Oct. 25, 1949. T. C. SHARP 2,485,848

TURNTABLE DRIVE SYSTEM

Filed Feb. 12, 1947 2 Sheets-Sheet 1

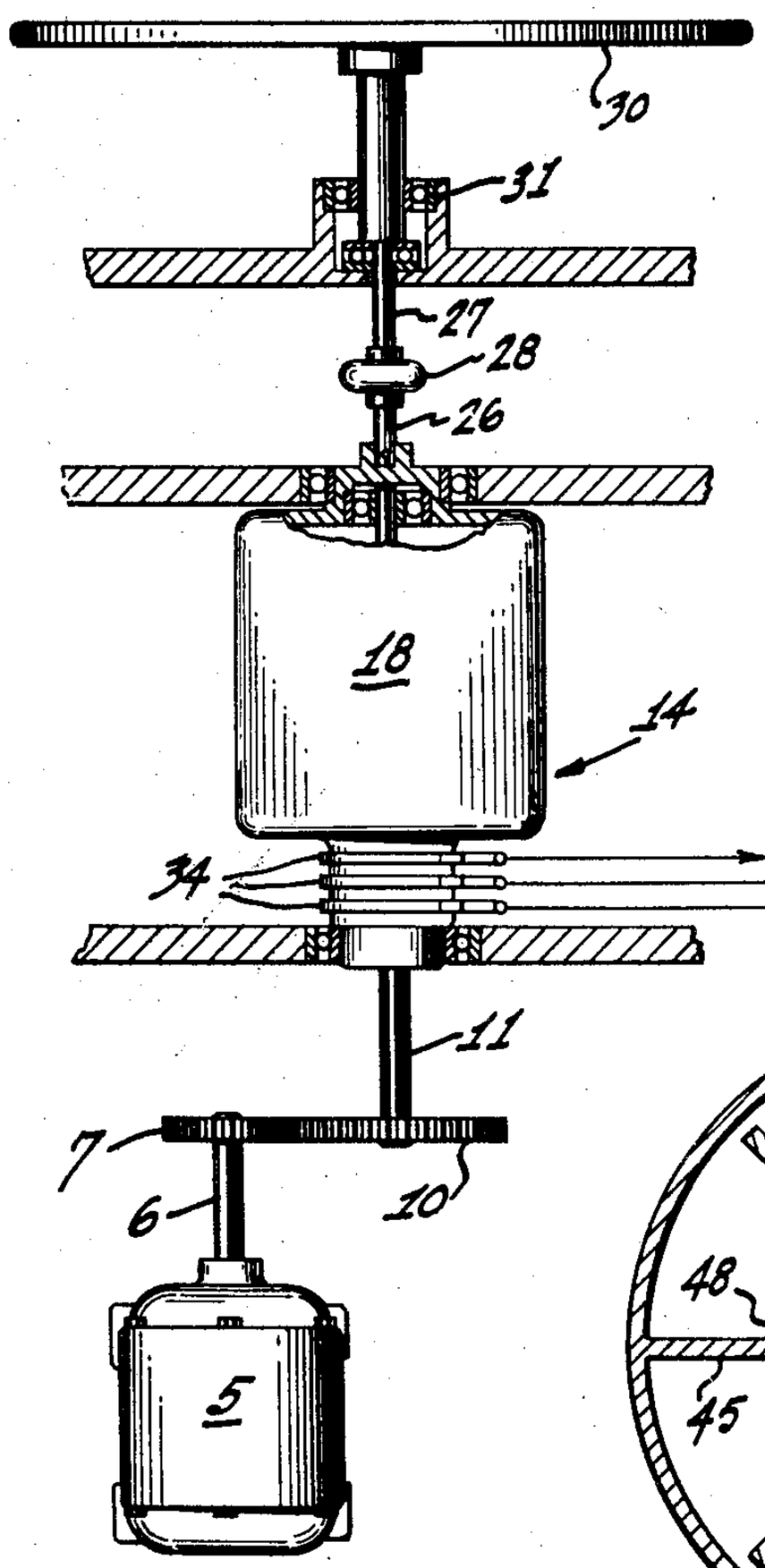


Fig. 1.

