W. W. BILLINGS.

ELECTROMAGNETIC MOTOR.

APPLICATION FILED JULY 5, 1919.

1,436,335.

Patented Nov. 21, 1922.

2 SHEETS—SHEET 1.

Fig-1

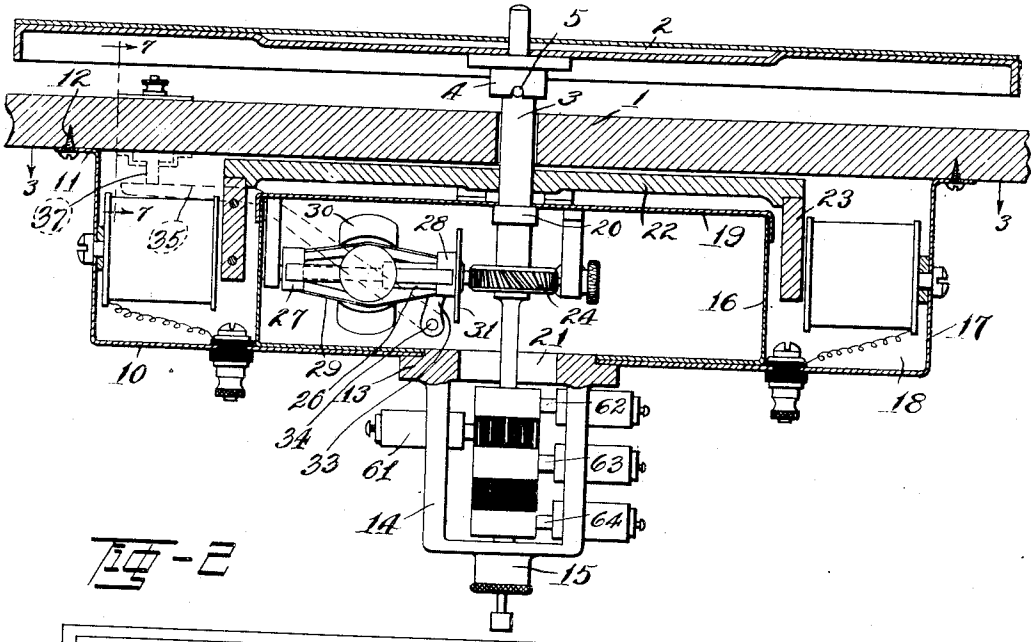
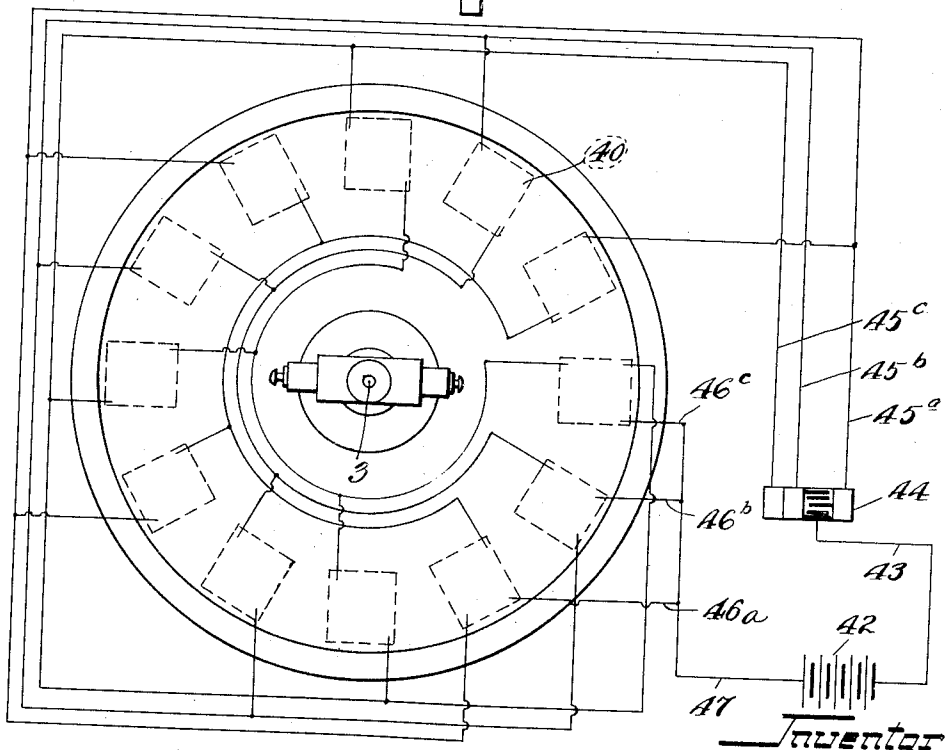


