Oct. 16, 1945. H. P. CLAUSEN 2,387,010

SOUND TRANSCRIPTION MACHINE

Filed Feb. 5, 1943 2 Sheets-Sheet 1

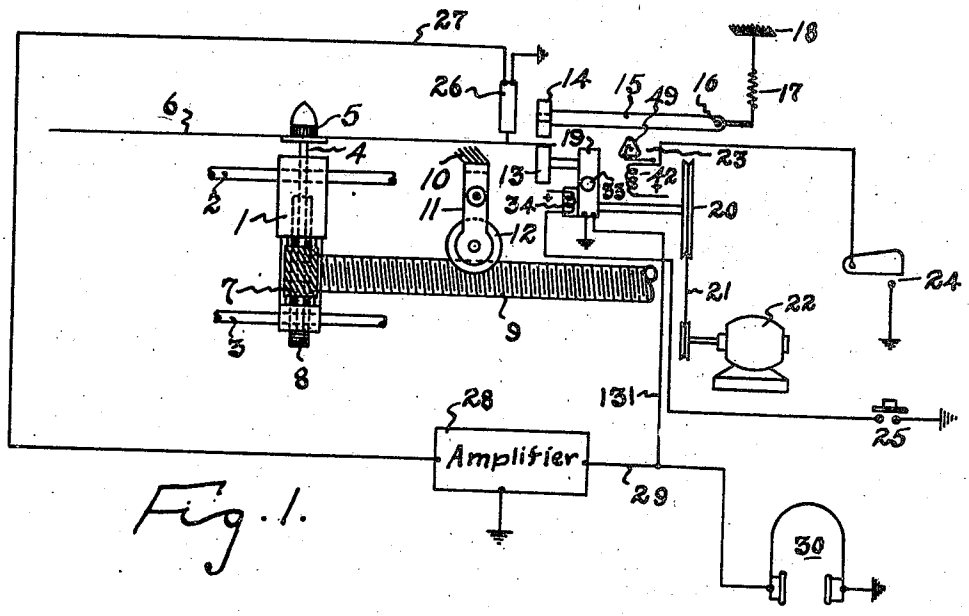


Fig. 1.

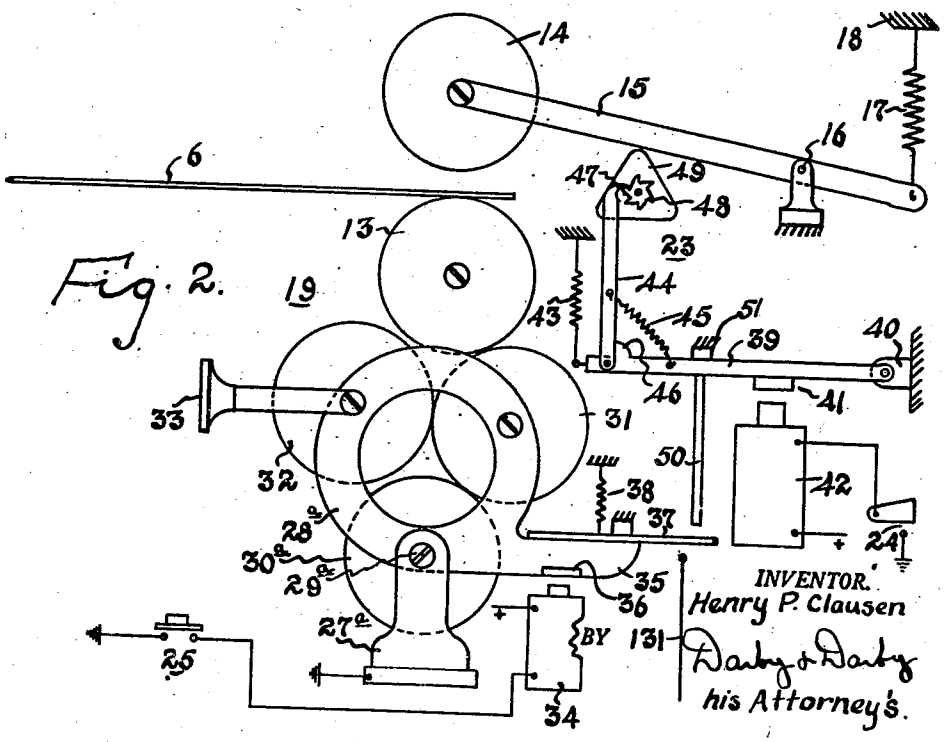


Fig. 2.