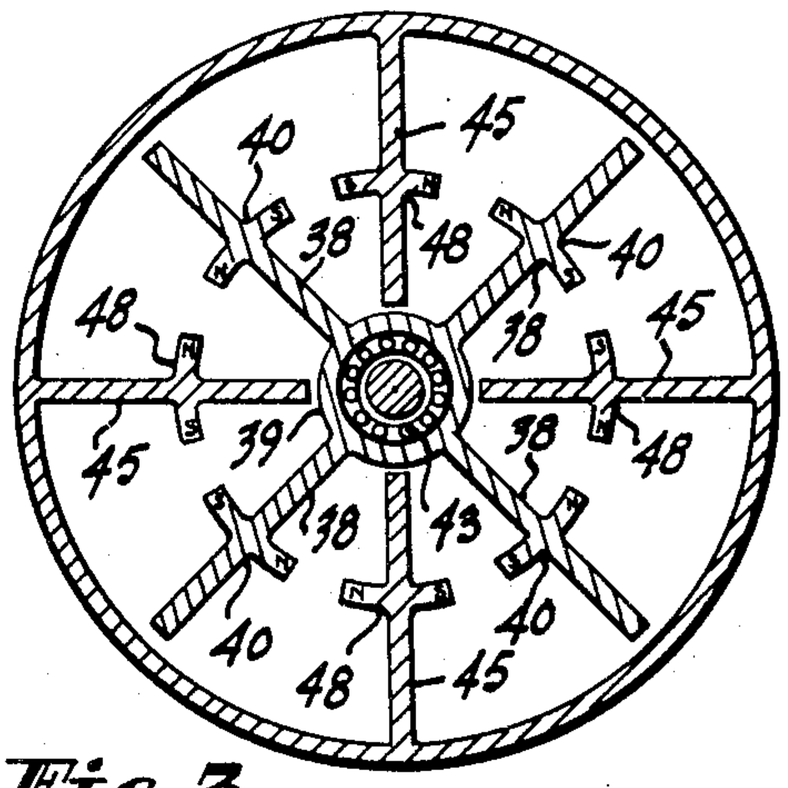


Fig. 3.

INVENTOR.
THOMAS C. SHARP
BY Orl R. Goldsmith
ATTORNEY.

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Filed Feb. 12, 1947 2 Sheets-Sheet 2

