

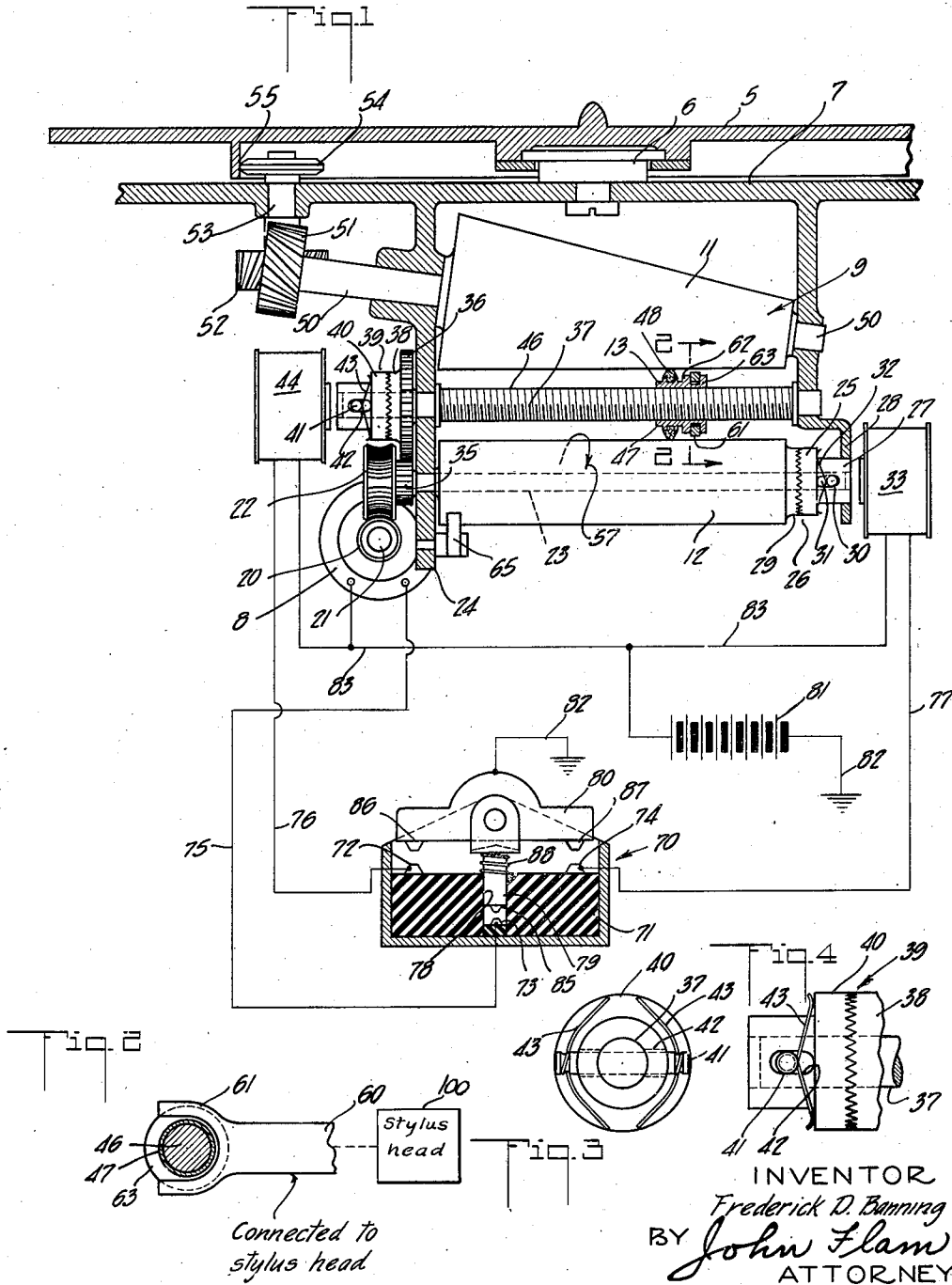
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PHONOGRAPH DRIVE

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PHONOGRAPH DRIVE

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This invention relates to transmission mechanism adapted to connect a phonograph turntable with a source of power for rotating the table.

