may be housed. A series of bolts 9 passing through openings 11 in the base 7 and threaded into the block 3 securely hold the pad 5 in place against the block 3, while a pair of bracket members 13 and associated nuts and bolts 15 hold the pad 5 in fixed position on the base 7. The felt pad 5 serves to insulate the motor 1 from the base 7, and oscillations resulting from motor vibrations are thus effectively damped out and prevented from reaching the cabinet and, through the cabinet, eventually to a turntable 17 which is provided with a record centering pin 18 and which is driven from the motor 1. The pad 5 also prevents motor noises from passing on into the studio and from being picked up by the broadcasting microphone.

Interposed between the motor 1 and the turntable 17 are a plurality of substantially axially aligned shaft sections 21, 23, 25, 27 and 29, the latter terminating in an enlarged, centrally bored portion 30. The section 21, which is geared to the motor, constitutes a drive shaft and has secured thereto adjacent its free end, as by a set screw 31, a female coupling member 33 adapted to cooperate with a spider-like male coupling member 35 on the section 23. The female member 33 is somewhat cup-shaped in form and has formed thereon a plurality of spaced, upstanding portions 37 between which two pairs of oil saturated felt damping blocks 39 are retained, the blocks 39 being slightly spaced apart for the snug reception therebetween of the blades 41 of the spider 35 which may be either formed integrally with or suitably secured to the lower end of the shaft section 23. In order to retain the shaft sections 21 and 23 in desired relation, the section 23 may be centrally bored for the reception of the reduced, free end 22 of the shaft section 21 and may be supported on the collar 24 thereof. The construction just described effectively serves to damp out motor oscillations to prevent them from passing up to the turntable 17 through the driving mechanism.

Coupling the shaft sections 23 and 25 is a flexible connection of any suitable form. For purposes of illustration, we have shown a universal joint comprising a pair of spaced discs 43, 45 which, through integrally formed collars 44, 46, may be secured, respectively, to the adjacent ends of the shaft sections 23 and 25. Intermediate the discs 43 and 45 and suitably spaced therefrom by washers 47 is a concentric flexible ring 49 of phosphor-bronze, for example, which is

secured at diametrically opposite points to the disc 43 by downwardly extending screws 51 and to the disc 45 by diametrically opposite, upwardly extending screws 53, the diameters passing through the screws 51 and 53, respectively, being 90° apart. A similar flexible coupling connects the shaft sections 27 and 29 and will not, therefore, be further described, but it is to be noted that the two flexible connections just described will take care of any bearing slap that may be present and will permit slight weaving of the various shaft sections, as by reason of slight misalignment, for example, without permitting the irregularities to be transmitted to the turntable 17.

In order to transmit power between the shaft sections 25 and 27 and to permit free rotation of the turntable 17 in a clockwise direction relative to the driving mechanism, we have coupled the shaft sections 25 and 27 by a coil spring clutch 55, the section 27 being centrally bored to receive the reduced end 26 of the section 25. Preferably, the lower end of clutch 55 is fixed to the section 25 at 57 and fits snugly about the sections 25 and 27, its other end being free upon the section 27. The coil 55 is wound in such a direction that, when the motor 1 commences rotation, the spring will tighten itself around the sections 25 and 27 and will transmit power to the latter shaft section. However, should the motor slow down or be stopped, the coil will unwind somewhat, permitting the turntable to continue its rotation freely. The clutch 55 permits the free rotation of the turntable in a forward direction relative to the motor 1, backward rotation being accomplished by a reversible gear train in the motor. If desired, the lower end of the clutch spring 55 need not be secured to the section 25 but may be loose thereon, being wound oppositely to the portion thereof around the section 27, in which case a snug fit of the spring 55 throughout its length should be insured.

The shaft section 29 is mounted for rotation within a housing 61 which is secured to a motor board 63 but is shock-insulated therefrom by a rubber or the like washer 64. The housing 61 is stepped to form a plurality of successively reduced housing portions 65, 67, 69 and 71. Within the housing portion 71 is fitted a bushing 73 in which the intermediate portion 29a of the shaft section 29 is received for rotation, while the housing portion 67 has fitted therein a ball bearing 75 in which the enlarged portion 30 of the shaft section 29 is received. The raceways of the ball bearing 75 are so inclined where they contact with the balls that the latter will take up the radial as well as the load thrust of the assembly, while a thrust bearing 77 within the bored portion 30 takes the load thrust of the turntable 17. A spacing member 79, resting on the bearing 77, in turn supports the hub 81 of the turntable 17 through a vertically adjustable screw 83 threaded into the hub 81 and adapted to be locked in any set position by a locking screw 85. Adjustment of the screw 83 permits locating the turntable 17 at any desired level above the motor board 63 and with respect to the selective speed change mechanism presently to be described for suitable control of the latter.