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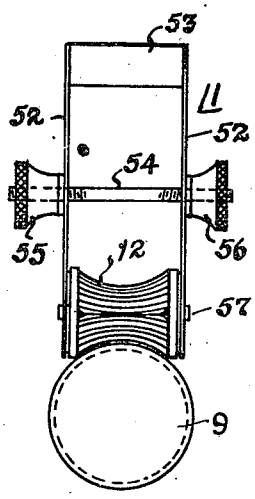


Fig. 3.

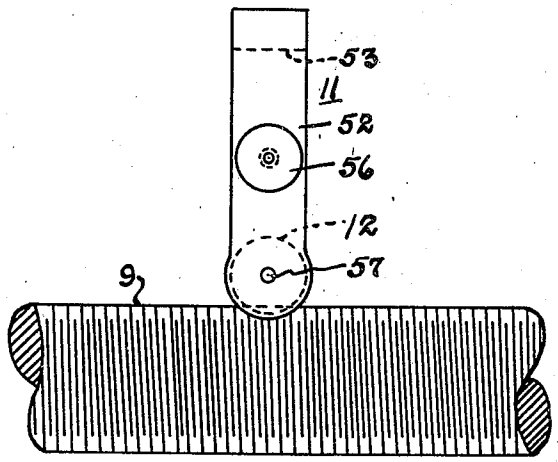


Fig. 4

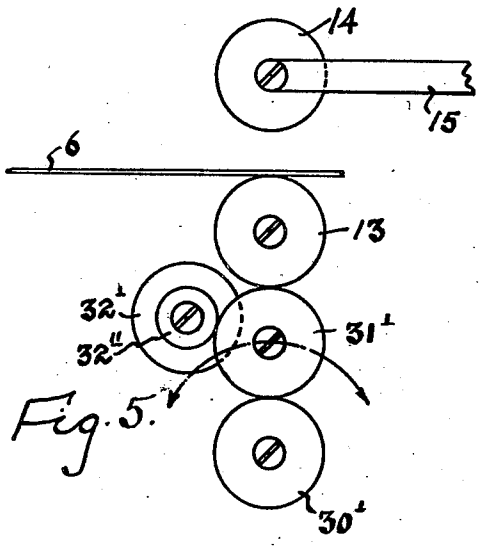


Fig. 5.

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Patented Oct. 16, 1945

2,387,010

UNITED STATES PATENT OFFICE

2,387,010

SOUND TRANSCRIPTION MACHINE

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Application February 5, 1943, Serial No. 474,780

20 Claims. (Cl. 274—13)

This invention relates to improvements for special application to machines for reproducing sound records in connection with the transcription of those records, although in the case of need, as will appear from the following disclosure, the subject matter of this invention could also be applied to sound recording machines and to sound recording and reproducing or transcription machines.

One important object of this invention is to provide a quite simple and practical power drive for a particular form of sound transcribing machine for effecting both forward and reverse movement of the machine, including the record, either at the same speed or at different speeds.

A more specific object of the invention within the above broader object is to provide various forms of control of such power transmission mechanisms so as to effect forward and reverse operation in a simple manner either independently of or as an incident to the normal operation of the machine and particularly to the starting and stopping thereof.

A further object of this invention is to provide in a machine of the type described an improved element which controls the traversing of the record carriage so as to simplify the manual traverse of the carriage while at the same time providing an effective power traverse thereof.

Other and more detailed objects of this invention will be apparent from the following detail description of one embodiment thereof as well as modifications as presented therein.

This invention resides substantially in the combination, construction, arrangement and relative location of parts, all as will be described in detail below.

In the accompanying drawings:

Figure 1 is a diagrammatic and schematic elevational drawing illustrating the principles of this invention;

Figure 2 is a side elevational view with some parts broken away of the power transmission mechanism employed in Figure 1 with some parts thereof diagrammatically illustrated;

Figure 3 is a front elevational view of the improvement relating to the carriage traversing mechanism;

Figure 4 is a side elevational view thereof; and

Figure 5 is a diagrammatic view of a modified form of the power transmission mechanism of Figure 2.