In records of the so-called disc type, the sound track or groove carrying the record extends in a helical path from near the periphery of the record to near its center, and the reproducing or recording head is moved over the record in a generally radial direction to permit the stylus to follow or form the groove. With a constant speed of rotation for the record disc, the linear speed at which the record surface passes the needle or stylus is constantly changing; being two to three or more times as great in the grooves adjacent the periphery of the record than in the grooves adjacent the center of the record.

The linear speed of the outer grooves may thus be much greater than is suitable for successful recording or reproduction, and in fact so great as to impose an undesirable load on the record material. On the other hand, the linear speed of the grooves adjacent the center, may be lower than that suitable for the best results in recording and reproduction, and in fact the nearness with which the recording may be carried to the center of the record is definitely limited by this reduction in surface velocity.

With certain types of record materials, it is quite essential to maintain the linear velocity of the record groove below certain limits; hence it has been proposed to arrange the driving mechanism for the turntable so that the latter revolves at a constantly varying speed, dependent upon the position of the head carrying the stylus, so that the record groove passes under the stylus at the same velocity, regardless of whether the head is near the periphery of the record or near its center.

Such an arrangement not only permits the use of record material which would otherwise not be useable, but also gives greatly improved recordation and reproduction. Further in any case it permits the use of larger diameter records since the peripheral speed does not reach prohibitive limits, and it likewise permits the carrying of the groove much nearer the record center, since the velocity is maintained at the proper figure, thus materially increasing the capacity of the record.

It is a principal object of this invention to provide an improved form of transmission mechanism for connecting a phonograph turntable to a source of power, operating at a constant speed,

so that the speed of the turntable will change progressively at a constant rate.

It is a further object of this invention to provide such a mechanism having means for causing the stylus head to move across the record at a desired rate.

It is still another object of this invention to provide a mechanism embodying means for maintaining the stylus head in correct position at any times with respect to the instantaneous ratio of the transmission; in other words, to ensure that the turntable will rotate at the proper speed with respect to the position of the stylus.

In using a phonograph, either for recording or reproduction purposes, it is frequently necessary to "back-space" or move the stylus head back from some point on the record, possibly the termination of the recording, either for a short distance as to hear the last few words or bars of the recording, or possibly the entire way to the beginning, as in a repeater, or as in preparation for a succeeding record carrying member.

It is a further object of this invention to provide a mechanism giving a quick and convenient means for accomplishing such back spacing.

It may also sometimes be desirable to advance the stylus head, while it is lifted off the record, toward the end of the record carrying member at a more rapid rate than normal, as when it is desired to skip a portion of the record or leave a blank space.

It is a still further object of this invention to provide a mechanism incorporating means for imparting such an advance to the head.

It is still another object of this invention to provide means for readily controlling the back spacing and advance of the stylus.

It is a still further object of the invention to provide a back spacing arrangement with which it is possible to back space for only a part of a groove on the record.

This invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawing accompanying and forming part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

In the drawing:

Figure 1 is a sectional view, largely diagrammatic, illustrating the transmission arranged to drive a turntable;

Fig. 2 is a detail section as seen on plane 2—2 of Fig. 1;

Fig. 3 is an end view on an enlarged scale of one of the clutches used in the transmission; and

Fig. 4 is a side elevation of the clutch of Fig. 3. Referring to the drawing, the phonograph turntable is indicated at 5 and is rotatably supported by means of a suitable bearing 6 upon a frame 7. A source of power 8, preferably an electric motor, is arranged to drive the turntable 5 through a transmission mechanism generally indicated by 9. It will be understood that a stylus head which may be either a reproducing head or a recording head, or a combination head, is supported on suitable guides so as to move across the table 5 in a generally radial direction. Means are provided for so moving this head, as will presently appear.