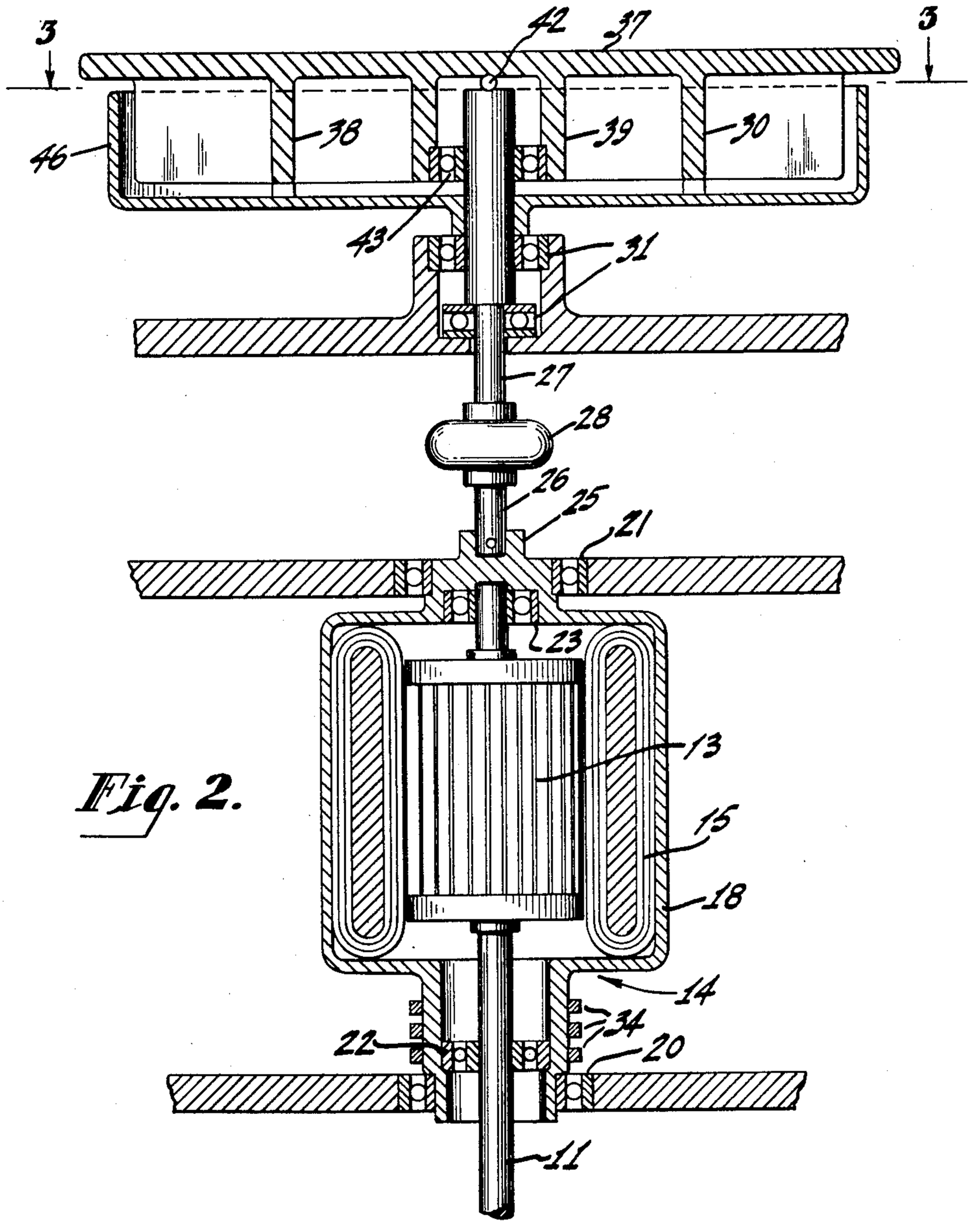


Fig. 2.

INVENTOR.
THOMAS C. SHARP
BY Orl R. Goshaw
ATTORNEY

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## TURNTABLE DRIVE SYSTEM

Thomas C. Sharp, North Hollywood, Calif., assignor to Radio Corporation of America, a corporation of Delaware

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4 Claims. (Cl. 318—34)

1

This invention relates to motor drives and particularly to a motor drive system for a record supporting turntable which may be used for either recording or reproducing sound.

In the art of phonograph sound recording and reproduction wherein the disc type of record is employed, the record supporting table or turntable is generally driven at either of two standard speeds, such as 33⅓ or 78 revolutions per minute. The turntable is usually driven by a motor through a shaft and set of reduction gears. A turntable drive of this type is disclosed and claimed in Carson et al. U. S. Patent No. 2,106,718 of February 1, 1938.

It is well known that it is desirable to have the turntable rotate at a constant and uniform speed in order to eliminate distortion, variations in speed changing the frequency of the sound being recorded and reproduced. Various methods of and means for obtaining a substantially constant speed have been suggested and employed, these prior methods using fly wheels and mechanical spring damped filters of different forms. One such type of filter is disclosed and claimed in Zimmerman U. S. Patent No. 2,133,390 of April 5, 1938.

