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A. G. ZIMMERMAN
PHONOGRAPHIC APPARATUS

2,113,390

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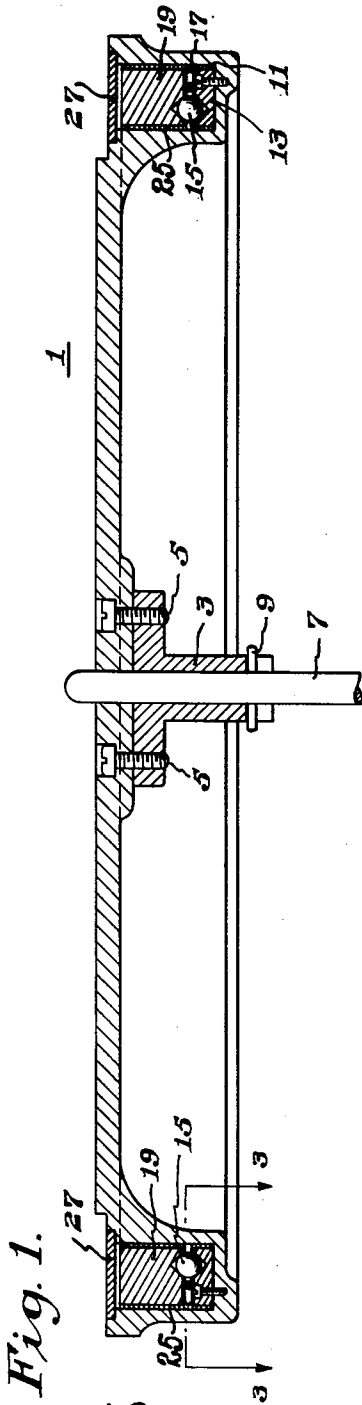


Fig. 1.

Witness:
M. Kahan

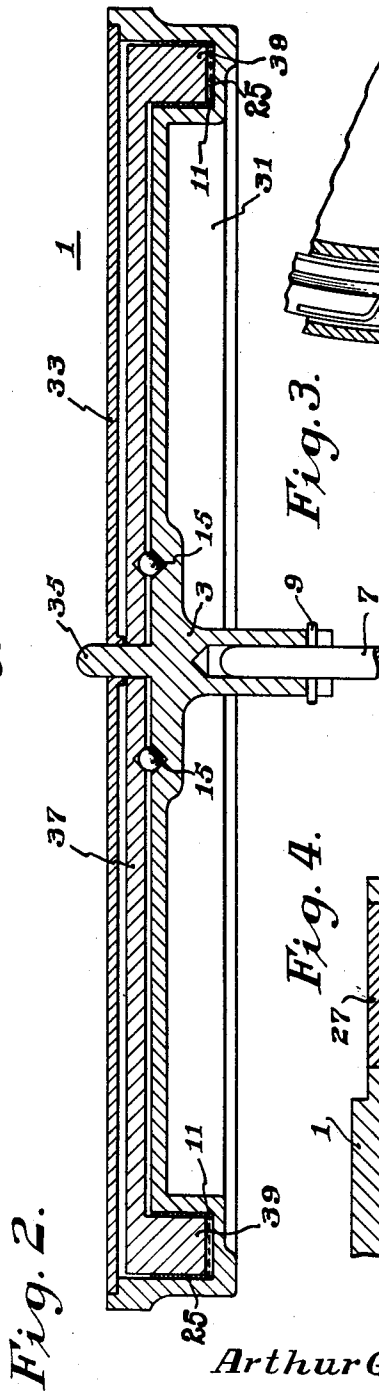


Fig. 2.

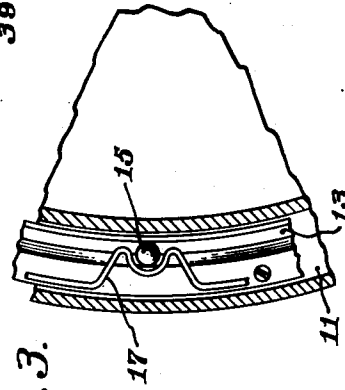


Fig. 3.