Transmission mechanism 9 includes rollers 11 and 12 which are rotatably supported on frame 7, and have non-parallel or diverging axes. One of these rollers, as 11, is tapered or conical, while the other roller 12 is shown as cylindrical. The lower roller 12 is arranged to be driven by motor 8, through connections to be presently described; the upper or conical roller 11 is arranged to drive the turntable 5. Operatively connecting roller 11 with roller 12 is a friction roller or idler 13. Means are provided for moving this roller and at the same time maintaining it in contact with rollers 11 and 12. Since one of these, 11, has a progressively changing diameter, the speed ratio between rolls 11 and 12 will be dependent upon the position of idler 13 between them, the speed ratio changing as the position of the idler changes. Thus the speed of the table 5 will vary as idler 13 is moved, and by providing suitable connections between the idler and the stylus head so that the head will move toward the outside of the record as the idler moves to decrease the speed of the turntable, and by suitable proportioning of the various parts, the rate at which the record groove passes the stylus can be maintained constant for all positions of the stylus.

With this general picture in mind, the details of the mechanism can be set forth. The motor 8 is suitably supported with relation to frame 7 and is provided with a worm 20 secured to its shaft 21, worm 20 engaging a worm wheel 22 secured on shaft 23. Shaft 23 adjacent worm wheel 22 is rotatably supported in a downwardly extending arm 24 of frame 7, the other end of shaft 23 having slidably secured thereon, one member 25 of a jaw clutch 26. Clutch member 25 has a hub 27 rotatably supported in a downwardly extending arm 28 of frame 7. Hub 27 in turn supports the right hand end of shaft 23. Roller 12 has the other member 29 of clutch 26 fixed to its right hand end. Roller 12 is carried on shaft 23 and is freely rotatable thereon, unless coupled to the shaft by clutch 26.

Clutch member 25, slidably mounted on the end of shaft 23 is restrained against rotation with respect thereto by a diametrically arranged pin 30. Pin 30 is secured in shaft 23 and engages slots 31 formed at diametrically opposite portions of hub 27. A pair of springs, one of which is shown at 32, extend between pin 30 and member 25, and are effective to urge member 25 to-

ward the left along the shaft and into engagement with clutch member 29 on roller 12. Thus, roller 12 is normally in driving engagement with shaft 23 and motor 8.

As a convenient means of disengaging clutch 26, an electromagnet 33 is provided. When magnet 33 is energized, clutch member 25 is attracted to the right, and out of engagement with the cooperating member 29. Thus, roller 12 is no longer driven by shaft 23, but is free to rotate thereon.

Secured on shaft 23 adjacent worm gear 22 is a spur gear 35 meshing with a larger spur gear 36, rotatably mounted on worm shaft 37. Gear 36 has one member 38 of a clutch 39 secured thereto. The other member 40 of clutch 39 is slidably secured on shaft 37 by means of a pin 41 engaging slots 42 in member 40. Member 40 is thus in driving relation with shaft 37 and is urged into engagement with member 38 by hairpin springs 43. Thus, shaft 37 is normally in driving engagement with gear 36, and hence motor 8. An electromagnet 44 is provided to pull member 40 to the left when energized, thus disengaging this member and freeing the shaft 37 from driving engagement with gear 36 and permitting gear 36 to revolve freely on the shaft. The arrangement of clutch 39 is similar in all respects to that of clutch 26, and is shown in detail in Figs. 3 and 4.

Idler 13 is mounted on and threadedly engages the threaded portion 46 of shaft 37, but is freely rotatable with respect thereto in response to force exerted by rollers 11 and 12. Idler 13 may conveniently include a hub 47 of metal or other suitable material with a friction facing 48 of leather, rubber or other suitable material engaging the rollers.