It may be helpful, although not necessary to a complete understanding of the subject matter herein disclosed to refer to United States Patent No. 2,296,870 issued September 29, 1942 to B. A. Proctor et al. for Sound recording and reproducing, because the subject matter of this invention is applied to a machine fundamentally of the type disclosed in that patent. The development of the subject matter herein disclosed is a result in part of the adaptation of the machine of said patent to commercial uses.

As outlined in the above patent, the machine diagrammatically herein disclosed, to which the subject matter of this invention is applied, employs a sound record in the form of a thin flexible disc of cellulose acetate or its equivalent, upon which sounds have been recorded along a spiral path beginning at a point near the center of the disc and extending adjacent to the periphery thereof. Upon consideration it will be seen that the diameter of the record grooves or paths increases progressively from the center outwardly. One size of record disc used on machines of this type has a diameter of 12". If recordings are begun at the center the approximate radius of the innermost convolution will be within the range of three to four inches, while the diameter of the outermost convolution near the periphery will be in the neighborhood of 11". It is at once apparent, therefore, that the number of words recorded in a single convolution near the center is considerably less than the number recorded in one of the outermost convolutions.

This fact is of importance in connection with the problem of back spacing when the record is employed in a transcription machine. Prior uses of machines of this type have generally relied upon a back spacing operation which caused the stylus of the reproducing head to skip radially from groove to groove, with the result that for each back spacing step one complete convolution of recording comprises the back spacing.

To better appreciate this fact, reference is made to the operation of a machine of this type wherein the record disc is impaled upon a vertical rotatable spindle which is journaled in a carriage mounted for transverse movement radially of the disc during reproduction. Driving power is applied to the disc itself causing the spindle to revolve and through it to operate mechanism to cause the carriage to progress slowly in a radial direction as the record revolves. A back spacing mechanism with a machine of this type causes back spacing movement one groove at a time where the stylus is at a point near the center or near the periphery of the record with the result that a variable amount or number of words of back spacing is effected. In the com-

mercial wax cylinder type of recording and transcription machine back spacing one groove at a time provides a uniform back spacing movement for every part of the record in view of its cylindrical form. The variable back spacing effect used heretofore with machines of the type herein disclosed has therefore been a distinctly undesirable feature of this type of machine. A transcribing operator having lost the thread of thought frequently needs a back spacing equal to two or three words as distinguished from some actual figures of as much as ten words near the periphery when back spacing is effected groove by groove.

There is another disadvantage of the radial groove by groove back spacing system present due to the fact that in spiral records of this type there has been adopted for commercial use a groove so small that there are two hundred twenty of them per inch of radial space. The result has been that it has been mechanically quite difficult to effect such a slight back spacing movement, so that frequently back spacing of more than one groove is caused, particularly under conditions of poor adjustments so that many times too many words of back spacing are produced for efficient use of the machine.

In accordance with this invention a reversing mechanism has been developed for causing actual reverse rotation of this particular form of mechanism under the conscious control of the operator, so that in effect the stylus moves backwardly in the record groove only an amount desired by the transcriber, followed by immediate forward movement of the stylus in the record groove so that the transcriber can pick up the thread of thought and continue with the transcription.

Likewise in machines of the type disclosed in the above patent the traversing movement of the carriage has been caused by the rotation of a threaded shaft connected to the carriage which engages a fixed nut upon manual movement of the carriage for the positioning thereof. It has been necessary to disconnect the fixed nut from the shaft thereby requiring an additional conscious manual operation. In accordance with this invention this additional operation is eliminated. A mechanism is herein disclosed which in normal operation causes traverse of the carriage and which without any act other than to apply pressure to the carriage in the right direction will release it for manual traverse.

