June 3, 1924. 1,495,993

E. A. FARMER

SOUND REPRODUCING MACHINE

Filed Feb. 4, 1922 2 Sheets-Sheet 1

Fig-1.

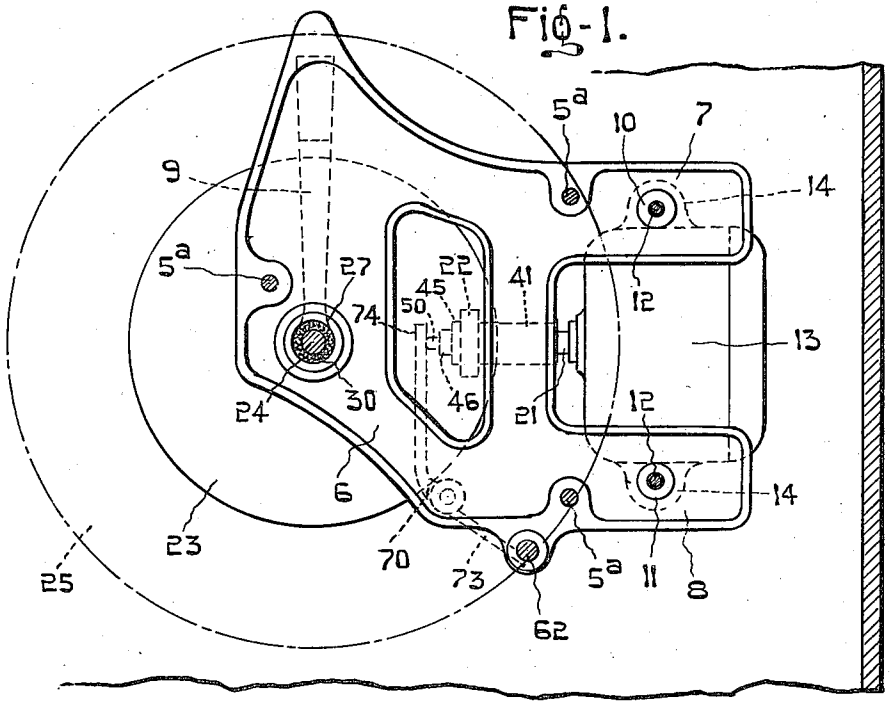
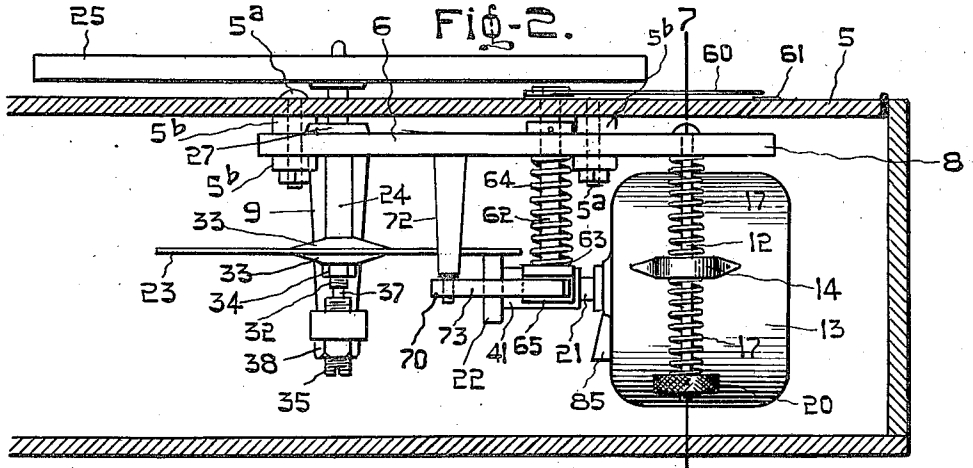


Fig-2.



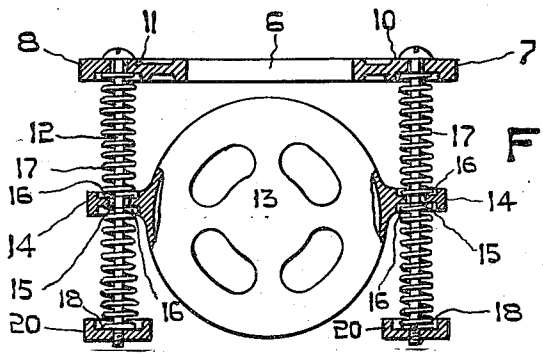


Fig-7.