One of the chief difficulties in obtaining a uniform speed of rotation of the turntable is in the use of the gears required for reducing the speed of the motor, which usually rotates in the neighborhood of 1,200 to 1,800 revolutions per minute, to the speed of the turntable which is either 33⅓ or 78 revolutions per minute. It has been found almost impossible to maintain gears between motor and turntable in such a condition that a "once around" variation in the speed of the turntable is not introduced. These speed variations produce what are commonly known as "wows," and are traceable to the fact that there is at least one gear rotating at the same speed as the turntable.

The present invention is directed to a motor drive system for a record turntable which, although gears may be used in a certain portion of the drive, they are rotated at a much higher speed than the turntable speed, the reduction in speed being accomplished by the magnetic field differential between a driven rotor and an energized stator of an intermediate motor. In the new drive, the coupling between the high speed unit and the low speed unit is magnetic and therefore is not subject to the mechanical imperfections of gears. Furthermore, any imperfections in the high speed gears are filtered out by the intermediate magnetic coupling. However, if any speed disturbances should be extraneously introduced a novel turntable filter may be added although the filter may be used with the standard type of drive.

The principal object of the invention, therefore, is to facilitate the obtaining of a constant and uniform speed for a sound record.

2

Another object of the invention is to provide an improved method of and motor drive for a phonograph turntable.

A further object of the invention is to provide an improved motor drive between a motor and a turntable driven thereby which obviates the necessity of a gear rotating at turntable speed.

A still further object of the invention is to provide a turntable driving system which utilizes a magnetic field coupling between a high speed rotating element and a low speed rotating element.

A still further object of the invention is to provide an improved filter for a sound record turntable.

Although the novel features which are believed to be characteristic of this invention will be pointed out with particularity in the appended claims, the manner of its organization and the mode of its operation will be better understood by referring to the following description read in conjunction with the accompanying drawings forming a part hereof, in which:

Fig. 1 is an elevational view partially in cross section of a motor drive embodying the invention.

Fig. 2 is a cross sectional view of a portion of Fig. 1 and a turntable filter, and

Fig. 3 is a plan view of the turntable filter taken along the line of 3—3 of Fig. 2.

Referring now to the drawings in which the same numerals identify like elements, a salient pole or slip ring motor 5 rotates a shaft 6 having a gear 7 mounted thereon. In mesh with gear 7 is a gear 10 mounted on a shaft 11 which drives a squirrel cage rotor 13 of a second salient pole motor 14 having a stator winding 15 (see Fig. 2). The stator mounted in the housing 18 is adapted to be rotated on bearings 20 and 21 while the rotor 13 is rotatable on bearings 22 and 23.

Directly connected to the upper end bell 25 of the housing 18 is a shaft 26 connected to a shaft 27 through a coupling 28. As shown in Fig. 1 the shaft 27 drives a turntable 30 mounted on a pair of bearings 31. The stator windings 15 are connected through three slip rings 34 to any suitable three phase power supply.

In operation the motor 5 is energized for rotation at any suitable speed such as 1,800 revolutions per minute. The gears 7 and 10 are then chosen so that the rotation of the rotor 13 is at a speed of 1,766⅔ revolutions per minute. Assuming that the normal speed of the stator 15 would be 1,800 revolutions per minute if the rotor 13 were stationary, the actual speed at which the stator actually rotates when the rotor is driven at 1,766⅔ revolutions per minute is the

difference between 1,800 and 1,766⅔, or 33⅓ revolutions per minute. By changing the ratio of the gears 7 and 10 the rotor would rotate at a speed of 1,722 revolutions per minute, and a turntable speed of 78 revolutions per minute would result. Other speeds could be easily obtained with standard speed motors by simply providing the proper gear ratio.

Although gears are actually used to couple motor 5 to rotor 13 these gears are rotating at a much higher speed of rotation than that of the turntable 30 and any "once around" variations in the gears would not be reflected in the turntable speed. The driving unit rotating at the speed of the turntable, namely, the stator 15, is magnetically and thus elastically coupled to the high speed unit, namely, the rotor 13. A filter is thereby formed the stator mass doing the damping. Such a drive has been found to provide a particularly constant speed even with the use of standard commercial gears purchased in the open market. The use of rotating stators for speed variations is known and disclosed in Fick U. S. Patent No. 1,527,637, the present invention, however, utilizing the magnetic coupling as a filter element in a reduction coupling.