Referring now first to Figure 1, there is illustrated diagrammatically at 1 a carriage representative of the type disclosed in said patent. This carriage is mounted upon a pair of fixed rods 2 and 3 so that it may have sliding movement thereon. A vertical spindle 4 is journaled in the carriage and is provided with a keyed impaling member 5 upon which the record disc 6 is impaled and to which it is keyed at the same time. This insures conjoint rotation of the spindle and the record disc. Mounted on the spindle 4 in a suitable cavity in the carriage is a worm 7 which meshes with a worm wheel 8, likewise journaled on the carriage. Connected to the worm wheel 8 is the threaded shaft 9 which in turn in previous machines engages a relatively fixed nut which could be swung into and out of engagement with the shaft as previously described. In accordance with this disclosure the threaded shaft 9 engages a spirally toothed gear 12 which is journaled in a frame 10 supported from any adjacent fixed part of the frame of the machine, as diagrammatically illustrated at 10.

The drive of this machine as in the case of that of the above patent, comprises a pair of friction wheels 13 and 14. The friction wheel 13 is positioned to continuously contact the end surface of the record disc 6. The upper friction wheel 14 is positioned diametrically opposite the wheel 13 on the other side of the disc 6 so that it can be moved downwardly to grip the disc between it and the wheel 13. Wheel 14 is rotatably mounted on an arm 15 which is pivotally mounted at 16 and provided with a tail 15' connected to a spring 17 anchored at 18 on a convenient part of the machine. The friction wheel 13 is the driving wheel and is connected through a power transmission chain diagrammatically illustrated at 19 into which power is put by means of a drive pulley 20 connected by the belt 21 to an electric motor 22. This power transmission mechanism is more fully disclosed in Figure 2, to which reference will be made shortly. At 23 is diagrammatically illustrated the mechanism for effecting movement of the lever 15 so that the wheel 14 will engage and disengage the disc 6 as required. This mechanism is likewise fully disclosed in Figure 2.

At 26 is diagrammatically illustrated the reproducing head, of which there are a number of types such as the electro-magnetic, piezo electric crystal, electrostatic, etc. One terminal of this reproducing head is grounded as shown and the other terminal is connected by circuit wires 27 to the input of a properly grounded amplifier 28. In accordance with modern practice this amplifier is preferably of the multistage vacuum tube type, of which many suitable forms are known. The output circuit wires 29 are connected to the head set or loud speaker 30 which is grounded in accordance with usual practice. The output circuit is connected by wire 131 to ground through a switch in the transmission mechanism 19, as will be shown in detail below, for the purpose of short circuiting the head set 30 during reverse movement of the record disc.

The structure of Figure 2 will now be described. The friction wheel 13 is shown as part of a train of friction wheels, of which friction wheel 30^a is rotatably mounted at 29^a on a suitable bearing member 27^a and driven by the motor 22. Also pivotally mounted on the axis of the wheel 30^a is a suitably shaped support or frame 28^a upon which is rotatably mounted the friction wheel 31 and the friction wheel 32. In the position of the parts shown in Figure 2, friction wheel 31 contacts friction wheel 30^a and friction wheel 13 while friction wheel 32 directly engages wheel 31 and is out of engagement with the wheels 30^a and 13. Connected to the frame 28^a is a manual operator 33, the function of which will be described later. The frame has a tangential tail 35 which is provided with a magnetizable armature 36 in the event it is made of non-magnetizable material. The armature 36 is positioned to be influenced by an electro-magnet 34 connected at one side to a suitably grounded current source, not shown, and at the other terminal to a normally open switch 25 through which the circuit to ground can be completed.

The tail piece 35 is provided with an extension 37 and a spring 38 connected to a suitably fixed part of the machine surface to hold the frame 28^a in the position shown, which is the position for forward drive of the record disc 6. The operating mechanism for the arm 15 includes a lever 39 piv-

otally mounted on a fixed part 40 of the machine. In the event this arm is not of magnetizable material the magnetizable armature 41 is provided to be influenced by the electromagnet 42, one terminal of which is also connected to the grounded current source, not shown, and the other terminal of which is connectible to ground through the normally open switch 24. A spring 43 is connected between a fixed part of the machine and the lever 39 so as to normally hold it against the fixed stop 51. A depending extension 50 connected to the arm 39 is arranged to engage the arm 37. At this point it may be noted that the frame 28a is grounded by bearing member 27a and that arm 37 cooperates with a fixed contact at the end of circuit wire 131. Extending upwardly from the arm 39 and pivotally connected thereto is an arm 44, terminating in a hooked end 47 comprising a pawl. The arm 39 is provided with a stop 46 to limit the clockwise rotation of arm 44 under the influence of spring 45, interconnecting the arm with arm 39 as shown. The end 47 of the lever 44 cooperates with a ratchet 48 connected to, for rotation with, a six-position three-point cam 49 arranged to cooperate with the pivoted lever 15. At this point it may be noted that all of the diagrammatically illustrated coil springs are tension springs.