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Fig. 3.

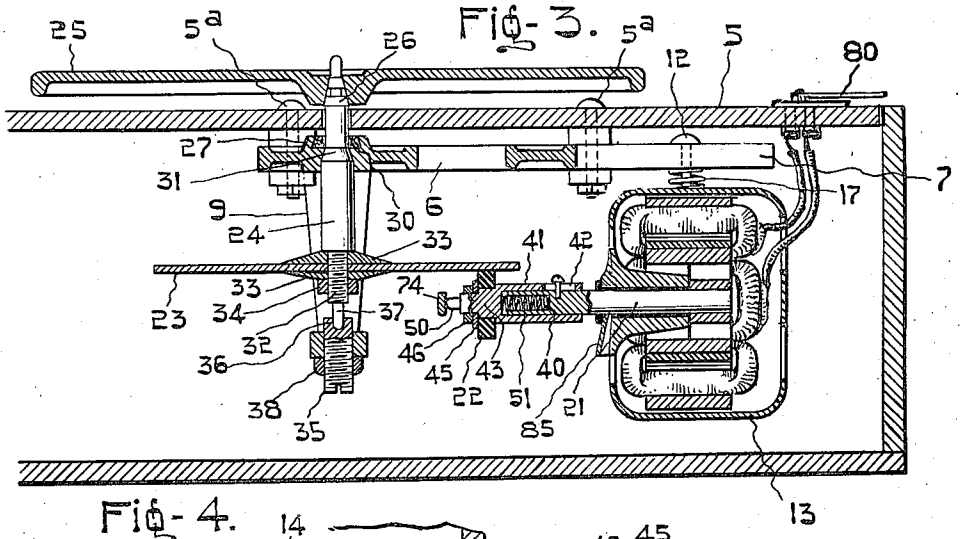


Fig. 4.

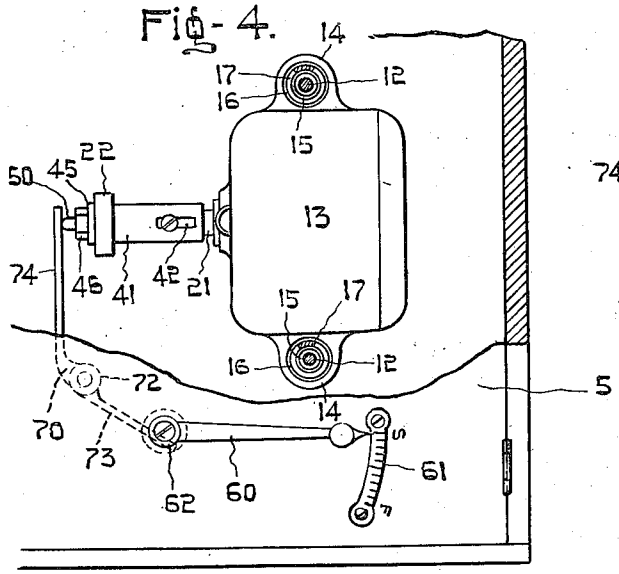


Fig. 5.

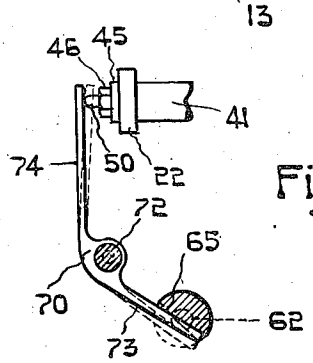


Fig. 6.