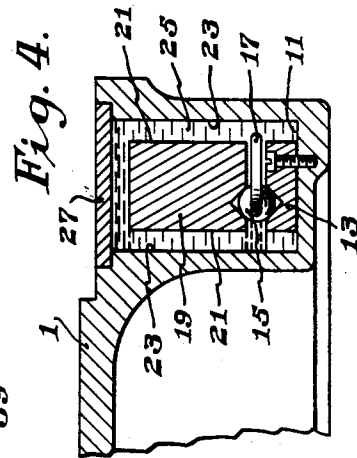


Fig. 4.

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PHONOGRAPHIC APPARATUS

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Application March 30, 1935, Serial No. 13,795

13 Claims. (Cl. 274—39)

This invention relates to phonographic apparatus, and more particularly to the record supporting turntable thereof.

In the copending application of Benjamin R. Carson and myself filed March 30, 1935, Serial Number 13,796, there is disclosed a phonograph especially adapted for use in electrical transcription radio broadcasting from records. This phonograph includes, between the prime mover and the turntable thereof, a mechanical filter system designed to filter out vibrations or oscillations resulting from irregularities in the mechanical parts, variations in motor torque, etc. The turntable itself is made of a light metal, such as aluminum, to permit quick acceleration and to lighten the load on the rotating parts, but since a light turntable has comparatively little inertia, a flywheel is provided in the aforesaid filter system, the flywheel being incorporated in the mechanism which couples the motor to the turntable.

Between the flywheel and the turntable, there is included a speed reduction transmission by means of which the turntable may be selectively driven at either one of two predetermined speeds. Occasionally, it happens that the parts of the speed reduction transmission mechanism will bind somewhat, as when dirt or other foreign matter finds its way in. In such cases, the flywheel does not satisfactorily filter out irregularities in the turntable speed. If the flywheel or other suitable inertia means could be placed directly on the turntable, this difficulty would be eliminated and other advantages inherent in a massive turntable obtained, but the turntable would then become very heavy and would defeat the purposes for which the turntable is made of light material.

The primary object of my present invention is to provide an improved phonograph turntable wherein the foregoing difficulties are eliminated.

More specifically, it is an object of my invention to provide an improved phonograph wherein the turntable may be made of a light material while still providing sufficient inertia at the turntable to insure adequate filtering action.

Another object of my invention is to provide an improved phonograph turntable which will operate at a uniform speed even when operated by mechanism itself subject to slight variations in speed.

Still another object of my invention is to provide, in a light weight phonograph turntable, sufficient mass to make the turntable run uniformly, the mass being so related to the turntable, however, that it will add practically no

additional load on the rotating parts of the turntable driving system.

A further object of my invention is to provide an improved turntable as aforesaid which will be simple in construction, economical of manufacture, and highly efficient in use.

In accordance with my invention, I provide the turntable with an annular trough adjacent its periphery and place a heavy annular ring or the like within said trough, coupling the heavy ring to the sides of the turntable trough through a viscous medium, such as oil. The ring may rest upon a plurality of anti-friction bearings on the bottom of the trough so that it will be free to rotate in the trough relative to the turntable, whereby the turntable can very readily attain full speed at the start. Through the viscous medium, the heavy ring will dampen any irregularities which tend to occur in the speed of the turntable and it will thus tend to keep the turntable speed always uniform, since the inertia of the ring comprises the greatest part, by far, of the total turntable inertia. By adjusting the machined clearance between the heavy ring and the sides of the turntable trough, or by varying the viscosity of the material which couples the ring and the turntable, the effect of the ring can be properly determined.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. However, the invention itself, together with additional objects and advantages thereof, will best be understood from the following description of several embodiments thereof, when read in connection with the accompanying drawing in which

Figure 1 is a central sectional view of one form of my invention,

Figure 2 is a similar view of a modified form thereof,

Figure 3 is a fragmentary view on the line 3—3 of Figure 1, and

Figure 4 is an enlarged, fragmentary view of a portion of the invention shown in Figure 1, greatly exaggerated for the sake of clearness.