Before describing the operation of this system the function of the structure of the member which engages the threaded shaft 9 should be set forth. As shown in Figures 3 and 4, this structure involves a pair of spring arms 52 mounted at one end on a spacing member 53 which is attached to a suitable fixed part of the machine. A rod 54 threaded at both ends passes through the spring arms 52 and is engaged by thumb nuts 55 and 56. Journaled at the lower end of the spring arms is a spiral worm wheel 12 having a shape complementary to a portion of the periphery of the threaded shaft 9 as clearly shown in Figure 3. The worm wheel 12 is pivotally mounted by means of the shaft 57 between the ends of the spring arms 52, and as shown, if desired, friction washers 12a may be mounted between the ends of the wheel 12 and the adjacent faces of the arms 52. It will be seen that the frictional engagement between these parts may be varied by means of the thumb nuts 55 and 56. The function of this structure will appear from the following description of the operation of the machine.

In the normal use of this machine a record disc will be impaled upon the spindle 4 and the carriage 1 will be forced to the right by sliding on the rods 2 and 3 to a point where the stylus of the reproducing head 26 engages the record convolutions at their beginning or innermost end. The carriage 1 may be thus traversed in a radial direction to the right simply by pushing upon it, at which time the worm wheel 12 will simply revolve on its shaft 57 because the frictional engagement between it and the spring arms 52 is easily overcome. It is likewise apparent that when necessary the carriage 1 can be traversed in the opposite direction in the same way. In either event it is not necessary to effect disengagement between the threaded shaft 9 and the worm wheel 12. With the carriage positioned as is mentioned, the reproducing head 26 is moved down to engage the record tablet. Drive motor 22 is then set in operation, it being noted that it is normally running continuously when the machine is in use. In order to start a reproduction of the sound record in the head set the operator momentarily closes switch 24, completing the circuit for magnet 42. This pulls the arm 39 downwardly, Figure 2, and causes one-sixth of a revolution of the cam 49 so that a flat side is exposed to the arm 15. Spring 17 causes counterclockwise rotation of arm 15 on the pivot 16, so that the friction wheel 14 engages the disc 6 and grips it between friction wheel 13 and itself. Under these conditions spring 17 maintains this gripping action. In the meantime the opening of switch 24 de-energizes the magnet 42 and spring 43 returns the arm 39 to the position shown in Figure 2, leaving cam 49 in its operated position.

It will be noted that the downward movement of arm 39 engaged the arm 37 by extension 50 and caused the frame 28a to pivot about 29a. As a result of this the circuit to ground through wire 131 is completed and the head set 30 is short circuited. When the frame 28a shifted it will be seen that friction wheel 31 disengages the friction wheel 13, which in turn is engaged by the friction wheel 32. Friction wheel 13 which for the sake of discussion can be assumed to have been rotating continuously in a counterclockwise direction, will now start to rotate in a clockwise direction because a reversing drive wheel 32 has been introduced into the drive chain. The disc 6 would then begin to move backwardly, but since the starting of the machine only requires a momentary closing of switch 24, little reverse movement will result. Immediately upon the de-energization of magnet 42, arm 39 will move back against stop 51 as described, and spring 38 will swing the frame 28a back to the position shown in Figure 2, which is the direction for forward driving of the disc 6 to effect reproduction. The result is, of course, that the pick-up head 26 will generate a current in accordance with the sound record and apply it to the head set through the amplifier 28, the circuit through wire 131 now being broken. Anytime that the operator desires to stop the machine for any purpose he merely momentarily closes switch 24, causing one-sixth of a reverse rotation of the cam 49 to raise the arm 15 upwardly to the position shown in Figure 2 and hold it there. Of course, at the same time the reverse drive roller 32 will be introduced into the drive chain but no reverse rotation of the disc 6 will result because friction idler 14 has disengaged the disc, and notwithstanding the fact that the driving disc 13 continues to revolve, the disc will not move, because the frictional forces between it and the wheel 13 are insufficient to cause its movement.