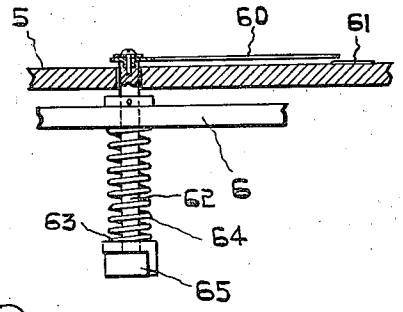
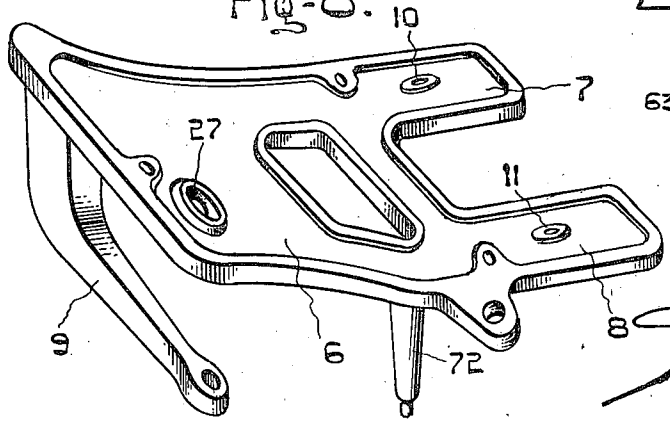


Fig. 8.



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Patented June 3, 1924. 1,495,993

UNITED STATES PATENT OFFICE.

ELMER A. FARMER, OF MONTREAL, QUEBEC, CANADA.

SOUND-REPRODUCING MACHINE.

Application filed February 4, 1922. Serial No. 534,252.

To all whom it may concern:

Be it known that I, ELMER A. FARMER, of the city of Montreal, Province of Quebec, Dominion of Canada, a citizen of the United States, have invented certain new and useful Improvements in Sound-Reproducing Machines; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention has particular reference to the means for operating the sound reproducer proper and relates more particularly to this operating mechanism of a gramophone.

It is not practical to drive a gramophone or other sound reproducing machine by a spring motor without a governor, for obvious reasons, and the governor has been the principal source of trouble; nor has it been practical to drive one of these machines as heretofore constructed by electric power because of the use of a motor of the commutator type with its attendant violent and noisy vibrations.

The object of my invention is to overcome these defects by employing a driving mechanism utilizing electric power without the necessity of a commutator; a further object being to eliminate the speed governor from machines of this type.

To this end the invention consists of a friction disc on the shaft for carrying the turn table, a roller in frictional engagement with the disc, a constant speed motor and an operative connection between the motor and roller so arranged and the motor being so mounted that the vibrations of the latter are absorbed and the wear in the operative connection is automatically taken up. More specifically stated the invention consists of a friction disc operatively connected with the sound reproducing elements, and an electro-induction motor supported by cushions to absorb the vibration thereof, the operative connection between the motor and disc being effected by a friction roller rotatively connected to the motor and variable in its radial position relatively to the disc. In order to take up the wear between the roller and disc I provide an off-center support for the motor for the purpose of utilizing the inherent tendency thereof to tilt and thereby maintain invariable frictional contact between the roller and disc.

Another important feature is my improved means for varying the radial position of the roller relatively to the disc for the purpose of regulating the time of the sound reproduced.

Briefly stated this regulating device performs its function by extending and reducing, as the case may require, the length of the member carrying the friction roller in its projection radially relatively to the disc. In the preferred embodiment of my invention the friction roller is carried directly on the end of the motor shaft which is specially constructed for the purpose.

Another feature of the invention is the particular means for providing the cushioning support for the motor, this preferably consists of a yielding resistance suspended from the frame of the instrument and connected to the motor at a point displaced from the vertical plane of the center of gravity of such motor; and I propose using as this yielding resistance a pair of expansile helical springs located respectively above and below the motor connection and disposed in a vertical line on the disc side of the vertical plane of the center of gravity of the motor, these springs being held in supporting engagement with the motor connection by a bolt suspended from the frame.

This particular cushioning means and the manner of tiltably supporting the motor permit a motor of the induction type to be employed in connection with a driving disc in direct communication therewith, the effect being that constant speed may be obtained without the use of a governor and an electric drive, without a commutator. And as is also important the entire driving mechanism and its regulator, with the exception of the top of the shaft for carrying the turn table and the time indicator hand, are contained entirely within the usual chamber for the driving mechanism. This particular construction and arrangement of parts also has the advantage of constituting a noiseless drive for the sound reproducing elements.