Referring more specifically to the drawing, wherein similar reference characters indicate corresponding parts throughout, there is shown, in Figure 1, a turntable 1 of light material, such as aluminum, provided with a depending hub 3 which may be suitably secured thereto, as by means of screws 5, the hub 3 serving to support the turntable on a motor spindle 7 from which it is adapted to receive power through a cross-pin 9 or equivalent means. Adjacent its pe-

riphery, the turntable 1 is provided with an annular trough 11 to the bottom of which is secured a raceway 13 for the reception of a plurality of ball bearings 15 held in suitably spaced relation by a spacing member or ball cage 17, and resting upon the ball bearings 15 is a heavy metal ring 19 of cast iron, steel, or the like constituting a flywheel for controlling the rotation of the turntable.

The sides 21 of the flywheel ring or inertia member 19 and the sides 23 of the trough 11 are preferably machined to provide a clearance therebetween, and the intervening space is filled with a viscous material 25, such as oil, the material 25 serving to couple the turntable and the flywheel for the transmission of power therebetween. An annular cover plate or closure 27 serves to prevent the escape of the liquid material 25.

The space between the sides 21 and 23 should be very small so that only a relatively thin film of oil will be provided therebetween. For the sake of clearness, this has been shown greatly exaggerated in Figure 4. This arrangement provides damping for the turntable, and the degree of damping is determined by the clearance between the sides 21 and 23 and by the viscosity of the material 25. For a given damping effect, therefore, a change in the aforesaid clearance should be accompanied by a corresponding change in the viscosity of the material 25. In other words, the amount of clearance between the sides 21 and 23 is a function of the viscosity of the material 25 and vice versa. During operation, if a change of speed occurs in the turntable 1, there will be a relative movement between it and the flywheel 19 which, once rotating in response to power received from the turntable through the viscous coupling material 25, tends to continue to rotate at a uniform speed by reason of its inertia. The relative motion is, of course, possible since the ring 19 rests on the ball bearings 15, and this relative motion causes energy absorption in the oil film between the sides 21 and 23 whereby any irregular or oscillatory movements of the turntable are damped out.

The device shown in Figure 1, while generally satisfactory in operation, may be found to be objectionable if the resistance offered by the bearings 15 to the free rotation of the ring 19 relative to the turntable 1 becomes too great. Being at a relatively great radius from the center of the turntable, it may be possible that the load upon the ball bearings 15 will become harmful. To overcome this, a device of the type shown in Figure 2 may be availed of. In this modification of my invention, the turntable 1 is comprised of a lower dish-like portion 31 and an upper cover portion 33 which may be force fit over the center pin 35 formed integrally with the hub 3. The flywheel in this case is constituted by a disc-like member 37 having a peripheral annular flange 39 in which most of its weight is concentrated. The flywheel 37 is supported for rotation upon the portion 31 through anti-friction bearings 15 located in close proximity to the center pin 35 and held in suitably spaced relation in any convenient manner, while the flange 39, corresponding to the ring 19 of Figure 1, extends down into the trough 11 and is coupled thereto through a film of viscous material in the manner previously set forth.

Although I have shown and described but two embodiments of my invention, I am fully aware that many modifications thereof are possible. Also, while I have described my invention as ap-

plied to phonograph turntables, it will be apparent to those skilled in the various arts that it has application in many other fields as well. I desire, therefore, that my invention shall only be limited by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. Phonographic apparatus comprising a record supporting turntable, an inertia member carried thereby, and viscous means coupling said member and said turntable.