Returning to the running condition it will be seen that as the disc 6 revolves it causes spindle 4 to turn with it as well as worm 7. The rotation of worm 7 causes rotation of worm wheel 8 and threaded shaft 9. The rotation of threaded shaft 9 will cause the traverse of the carriage 1 towards the left. It is at this time that the adjusted frictional force holding the worm wheel 12 is sufficient to prevent it from turning, with the result that the reaction thereof is the same as a fixed half-nut interengaging shaft 9 to cause it to move in a longitudinal direction. Thus for normal forward running the carriage 1 moves slowly to the left as the disc 6 revolves, and thus the stylus of the head 26 progresses through the spiral record from near the center towards the periphery.

If during normal running and transcription the transcriber loses his thought connection for any reason, he may effect a back spacing move-

ment of the record disc by closing switch 24 to stop the machine, and then immediately closing it again to start the machine. At this time, however, he holds switch 24 closed a part of time learned by experience to cause reverse rotation of the disc 6 as previously described an amount which is believed to be sufficient to pick up the thread of thought. Immediately upon releasing switch 24 arm 39 returns to normal position as does the frame 28a, whereupon the disc 6 proceeds forwardly again, it being remembered that the arm 15 remains in operated position so that wheel 14 engages the record 6. Thus immediately upon completing what is learned by experience to be the necessary back spacing movement, the machine starts forwardly and reproduction begins. The amount of back spacing movement can be determined by the period of time during which the operator holds switch 24 closed on any operation involving the starting of the machine. It may be mentioned for emphasis that the same switch 24 starts and stops the machine and each alternate operation effects starting and stopping. Throughout back spacing movement the head set is short circuited so that no disturbing sounds are reproduced thereby.

Additional back spacing controls are illustrated in the drawings, all of which may be used or any desired combination thereof. For example, back spacing can be effected manually at any time while the machine is running forwardly by pressing the manual operator 33 to shift the frame 28a as previously described. This causes the disengagement of 31 from 13 and the engagement of 32 with 13 as in the case of electrical operation to effect reverse operation of the driver 13.

Finally another electrical control is provided through the magnet 34, particularly when it is desired to dissociate the reversal from the mechanism which operates the cam 49. In this case extension 50 would preferably be omitted. Each time that switch 25 is closed to energize magnet 34, the frame 28a will be shifted in the same manner and to effect the same result as is secured by shifting through the manual 33. Of course, if for some special reason it is desired all three controls could be incorporated in the machine, in which event the extension 50 would be employed. An advantage of the use of the manual 33 or of the use of the switch 25 would be that it would not be necessary to first stop the machine and again start it in order to get reverse operation as results from the use of the mechanism for operating the cam 49 for also shifting the frame 28a.

The structure of Figure 5 is a diagrammatic illustration of a modification of the drive chain by means of which reverse movement of the record disc 6 at a greater linear speed than is caused during forward movement can be secured. In this case the intermediate or reversing friction wheel corresponding to the wheel 32 of Figure 2 is a compound wheel comprising portion 32' and portion 32'' of lesser diameter. The portion 32'' engages the wheel 31' which in turn connects the motor driven wheel 30' with the disc driver 13 in normal forward operation. For reverse operation the wheel 31' and the compound wheel 32' and 32'' are mounted on a frame, not shown, the equivalent of the frame 28a, which can be pivoted on the axis of the wheel 30' as indicated by the double headed arrow so that 31' while remaining in contact with 30' disengages 13 and wheel 32' engages wheel 13. 32'' of course always engages wheel 31'. By this shifting the compound wheel is interposed in the train with the result that disc driver 13 is driven the reverse direction, but in this case at a greater speed than it moves in a forward direction. With this description those skilled in the art can readily apply this principle with the structure of Figures 1 and 2.

In addition to the advantages herein disclosed the subject matter of this invention has the important advantage of substituting for a rather complex and expensive mechanism a relatively simple and inexpensive mechanism. Back spacing devices previously used in machines of this type, as will appear from the above patent, are quite complex and thereby require a lot of space, are expensive to make and hard to maintain in the proper operating condition. This invention eliminates fairly completely all of these problems.