For full comprehension, however, of my invention reference must be had to the accompanying drawings in which similar reference characters indicate the same parts and wherein:

Figure 1 is a horizontal sectional view

through a gramophone case illustrating the turn table supporting shaft and my improved driving mechanism in plan view;

Figure 2 is a vertical sectional view through a gramophone case illustrating the turn table supporting shaft and my improved driving mechanism in side elevation;

Figure 3 is a similar view to Figure 2 the section, however, being taken in the vertical plane of the turn table shaft and the shaft of the motor;

Figure 4 is a plan view of my improved gramophone with the case and supporting frame partially broken away for the purpose of illustrating the time regulator;

Figure 5 is a detail view of a bell crank lever which is a component part of the time regulator;

Figure 6 is a detail fragmentary elevation of the cam shaft forming a part of the regulator mechanism;

Figure 7 is a transverse sectional view taken on line 7—7 Figure 2 and illustrating particularly the cushioning excentric support for the motor; and

Figure 8 is a perspective view of the main frame of the mechanism, inverted.

I have illustrated my improved driving mechanism applied to a gramophone, and will now specifically describe this particular application of the invention.

In order to mount my driving mechanism upon the underside of the hinged top 5 or motor board of a gramophone I have designed a special frame secured to the motor board by screws 5^a through cushions 5^b in the form of comparatively thick washers of soft rubber. This frame consists of a casting comprising a main frame plate 6 with arms 7 and 8 and a bracket 9 cast integrally with the underside of one end of the frame. Each of the arms 7 and 8 has a boss indicated at 10 and 11 respectively. These bosses support bolts 12 for suspending the motor through the medium of spring cushions. The motor case, indicated at 13 has a pair of lateral lugs 14 disposed in a horizontal plane slightly above the axis of the motor as indicated in Figure 7 and slightly nearer the turn table shaft than the center of gravity of the motor as shown in Fig. 2. These lugs are each provided with an opening 15 of larger diameter relatively to the bolts 12 and the top and bottom surfaces of the lugs are recessed as at 16 to form seats for expansile helical springs 17 the opposite ends of which are seated in recesses 18 in the underside of the arms 7 and 8 of the frame and in the top surface of supporting nuts 20 screwed onto the lower ends of the bolts 12. The motor mounted in this case 13 is of the induction type as will be presently further alluded to. The motor shaft, indicated at 21, carries at its outer end and in rotative relation therewith, and longitudinally movable thereon, a friction roller 22 adapted to bear upon the underside of a friction disc 23. This disc is mounted upon the shaft 24 of the turn table 25. This turn table is of usual construction, and the shaft has the usual conical tip 26 upon which the turn table is removably seated. In order to provide an end-thrust-bearing for the shaft 24 the frame 6 has a boss 27 through which the shaft projects and such boss is formed with a conical bearing 30 oiled as usual by an oil soaked felt washer and the shaft has a conical shoulder 31 seated in the bearing 30. The lower end of this shaft is reduced in diameter and screw-threaded as at 32 and the friction driving disc 23 is mounted rigidly thereon by means of clamping washers 33 and clamping nut 34. A ball and socket bearing between the lower end of the shaft and the bracket is provided by an end-thrust-bearing screw 35 presenting a socket 36 and the spheroidal end 37 of the shaft, the screw 35 being threaded through the bracket and locked in place by a lock nut 38.

The points of suspension of the motor case, and the motor within it, imparts to the same a tendency to tilt the friction roller 22 upwardly and thereby causing it to be automatically maintained in proper frictional relation with the disc, and at the same time taking up any wear between these parts.