2. Phonographic apparatus comprising a record supporting turntable, an inertia member carried thereby, and viscous means forming a driving coupling between said member and said turntable, said viscous means constituting substantially the sole driving connection between said member and said turntable.

3. Phonographic apparatus comprising a record supporting turntable, a flywheel in cooperative relation thereto, and a viscous connection between said flywheel and said turntable.

4. A phonograph turntable comprising a record supporting member having a trough formed therein, an inertia member carried by said supporting member in said trough, said inertia member being movable in said trough relative to said supporting member, and a viscous connection between said inertia member and said supporting member.

5. A phonograph turntable comprising a record supporting member of relatively light weight having an annular trough therein, an annular ring of relatively heavy weight carried by said supporting member in said trough, said inertia member being movable in said trough relative to said supporting member, and a viscous connection between said inertia member and said supporting member.

6. A phonograph turntable comprising a record supporting member of relatively light weight having an annular trough therein adjacent its periphery, an annular ring of relatively heavy weight in said trough, and a viscous coupling between said ring and said member.

7. A phonograph turntable comprising a record supporting member of relatively light weight having an annular trough therein adjacent its periphery, an annular ring of relatively heavy weight in said trough, a liquid viscous coupling between said ring and said member, and a closure on said trough for preventing the escape of said liquid.

8. A phonograph turntable comprising a record supporting member of relatively light weight having an annular trough therein adjacent its periphery, an annular ring of relatively heavy weight in said trough, there being a clearance between the sides of said ring and the sides of said trough, and viscous means within the space between said ring and said trough coupling said ring and said member, said clearance being a function of the viscosity of said viscous means.

9. A phonograph turntable comprising a record supporting member of relatively light weight, anti-friction bearings carried by said member, a flywheel of relatively heavy weight supported on said anti-friction bearings for movement relative to said rotatable element, and viscous means coupling said flywheel and said member, said viscous means being adapted to absorb the energy developed upon relative movement between said flywheel and said member whereby to dampen out irregularities in the movement of the latter.

10. A phonograph turntable comprising a record supporting member of relatively light weight having an annular trough therein adjacent its periphery, anti-friction bearings carried by said member in the bottom of said trough, an annular flywheel of relatively heavy weight supported within said trough on said bearings for movement relative to said member, there being a clearance between the sides of said flywheel and the sides of said trough, and viscous means within the space between said flywheel and said trough coupling said flywheel and said member, said viscous means being adapted to absorb the energy developed upon relative movement between said flywheel and said member whereby to dampen out irregularities in the movement of the latter.

11. A phonograph turntable comprising a record supporting member of relatively light weight having an annular trough therein adjacent its periphery, anti-friction bearings carried by said member in proximity to its center, a flywheel of relatively heavy weight comprising a disc-like member having most of its weight concentrated in an annular flange, said flywheel being supported on said bearings for movement relative to said record supporting member and having its flange extending into said trough, and a viscous coupling between said flange and said trough.

12. A phonograph turntable comprising a record supporting member of relatively light weight having an annular trough therein adjacent its periphery, anti-friction bearings carried by said member in close proximity to its center, a flywheel of relatively heavy weight comprising a disc-like member having most of its weight concentrated in a peripheral annular flange, said flywheel being supported on said bearings for movement relative to said record receiving member and having its flange fitted in said trough, there being a clearance between the sides of said flange and the sides of said trough, and viscous means within the space between said flange and said trough coupling said flywheel to said member, said viscous means being adapted to absorb the energy developed upon relative movement between said flywheel and said member whereby to dampen out irregularities in the movement of the latter.

13. In a phonograph turntable, a record supporting member of relatively light weight, a flywheel carried by said member for movement relative thereto, the inertia of said flywheel constituting the greatest part of the total turntable inertia, and a viscous coupling between said flywheel and said member.

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