From the above description it will be apparent to those skilled in the art that the subject matter of this invention can be embodied in other physical forms. For example, those skilled in the art will appreciate that similar results could be secured by the use of gear trains rather than friction wheels, in which case the wheel 30a would be coupled through a gear to the train and the rest of the train made to cooperate with that gear. I prefer, therefore, to be limited solely by the true scope of the claims granted me.

What is claimed is:

1. In a machine of the type described a record support, a pair of friction drive members for engaging a record on opposite sides when mounted on said support to rotate the record, a power transmission train comprising a plurality of cooperating wheels for rotating one of said members in one direction, and means for introducing another wheel into said train to drive the record in the opposite direction.

2. In the combination of claim 1, said last means comprising a manually controlled electromagnetic operator.

3. In the combination of claim 1, said last means comprising a manually shiftable member.

4. In a machine of the type described a record support, a pair of friction drive members for engaging a record on opposite sides when mounted on said support to rotate the record, one of said members being bodily shiftable into and out of contact with said record, a power transmission train comprising a plurality of cooperating wheels for rotating the other of said members in one direction, means, upon successive actuations for moving said shiftable member into and out of engagement with the record, and means for introducing another wheel into said train to drive the record in the opposite direction.

5. In the combination of claim 4, said last named means comprising a manually controlled electro-magnetic operator.

6. In the combination of claim 4, said last means comprising a manually operated member.

7. In the combination of claim 4, said last means including a member operated with the movement of said shiftable member.

8. In the combination of claim 4, said last means including means operated by said shiftable member.

9. In the combination of claim 4, said last means including means actuated by the means for moving said shiftable member.

10. In a machine of the type described, a carriage, a rotatable record support journaled on said carriage, means for supporting said carriage for slight movement, a pair of friction drive

members for engaging a record on opposite sides when mounted on said rotatable support to rotate the record and said support, means driven by said support for causing said carriage to move, one of said members being bodily shiftable into and out of contact with the record, a power transmission train comprising a plurality of cooperating wheels for rotating the other of said members in one direction, means, upon successive actuations for moving said shiftable member into and out of engagement with the record, and means for introducing another wheel into said train to drive the record in the opposite direction.

11. In a machine of the type described, a carriage, a rotatable record support journaled on said carriage, means for supporting said carriage for slight movement, a pair of friction drive members for engaging a record on opposite sides when mounted on said rotatable support to rotate the record and said support, means driven by said support for causing said carriage to move, one of said members being bodily shiftable into and out of contact with the record, a power transmission train comprising a plurality of cooperating wheels for rotating the other of said members in one direction, means, upon successive actuations for moving said shiftable member into and out of engagement with the record, and means actuated by the means for moving said shiftable member for introducing another wheel into said train to drive the record in the opposite direction.

12. In a machine of the type described, a carriage, a rotatable record support journaled on said carriage, means for supporting said carriage for slight movement, a pair of friction drive members for engaging a record on opposite sides when mounted on said rotatable support to rotate the record and said support, means driven by said support for causing said carriage to move, one of said members being bodily shiftable into and out of contact with the record, a power transmission train comprising a plurality of cooperating wheels for rotating the other of said members in one direction, means, upon successive actuations for moving said shiftable member into and out of engagement with the record, and means actuated with said means for moving said shiftable member for introducing another wheel into said train to drive the record in the opposite direction.

13. In the combination of claim 10, said wheels comprising friction wheels.

14. In the combination of claim 11, said wheels comprising friction wheels.

15. In the combination of claim 12, said wheels comprising friction wheels.

16. In the combination of claim 10, said additional wheel being a compound wheel.

17. In the combination of claim 11, said additional wheel being a compound wheel.

18. In the combination of claim 12, said additional wheel being a compound wheel.

19. In a machine of the type described, a carriage, a rotatable record support on said carriage, means for supporting said carriage for rectilinear movement, a threaded shaft connected to said carriage and said rotatable support to cause rotation thereof, means for causing rotation of said record support, and relatively fixed means engaging said threaded shaft to cause it to move longitudinally as it revolves comprising a frictionally supported toothed member.

20. In the combination of claim 19, means for adjusting the frictional resistance to rotation of said toothed member.

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