This particular combination and arrangement of parts lends itself to the adjustment of the speed of rotation of the turn table and consequently the time of the music or other sounds reproduced. To effect this the end of the motor shaft carrying the friction roller has an axial boring 40 and carries a sleeve 41 slotted as at 42 and having one end closed to present a trunnion 43 upon which the roller 22 is mounted and clamped rigidly in place by a washer 45 and clamping nut 46. The protruding end 50 of this shaft is of spheroidal form to permit of end-thrust action with minimum friction. An expansile helical spring 51 located in the boring 40, bears between the inner end thereof and the closed end of the sleeve. This spring imparts to the sleeve a tendency to move axially in a vertical plane radially to the disc 23, and the length of the slot 42 confines the extent of this movement to the limit of adjustment of time required. The axial position of this sleeve on the motor shaft and consequently its radial position relatively to the disc is regulated by a regulator hand 60 adapted to have its point swung over an indicator plate or dial 61 on the motor board and exposed to the operator of the machine as is usual and necessary. Both the hand and dial may be of the usual type. According to my invention this hand is carried rigidly by the upper end of the shaft 62 carried rotatably by the frame 6

and having a shoulder 63 at its lower end between which and the frame an expansile spring 64 bears. The purpose of this spring is to offer a yielding resistance to the adjustment of the regulator hand in order that it will be held yieldingly in any position to which it may be moved. This shoulder 63 is presented by the upper end of a cam 65 illustrated in detail in Figures 5 and 6. A bell crank lever 70 fulcrumed on a boss 72 cast on the underside of the frame 6, has one arm 73 projecting across the cam to be operated thereby and the other arm 74 projects into position to engage and be engaged by the spheroidal end of the motor shaft. The cam is of substantially semi-circular form. The axial expansile force of spring 51 causes the end 50 of the shaft 21 to exert pressure in projection from the shaft against the arm 74 of the bell crank lever thus maintaining the arm 73 in constant bearing relation with the cam 65. This time regulator mechanism possesses the advantage of sensitiveness and instantaneous response to movement of the regulator hand 60 without lost motion. A switch 80 controls the electric circuit including the motor.

In order to more conveniently locate all the driving mechanism beneath the motor board of the instrument I employ a grease cup 85 and locate the same beneath the bearing in the motor case at the underside thereof.

Operation.

In the operation of my improved sound reproducing mechanism the turn table carrying the record is driven noiselessly and at a uniform speed regulated to render the music whether instrumental or vocal or other sounds at any desired time within reasonable limits. The record is as usual placed upon the turn table and the motor circuit is closed by switch 80. The rotation of the roller through its shaft 21 rotates the disc 23 at a speed which is regulated by the movement of the roller axially relatively to the disc. The operative connection is to all intents and purposes direct and noiseless and, because of the use of an induction type motor the speed is uniform. The vibrations of this motor are absorbed by the springs 16 and 17 and the cushions 5^b.

The movement of the regulator hand 60 turns the shaft 62 against the resistance of the spring 64 thereby causing the cam 65 to move the bell crank lever 70 through its arm 73 as, for instance, indicated in Figure 5 by dotted lines. This movement is transmitted to the movable end 50 of shaft 21, if the movement is in a direction towards that shaft, if, however, the movement is in the opposite direction the movable end 50 will be released and spring 51 will cause it to move with the bell crank lever. In this manner the adjustment of the time at which the music is rendered or other sounds reproduced is effected by direct connection without lost motion, and minute variation may be instantly effected.

In sound reproducing machines such as illustrated the sound reproducing elements proper are the record and needle, the sound reproduced from the record by the needle being amplified by the sound box, the arm and the horn the latter being either concealed or exposed. These elements form no part of my invention and as they are well known and may be of any preferred construction they are neither illustrated nor described.

What I claim is as follows:

1. In a sound reproducing machine, a frame, a shaft vertically mounted therein, a turntable supported upon said shaft, a motor, a friction drive between said motor and shaft, means for resiliently suspending the motor from the frame, the points of connection of the said means to the motor being located on opposite sides of the motor and adjacent its shaft end for the purpose of utilizing the weight of the motor in maintaing the friction elements in relative engagement.

2. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber, a frame rigidly upon the top, and a shaft within the chamber and protruding through the top for supporting one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a friction roller in rotative engagement with the disc, and a motor for driving the roller and carried yieldingly by the frame and within the chamber, means for supporting the motor in the manner to utilize the weight thereof in maintaining the rotative engagement between the roller and disc, said last mentioned means consisting of suspension devices extending between the frame and motor with the points of connection to the latter located to one side of the centre of gravity of the motor.