The hub 81 has an enlarged head or flange 87 whereby it is secured to the turntable 17, as by means of screws 89. A plurality of screws or the like 91 secure a downwardly extending ball cage 93 to the bottom of the head 87, the cage 93 extending down between a pair of cooperable ring

elements or raceways 95 and 97 for the reception of a plurality of balls 98. The inner raceway 95 is force fitted onto the upper end of the shaft portion 30 for rotation therewith at constant speed while the outer raceway or ring element 97 has pivoted thereto on a pair of diametrically opposed pins 96 (only one of which is shown in the drawing) a holding ring 99 provided with a knife-like projection 101 adapted to engage a resilient or other suitable restraining member 103 seated in an annular groove 105 in the housing portion 65. The holding ring 99 is normally constrained or urged to and held in the position shown in Figure 1 by a suitable spring 106 preferably mounted on one of the pivot pins 96 of the holding ring 99 with one end thereof fixed to the latter pin 96 and its other end bent under the ring 99, as clearly shown in Fig. 4, whereby the projection 101 engages or bites the restraining member 103 to be held stationary thereby. In such case, the turntable is driven at a lower speed than that of the shaft section 29 since the raceways 95, 97 and balls 98 act as a planetary transmission mechanism effective to rotate the balls 98 and the cage 93 in the orbit of the balls 98 at a slower speed than that of the inner raceway 95. The restraining ring 103 may, for example, be made of rubber, in which case, as the projection 101 engages the restraining member 103, the frictional resistance offered by the latter will slow down the holding ring 99 gradually until it has stopped completely, and thus shock to the rotating mechanism will be avoided.

Slidably mounted on the bottom of the turntable 17 is a slide 107 which is operable through the slot 109 in the surface of the turntable by means of an upstanding thumb piece 111 thereon. On the end of the slide 107 adjacent the ring 99 is a cam piece 113 which is adapted, when brought into engagement with the uppermost portion of the holding ring 99, to raise the projection 101 away from engagement with the restraining member 103 and to latch the turntable to the ring 99 upon entering the notch 115 therein. When thus latched to the ring 99, the turntable 17, ring 99, raceways 95 and 97, balls 98 and ball cage 93 all rotate as a unit with the shaft section 29, and therefore the turntable will be rotated at the speed of the latter.

As stated heretofore, the turntable 17 is preferably made of aluminum or other light material to lessen the load on the rotating parts within the housing 61. A light turntable does not, however, possess sufficient inertia to maintain uniform speed of the record being reproduced. In order to provide sufficient inertia for this purpose, we have provided a relatively heavy mass in the form of a fly wheel 121 which we secure to the bottom of the shaft section 29 in slightly spaced relation to the bushing 73. The fly wheel or inertia member 121 may be either solid or may be of the type shown in United States Patent No. 1,969,755, being fixed on the shaft section 29 in any suitable manner, as by a nut 123 threaded on the section 29 and adapted to force the inertia member 121 against the shoulder 125 formed by the intermediate portion 29a of the shaft section 29. By securing the fly wheel 121 to the shaft section 29, it is obvious that it will always exert the same inertia action upon the system regardless of the speed of the turntable.

Although we have shown and described but one specific form of our invention, it will be apparent to those skilled in the art that many modifications thereof are possible. Also, while we

have described our invention specifically with reference to a disc phonograph, it will be apparent that it has application in many other types of apparatus where uniform speed of the final driven member is desired, such as talking moving picture apparatus, television apparatus, clocks and other timing devices, etc. We desire, therefore, that only such limitations shall be imposed thereon as are necessitated by the prior art and by the spirit of the appended claims.

We claim as our invention:—

1. In a phonograph, the combination with a turntable of means for driving said turntable, and means coupling said driving means to said turntable, said coupling means including a shaft driven at a constant speed, a selectively variable speed transmission interposed between said shaft and said turntable, said transmission including a controllable element for varying the speed transmitted thereby, an inertia member on said shaft, and movably mounted means for selective movement into and out of engagement with said element whereby to selectively control the speed to be imparted to said turntable.

2. In a phonograph, the combination of a shaft driven at a constant speed, a turntable, a selective, variable speed, planetary transmission mechanism interposed between said shaft and said turntable and including an outer movable ring element adapted to rotate as a unitary part of said mechanism for the transmission of one speed thereby and adapted to be restrained against rotation for the transmission of a different speed by said mechanism, a resilient restraining member associated with said transmission mechanism, and means on said ring element adapted to engage said restraining member whereby to restrain movement of said ring element.

3. In a phonograph, the combination of a shaft driven at a constant speed, a turntable, a selective, variable speed, planetary transmission mechanism interposed between said shaft and said turntable and including an outer movable ring element adapted to rotate as a unitary part of said mechanism for the transmission of one speed thereby and adapted to be restrained against rotation for the transmission of a different speed by said mechanism, a resilient restraining member associated with said transmission mechanism, means pivotally mounted on said ring element and adapted to engage said restraining member whereby to restrain movement of said ring element, means constantly urging said first named means into engagement with said restraining means, and means on said turntable for controlling the engagement and disengagement of said first named means with said resilient restraining member.

4. The invention set forth in claim 3 characterized in that said resilient restraining member comprises a rubber ring, and characterized further in that said pivotally mounted means includes a projection adapted to engage said ring for restraining movement of the ring element.

5. The invention set forth in claim 3 characterized in that said shaft terminates in a bored portion adjacent said turntable, characterized further in that said transmission mechanism is mounted on said bored shaft portion in fixed relation thereto, characterized further in that said turntable is provided with a hub which is adjustably received within said bored portion, and characterized still further by the addition of adjustable means within said bored portion in co-operative association with the bottom of said bore

and with said hub for adjusting the turntable relative to the transmission mechanism whereby to properly position the controlling means on the turntable relative to said pivotally mounted means on said ring element.

5

6. In a planetary transmission mechanism of the type having a ring element adapted to rotate as a unit with said mechanism for the transmission of one speed and adapted to be restrained

against movement for the transmission by said mechanism of another speed, the combination of a relatively fixed resilient restraining member, and means on said ring element for engaging said restraining member to restrain movement of said ring element.

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