If it is desired to obtain additional filtering action between the shaft 27 and turntable 30 a novel turntable filter is illustrated in Figs. 2 and 3, it being understood, of course, that the turntable filter may also be used with the standard motor drive system to minimize the "wows" therefrom.

Referring now to Figs. 2 and 3, the flat top of a turntable 37 has depending therefrom and attached to a central collar 39, a plurality of radial fins or vanes 38 with permanent magnet insert elements 40 positioned substantially half way along their length as shown in Fig. 3. The turntable is mounted on a single thrust bearing 42 and on a lateral stabilizing bearing 43. Interposed between the fins or vanes 38 are a group of similar fins or vanes 45 extending upwardly from the bottom surface of and attached to the outer rim of a driving element 46. Positioned along the length of the fins 45 at the same radial distance from the axis of rotation of the table as the element 40, are a plurality of permanent magnets 48 similar to magnets 40 on the vanes 38. The element 46 is adapted to contain oil or a similar viscous damping material. As shown in Fig. 3, the magnets 40 and 48 are so poled that the north and south poles oppose one another and thus a resilient magnetic coupling is produced between the driving element 46 and the driven turntable 37. The oil between the vanes 38 and 45 introduces damping while the magnetic coupling provides the elastic component of the filter.

Thus, by the use of the motor field magnetic coupling in series with the magnetic coupling between the elements of the turntable, a very constant and uniform speed of rotation is obtainable for the turntable itself. As mentioned above, the gear "wows" in any standard gear driven motor drive will be greatly reduced by the use of the turntable magnetic filter shown in Figs. 2 and 3.

I claim:

1. A motor drive comprising a substantially independent constant speed motor unit, a stator and a rotor for said unit, a turntable adapted to be driven at a constant speed, an intermediate alternating current motor unit between said first mentioned motor and said turntable, a rotor for said intermediate motor unit, a gear connection between said rotors, said first mentioned motor rotor driving said intermediate motor rotor at a different speed, a stator for said intermediate motor connected to said turntable, and means for energizing said stator of said intermediate motor with alternating current of a frequency to rotate said stator and said turntable connected thereto at a predetermined speed with respect to the speed of rotation of said rotor of said intermediate motor.



2. A motor drive comprising a substantially independent, constant speed motor unit, a stator and a rotor for said unit, a turntable adapted to be driven at a constant speed, an intermediate motor unit between said first mentioned motor and said turntable, a rotor for said intermediate motor unit, a gear connection between said rotors, said first mentioned motor rotor driving said intermediate motor rotor at a different speed, a stator for said intermediate motor connected to said turntable, said intermediate motor being energized to rotate its stator at a predetermined speed with respect to the speed of rotation of its rotor, and a damped coupling interposed between said stator of said intermediate motor and said turntable, said coupling including opposing magnets in a single plane and oil between said magnets.

3. A turntable drive system comprising a high speed motor, a turntable having fixed magnets thereon and adapted to be rotated at a comparatively low speed, a second motor connected between said first motor and said turntable, the rotor of said first motor driving the rotor of said second motor at a predetermined speed, a rotating element having fixed magnets thereon and connected to the stator of said second motor, and oil between said fixed magnets.

4. A turntable driving system comprising a motor having a stationary stator and a rotatable rotor adapted to rotate at a comparatively high speed, a second motor having a rotatable rotor and a rotatable stator, the rotor of said first motor driving the rotor of said second motor, and means connecting said rotatable stator of said second motor to said turntable, said means including a vaned driving element connected to said rotatable stator, said vanes having magnets thereon, and vanes interposed between said driving element vanes, said interposed vanes having magnets thereon opposing said first mentioned magnets, and oil between said vanes.

THOMAS C. SHARP.


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