Fig-2



Inventor

William W. Billings

By Brocker and Hyde

Attys.

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2 SHEETS—SHEET 2.

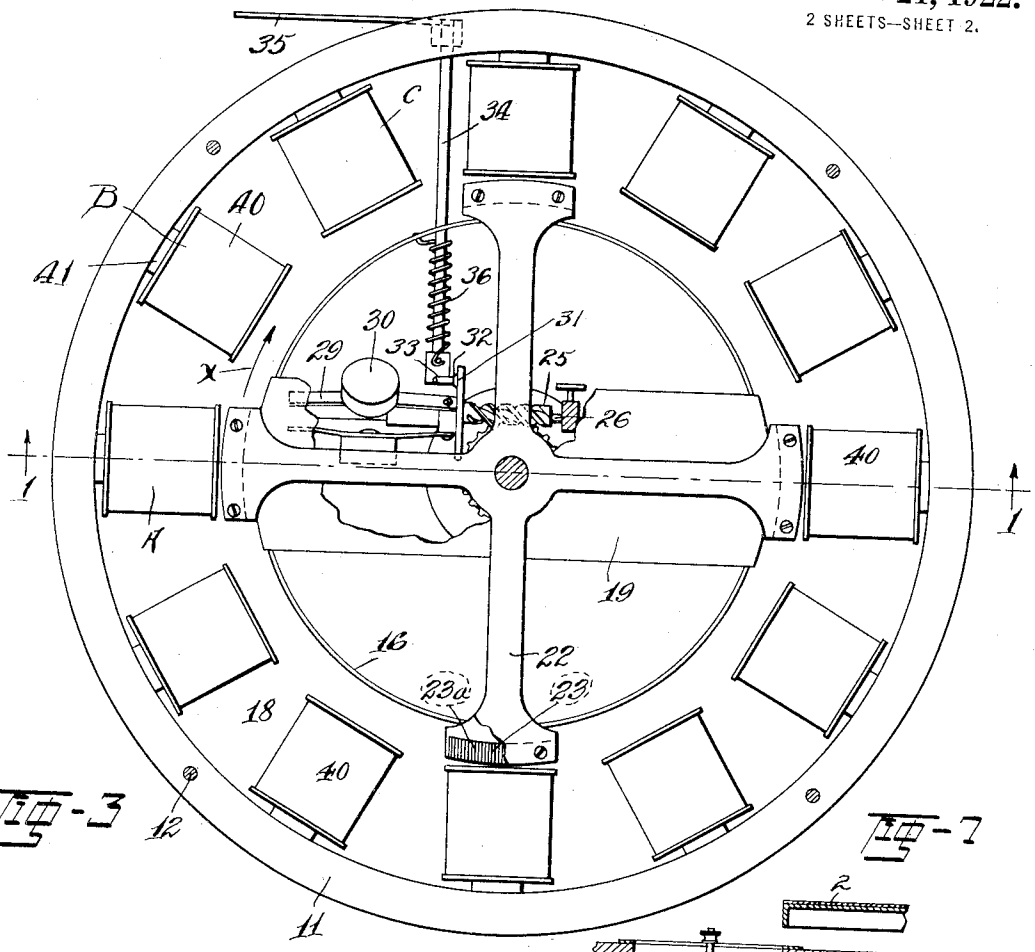


Fig-3

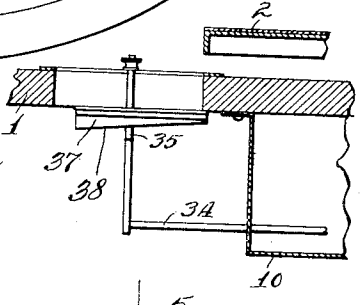


Fig-7

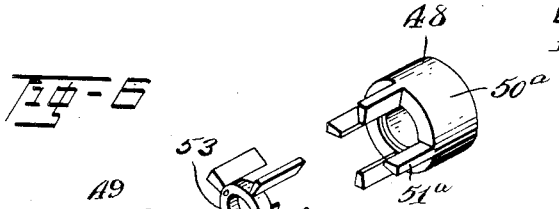


Fig-6

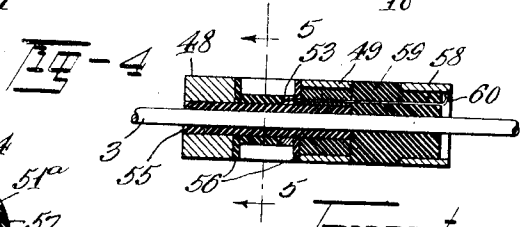


Fig-4

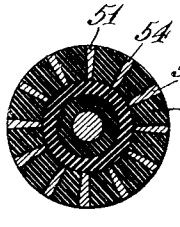


Fig-5

Inventor

William W. Billings

By Brooks Kenyon & Hyde

Attys.

Patented Nov. 21, 1922.

1,436,335

UNITED STATES PATENT OFFICE.

WILLIAM W. BILLINGS, OF LAKEWOOD, OHIO, ASSIGNOR TO THE B. & W. TOOL & DIE CO., OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

ELECTROMAGNETIC MOTOR.

Application filed July 5, 1919. Serial No. 308,689.

To all whom it may concern:

Be it known that I, WILLIAM W. BILLINGS, a citizen of the United States, residing at Lakewood, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electromagnetic Motors, of which the following is a specification.

This invention relates to electro-magnetic motors, such as are used for actuating the record tables of talking machines or operating parts of other mechanisms.

One object of the invention is to provide a simple, inexpensive motor which operates at low current cost and which produces uniform motion of the operated part at any desired speed, within limits.

A further object of the invention is to provide an electro-magnetic motor including a series of magnets and an armature or armatures attracted thereby and caused to move in succession past the several magnets, so as to produce uniform continuous motion of said armatures.

A further object of the invention is to provide an improved distributer for controlling the circuit connections to the magnets.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

Referring to the drawings, Fig. 1 illustrates a sectional elevation on the line 1—1, Fig. 3, showing the motor arranged for driving the table on a talking machine; Fig. 2 is a diagrammatic view of the electrical circuits; Fig. 3 is a horizontal section on the line 3—3, Fig. 1; Fig. 4 is a longitudinal section through the distributer; Fig. 5 is a cross section on the line 5—5, Fig. 4; Fig. 6 is a perspective view, illustrating the metal parts of the distributer; and Fig. 7 illustrates the governor controlling or adjusting mechanism.

The electro-magnetic motor forming the subject matter of the present invention may be utilized for driving or operating any mechanism, machine or device, but for convenience of illustration has been shown in the drawings as connected for driving the record table of a talking machine, for which purpose it is particularly adapted, although such illustration should not be considered as in any sense limiting the invention.

In the drawings, 1 illustrates a portion of the talking machine cabinet or case above which is the usual record supporting and driving table 2 removably attached to the operating spindle 3 by the usual notched table collar 4 and spindle cross pin 5. The motor is attached to the lower surface of the cabinet member 1, spindle 3 extending from the motor upwardly through an opening in the cabinet, as is usual.