3. In a sound reproducing machine a turntable, a frame, an induction motor for driving said turntable, and means for suspending the motor from the frame and adapted to absorb the vibrations of the motor, said means consisting of lugs on opposite sides of the motor and located to one side of the center of gravity of the motor each lug having an opening, bolts extending downwardly from the frame through the lugs and having spring seats at their lower ends, springs bearing between the frame and the lugs and encircling the bolts, and independent springs bearing between the lugs and the seats on the lower ends of the bolts and encircling said bolts.

4. In a sound reproducing machine a

turntable, a frame, a motor having a shaft, a friction drive between the motor and turntable including a roller on the shaft and a disc in engagement with the roller, means for suspending the motor from the frame and adapted to absorb the vibrations of the motor, said means consisting of a pair of laterally extending lugs located one at each side of the motor and off-centered towards the shaft end of the motor for the purpose of utilizing the weight of the motor in maintaining the friction elements in engagement with each other, each of said lugs having an opening, bolts extending downwardly from the frame through the lugs and having threaded lower ends, nuts adjustable upon said ends, springs bearing between the frame and lugs and encircling the bolts, and independent springs bearing between the lugs and nuts and encircling the bolts.

5. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for carrying one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a motor flexibly mounted off-center and having a shaft projecting to close proximity with the disc, a friction roller, means effecting a rotative engagement between the shaft and roller and projecting the roller into frictional engagement with the disc, such means consisting of a sleeve slidable axially upon the shaft and carrying the roller, means for limiting the extent of axial movement of the sleeve and for effecting rotative engagement therebetween and the shaft and manually operated means for moving the sleeve.

6. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for carrying one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a motor flexibly mounted off-center and having a shaft projecting to within close proximity with the disc, a friction roller, means effecting a rotative engagement between the shaft and roller and projecting the roller into frictional engagement with the disc, consisting of a sleeve slidable axially upon the shaft and carrying the roller, a spring between the end of the shaft and the sleeve and tending to move the sleeve axially along the shaft, means for limiting the extent of axial movement of the sleeve and for effecting rotative engagement therebetween and the shaft and manually operated means for moving the sleeve, said last mentioned means consisting of a shaft carried by the top of the chamber and protruding through the same, a regulator hand carried by the last mentioned shaft and manually movable, a cam upon the end of this last mentioned shaft, a bell-crank lever having one end in engagement with the cam and means effecting an operative engagement between the opposite end of the bell crank lever and the sleeve.

7. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for carrying one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a motor flexibly mounted off-center and having a shaft projecting to close proximity with the disc, a friction roller, means effecting a rotative engagement between the shaft and roller and projecting the roller into frictional engagement with the disc, consisting of a sleeve slidable axially upon the shaft and carrying the roller, means for limiting the extent of axial movement of the sleeve and for effecting rotative engagement therebetween and the shaft and manually operated means for moving the sleeve, said last mentioned means consisting of a shaft carried by the top of the chamber and protruding through the same, a regulator hand carried by the last mentioned shaft and manually movable, a cam upon the end of this last mentioned shaft, a bell-crank lever having one end in engagement with the cam and means effecting an operative engagement between the opposite end of the bell crank lever and the sleeve, the said last mentioned operative connection consisting of a spring bearing between the shaft and sleeve and causing the latter to bear upon the end of the bell-crank lever.

8. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for carrying one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a motor flexibly mounted off-center and having a shaft projecting to close proximity with the disc, a friction roller, a rotative engagement between the shaft and roller and projecting the roller into frictional engagement with the disc consisting of a sleeve slidable axially upon the shaft and carrying the roller, means for limiting the extent of axial movement of the sleeve and for effecting rotative engagement therebetween and the shaft and manually operated means for moving the sleeve, said last mentioned means consisting of a shaft carried by the top of the chamber and protruding through the same, a regulator hand carried by the last mentioned shaft and manually movable, a cam upon the lower end of this last mentioned shaft, a bell crank

lever having one end in engagement with the cam and means effecting an operative engagement between the opposite end of the bell crank lever and the sleeve, the said last mentioned operative connection consisting of a spring bearing between the shaft and sleeve and causing the latter to bear upon the end of the bell crank lever and a spring yieldingly resisting rotation of the said regulator shaft.

9. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for supporting one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a friction roller in rotative engagement with the disc, a motor for driving the roller, means for supporting the motor in a manner to utilize gravity in maintaining the rotative engagement between the roller and disc consisting of a frame secured to the underside of the top of the chamber, a pair of lugs extending from opposite sides of the motor slightly above the horizontal plane of the axis thereof and slightly nearer the disc than the vertical plane of the center of gravity of the motor, the said lugs having relatively large openings, bolts suspended from the frame and passing through the openings in the lugs, upper expansile helical springs encircling the bolts and bearing between the frame and the lugs, nuts upon the lower ends of the bolts, and lower expansile helical springs bearing between the nuts and the lugs, for the purpose of absorbing vibration in the said motor supporting means.

10. In a sound reproducing machine a turntable mounted upon a shaft, a motor having a shaft and a friction drive between the motor shaft and the turntable, said drive consisting of a friction disc of comparatively large diameter mounted upon the turntable shaft; a sleeve mounted upon said motor shaft and rotatable in unison therewith and slidable axially thereon; means limiting axial movement of the sleeve upon said shaft; resilient means for yieldingly maintaining the sleeve at one end of its axial travel upon said shaft and a friction roller carried by said sleeve and rotatable therewith and in engagement with said disc, and means for moving said roller and sleeve axially upon the motor shaft and radially relatively to the disc.

11. In a sound reproducing machine a turntable mounted upon a shaft, a motor having a shaft and a friction drive between the motor shaft and the turntable, said drive consisting of a friction disc of comparatively large diameter mounted upon the turntable shaft; a sleeve mounted upon said motor shaft and rotatable in unison therewith and slidable axially thereon; means limiting axial movement of the sleeve upon said shaft; resilient means for yieldingly maintaining the sleeve at one end of its axial travel upon said shaft, and a friction roller carried by said sleeve and rotatable therewith and in engagement with said disc, and means for moving said roller and sleeve axially upon the motor shaft and radially relatively to the disc, said means consisting of a shaft; a manually operated regulator mounted upon said shaft; a cam upon said shaft; a bell crank lever having one end in engagement with the cam and having its opposite end operatively connected to the sleeve.

12. In a sound reproducing machine a vertical turntable shaft; a turntable adapted to be mounted upon the upper end of said shaft; a motor having a shaft, a friction drive between the motor shaft and the turntable shaft consisting of a friction disc of comparatively large diameter mounted upon the lower end of the turntable shaft, and a roller adapted to be driven by the motor shaft and in engagement with said disc, and means effecting rotative connection between the roller and the roller shaft and adapted to permit of axial movement of the roller thereon for the purpose of permitting adjustment of the speed of rotation of the turntable, said means consisting of a socket in the free end of the motor shaft; a sleeve having a closed end mounted upon said free end and having a slot therein; a pin rigidly carried by the motor shaft and projecting into said slot; a spring contained within said socket and bearing between the closed end of the sleeve and the inner end of the socket, said sleeve carrying a roller and means for adjusting the sleeve axially upon the motor shaft and radially relatively to the disc.

13. In a sound reproducing machine a vertical turntable shaft; a turntable adapted to be mounted upon the upper end of said shaft; a motor having a shaft, a friction drive between the motor shaft and the turntable shaft consisting of a friction disc of comparatively large diameter mounted upon the lower end of the turntable shaft, and a roller adapted to be driven by the motor shaft and in engagement with said disc, and means effecting rotative connection between the roller and the roller shaft and adapted to permit of axial movement of the roller thereon for the purpose of permitting adjustment of the speed of rotation of the turntable, said means consisting of a socket in the free end of the motor shaft; a sleeve carrying the roller and having a closed end mounted upon said free end and having a slot therein; a pin rigidly carried by the motor shaft and projecting into said slot; a spring contained within said socket and bearing between the closed end of the

sleeve and the inner end of the socket, and means for adjusting the sleeve axially upon the motor shaft and radially relatively to the disc.

14. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for carrying one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a motor flexibly mounted off-center and having a shaft projecting to close proximity with the disc, a friction roller, a rotative engagement between the shaft and roller and projecting the roller into frictional engagement with the disc, such means consisting of a sleeve slidable axially upon the shaft and carrying the roller, means for limiting the extent of axial movement of the sleeve and for effecting rotative engagement therebetween and the shaft and manually operated means for moving the sleeve.

15. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for carrying one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a motor flexibly mounted off-center and having a shaft projecting to close proximity with the disc, a friction roller, a rotative engagement between the shaft and roller and projecting the roller into frictional engagement with the disc, consisting of a sleeve slidable axially upon the shaft and carrying the roller a spring between the end of the shaft and the sleeve and tending to move the sleeve axially along the shaft, means for limiting the extent of axial movement of the sleeve and for effecting rotative engagement therebetween and the shaft and manually operated means for moving the sleeve, said last mentioned means consisting of a shaft carried by the top of the chamber and protruding through the same, a regulator hand carried by the top of the last mentioned shaft and manually movable, a cam upon the lower end of this last mentioned shaft, a bell crank lever having one end in engagement with the cam and means effecting an operative engagement between the opposite end of the bell crank lever and the sleeve.

16. In a sound reproducing machine, of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for carrying one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a motor flexibly mounted off-center and having a shaft projecting to close proximity with the disc, a friction roller, a rotative engagement between the shaft and roller and projecting the roller into frictional engagement with the disc consisting of a sleeve slidable axially upon the shaft and carrying the roller, means for limiting the extent of axial movement of the sleeve and for effecting rotative engagement therebetween and the shaft and manually operated means for moving the sleeve, said last mentioned means consisting of a shaft carried by the top of the chamber and protruding through the same, a regulator hand carried by the top of the last mentioned shaft and manually movable, a cam upon the lower end of this last mentioned shaft, a bell crank lever having one end in engagement with the cam and means effecting an operative engagement between the opposite end of the bell crank lever and the sleeve, the said last mentioned operative connection consisting of a spring bearing between the shaft and sleeve and causing the latter to bear upon the end of the bell crank lever.

17. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for carrying one of the sound reproducing elements, of a friction driving disc mounted upon the shaft within the chamber, a motor flexibly mounted off-center and having a shaft projecting to close proximity with the disc, a friction roller, a rotative engagement between the shaft and roller and projecting the roller into frictional engagement with the disc consisting of a sleeve slidable axially upon the shaft and carrying the roller, means for limiting the extent of axial movement of the sleeve and for effecting rotative engagement therebetween and the shaft and manually operated means for moving the sleeve, said last mentioned means consisting of a shaft carried by the top of the chamber and protruding through the same, a regulator hand carried by the top of the last mentioned shaft and manually movable, a cam upon the lower end of this last mentioned shaft, a bell crank lever having one end in engagement with the cam and means effecting an operative engagement between the opposite end of the bell crank lever and the sleeve, the said last mentioned operative connection consisting of a spring bearing between the shaft and sleeve and causing the latter to bear upon the end of the bell crank lever and a spring yieldingly resisting rotation of the said regulator shaft.

18. In a sound reproducing machine of the type having a chamber for the driving mechanism, a top for the chamber and a shaft within the chamber and protruding through the top for supporting one of the sound reproducing elements, of a friction

driving disc mounted upon the shaft within the chamber, a friction roller in rotative engagement with the disc, a motor for driving the roller, means for supporting the motor in a manner to utilize gravity in maintaining the rotative engagement between the roller and disc consisting of a frame secured to the underside of the top of the chamber, a pair of lugs extending from opposite sides of the motor slightly above the horizontal plane of the axis thereof and slightly nearer the disc than the vertical plane of the center of gravity of the motor, the said lugs having relatively large openings, bolts suspended from the frame and passing through the openings in the lugs, upper expansile helical springs encircling the bolts and bearing between the frame and the lugs, nuts upon the lower ends of the bolts, and lower expansile helical spring bearing between the nuts and the lugs, for the purpose of absorbing vibration in the said motor supporting means.

In testimony whereof I have signed my name to this specification in the presence of two witnesses.

ELMER A. FARMER.

Witnesses:

GORDON G. COOKE,

HARRIETTE MCDONALD.