Referring more particularly to the motor, it comprises a hollow pan shaped casing 10 provided with a peripheral flange 11 through which the screws 12 are passed into the cabinet. Attached to the bottom of said casing 10 is a frame including a ring like base member 13 and a yoke 14 provided with a bearing member 15. 16 represents an upstanding annular wall in the casing, preferably formed of non-magnetic material, concentric with the outer wall 17 of said casing and spaced therefrom to form an annular cavity or recess 18 between said walls. To said wall 16 is attached a cross bridge 19 provided with a sleeve bearing member 20. The spindle 3 before referred to rotates in the bearing 20 and is supported for rotation in the bottom bearing 15, and extends through the opening 21 in the base member 13. On the spindle is secured an armature frame comprising a series (four being shown) of radiating arms 22, each of which is formed of suitable non-magnetic material, such as brass, copper, aluminum, composition metal, or the like, and each of which at its outer end supports an armature member 23 of magnetic material, such as steel or the like and preferably consisting of a series of thin laminations 23^a extending radially and suitably secured together. The electro-magnetic attraction of said armature members by the magnets to be described causes the frame 22 to rotate in the casing 10 and thereby turn the spindle 3.

The speed of rotation of spindle 3 may be governed in any suitable manner. The drawings show for this purpose a quick pitch, say 45°, worm wheel 24 in driving relation with a worm 25 on a shaft 26 rotatable in suitable fixed supports. On said shaft is a fixed collar 27 and a longitudinally movable collar 28 connected to collar 27 by a series of yielding members, such as the leaf springs 29 each of which carries a weight 30. Collar 28 is provided with a disc portion 31 behind

which is a friction shoe or brake 32 carried by an arm 33 on a shaft 34 provided with suitable operating means, such as the operating arm 35. A tension spring 36 surrounds the shaft 34, one end of said spring being fastened to a fixed point and the other to a portion of the shaft so as to constantly tend to turn said shaft in the direction to press the shoe 32 against the disc 31.

As the spindle 3 rotates the worm wheel 24 and worm 25 drive the shaft 26, causing the weights 30 to fly out by centrifugal force and thereby slide the collar 28 and disc 31 along the shaft 26 to the left in Figs. 1 and 3. As the speed increases the frictional pressure of the brake 32 on the disc 31 increases, and said brake tends to retard rotation of the parts and thereby maintain rotation at a definite speed.

The permitted speed of rotation may be varied by suitable adjustment of the brake shoe 32, for which purpose any suitable means may be provided for holding the arm 35 in any position to which it may be moved. The drawings show, for example, a wedge 37 slidable in suitable guides on the frame, the inclined edge 38 of said wedge lying above the lever 35. As the wedge is shifted laterally in Fig. 7 the brake shoe 32 is adjusted to the left or right in Fig. 3. Consequenty, said brake, if moved away from the disk 31, does not become effective until the speed of rotation of the parts becomes sufficient to move the disc 31 far enough to contact with said brake, after which the brake can be moved over by an increasing speed against the force of spring 36, but with increasing retarding effect of the brake, as will be readily understood.

The armature members 23 cooperate with a series of electro-magnets 40, shown as wire coils surrounding soft metal cores 41. These electro-magnets are located in the annular cavity 18 and are suitably supported so as to be rigidly held with the axes of the cores extending radially to the shaft 3. The inner ends of the magnet cores lie closely adjacent to the path of travel of the several armature members, but are not touched by said members.

In the specific form illustrated twelve magnets are utilized so as to secure constant impulses or electro-magnetic effect upon the armature members and thereby produce a constant rotating pull upon the armature frame. The coils of said magnets are energized by current derived from any suitable source of either direct or alternating current. Said source of current is indicated at 42. One lead from the source, marked 43, runs to a distributer indicated generally at 44, Fig. 2, from which the current is distributed by three branch lines 45^a, 45^b, and 45^c to each of three groups of magnet coils, the return from said three groups being by way of the branch wires 46^a, 46^b, and 46^c to a common return wire 47 running back to the source. Each of the three groups of magnets includes four magnets uniformly spaced at 90° apart around the circle, so that in succession around the circle single magnets of the three groups A, B, and C occur in turn.

The distributer is of special form and is illustrated in detail in Figs. 4, 5 and 6. It comprises two like end conducting members 48 and 49, each having a continuous annular conducting surface 50 and four circumferentially separated conducting segments 51, associated with an intermediate third conducting member 52 having a central collar portion 53 and a series of four separated segments 54. These three members surround and are tightly fitted to a central insulating bushing 55 sleeved on and driven by a portion of the spindle 3. Said three members are nested together with the segments 51 of the end members extending toward and overlapping each other, so that segments of all three metal members lie in the same cross sectional plane, as indicated in Fig. 5, and occur in succession or recurring order around the circumference. In assembling the three parts they are pushed into place over the central bushing and are separated longitudinally from each other by star shaped transverse insulating plates 56, formed of one or more layers of mica, for example, after which spaces between segments are filled with small mica plates secured together by shellac or the like to build up the substantially solid intervening insulating segments 57.

At one end the distributer is provided with a continuous annular conducting ring 58 carried by an insulating sleeve 59. Electrical communication is provided between said sleeve 58 and the intermediate conducting member 52, such as by providing the sleeve 59 with a longitudinally extending rod 60 which can be passed through an opening in the sleeve 59 and threaded into an opening in the central collar 53 of the intermediate conducting member. This end conducting member is assembled with the connected conducting members 48, 49 and 52 before the assembled parts are sleeved upon the spindle 3, as will be readily understood.

The distributing member described cooperates with a series of yielding brushes of ordinary form held in the arms of the yoke 14. One of said brushes, indicated at 61, is connected to the lead wire 43 and cooperates with the successively recurring segments 51, 54, 51^a, etc. Other brushes, marked respectively 62, 63 and 64 are connected to the lead wires 45^a, 45^b and 45^c and contact with the continuous annular conducting surfaces 50, 50^a, 58 and complete the circuits to the several conducting members.

The operation of the governing mechanism has already been described. It there-

fore remains to describe the effect of the magnets. The effect upon each one of the armature members 23 is the same. Indeed, the number of said armature members and the number of cooperating magnet coils may be increased or diminished as may be desired. Therefore it will be necessary to describe the effect upon a single armature member.

Referring now to the armature member at the left in Fig. 3, said member lies directly opposite a magnet coil A of one group of four such coils and will be understood to be turning with the armature frame in the direction of the arrow X. In this position of the armature member coil A is de-energized, coil B of the second group is energized, and coil C is de-energized, due to the cooperating relation and relative circumferential spacing of the brushes and segments of the distributer member and to the fact that the brush 61 is made long enough circumferentially of the distributer to simultaneously ride on two successive segments. The effect of coil B is therefore to advance the armature member. As soon as said armature member is advanced 10° or 15° towards coil B brush 61 engages an additional segment completing the circuit through the coils C, so that the armature is then subject to the force of two coils B and C. Just before the armature reaches coil B the circuit through said coil is interrupted, so that the armature is affected only by magnet C.

To state the matter in another way, each armature member just before approaching a given coil is subject to its pull and to the pull of the next advanced coil. As it passes the given coil said coil becomes de-energized and ineffective and almost immediately thereafter the second following coil becomes effective.

The net effect is a steady continuous rotative effect upon the armature carrying frame so long as current is supplied from the source.

The motor described is simple, can be made at low cost and is efficient in operation.

What I claim is:

1. Phonograph motor mechanism, comprising a horizontal supporting wall, a vertical table driving spindle extending through the same, a stationary hollow pan-shaped casing depending from said wall and provided with inner and outer circumferentially extending walls forming an annular space, a series of electromagnets attached to the outer wall and circumferentially spaced in said annular space, and armature members attached to the spindle and lying between said electromagnets and said inner casing wall.

2. Phonograph motor mechanism, comprising a horizontal supporting wall, a vertical table driving spindle extending through the same, a stationary hollow pan-shaped casing depending from said wall and provided with inner and outer circumferentially extending walls forming an annular space, a series of electromagnets attached to the outer wall and circumferentially spaced in said annular space, armature members attached to the spindle and lying between said electromagnets and said inner casing wall, and speed controlling devices inclosed within the inner wall of said casing and actuated by said spindle.

In testimony whereof I affix my signature.

WILLIAM W. BILLINGS.