Roller 11 is secured on shaft 50 which is rotatably supported in arms 24 and 28 of frame 7. One end of shaft 50 carries a skew gear 51 which meshes with a cooperating skew gear 52 carried by a short vertical shaft 53 rotatably supported in frame 7. Shaft 53 also carries a friction wheel 54 which engages an annular flange 55 on the underside of turntable 5. By this means, roller 11 is in driving relation with turntable 5.

With clutches 26 and 39 each engaged and motor 8 operating to drive roller 12 in the direction indicated by arrow 57, roller 11 will be driven in the same direction by means of idler 13, the relative rates of rotation of the rollers 11, 12 depending on the position of the idler 13. The rotation of idler 13 on the worm 46, will cause the idler to travel axially along worm 46, the speed and direction of the movement depending on the rate and direction of the rotation of the worm 46 with respect to idler 13 as well as on the pitch and direction of the threads of the worm.

As shown, worm 46 has right hand threads and rotates at a less speed than idler 13, since the ratio between gears 35 and 36 is less than the ratio between rollers 12 and idler 13. Thus idler 13 and shaft 46 rotate in the same direction but the idler rotates faster than the shaft. Hence, the idler structure 13 moves slowly to the left as a result of the action of the threads. This movement results in the idler contacting a continuously larger portion of roller 11 resulting in increased speed reduction and a decrease in the speed of turntable 5.

To correspond with this decreasing turntable speed, the stylus head should of course be moving toward the periphery of the table. Such

movement can be conveniently supplied to the stylus head 100 by connecting it with an arm 60 (Fig. 2) carrying a fork 61 adapted to be confined between flanges 62, 63 formed on hub 47 of the idler structure 13.

With the mechanism operating as shown and described, the stylus head 100 travels toward the periphery of the record or to the left (Fig. 1), and the speed of the table 5 decreases. However, roller 11 can be driven in the opposite direction equally as well, in which case the stylus head 100 would travel to the right, or toward the center of the record, and the speed of the table would increase.

If now clutch 26 is disengaged, as by energizing magnet 33, roller 12 will not be driven by the shaft 23 and will be restrained by a small friction brake 65 which may be a piece of felt secured to arm 24 of frame 7 and continuously engages the surface of the roller. The roller 11 will not entirely stop, however, as will presently appear. Worm 46 will continue to rotate, and since idler 13 is no longer being driven, it will now be urged to the right, or in a back-spacing direction, by the threads of worm 46. If roller 12 was held against rotation it would be necessary for the surface of idler 13 to slide in an axial direction along the surfaces of rollers 12 and 11. On the other hand if roller 12 was free to rotate, the idler 13 would probably be carried around by worm 46 without relative rotation between them, and the idler 13 would not move along the worm at all.

By placing the restraint 65 on roller 12, idler 13 is prevented from turning with the worm 46, thus ensuring that the idler will be moved to the right. At the same time, since roller 12 is capable of restrained rotation, idler 13 is not compelled to slide on its surface, but turns slowly due to the friction between the idler 13 and the worm 46. This turning imparts a corresponding slow rotation to rollers 11 and 12, so that idler 13 describes a spiral on the surface of the rollers. It will be plain that the back spacing movement of the idler structure 13 and connected parts is much more rapid than its movement in a forward direction. Due to the continued rotation of the turntable, it is possible to back space the stylus for less than one groove or complete revolution of the table.

If it is desired to move the stylus head rapidly in the direction of advance, clutch 39 is disengaged, clutch 26 remaining in engagement. This causes worm 46 to stop rotating. The idler 13 due to its rotation imparted by roller 11, will then move rapidly to the left along the worm. Here again the turntable will continue to rotate, making possible an advance of a fraction of a groove.

The operation of the phonograph may be conveniently controlled by a push button type of switch 70, diagrammatically shown in Fig. 1. This switch may comprise a block of insulating material 71 supporting three stationary contacts 72, 73 and 74. The middle one 73 of these contacts is connected by a lead 75 to one terminal of the motor 8; contact 72 is connected to one terminal of the electromagnet 44 by lead 76, while contact 74 is connected to one terminal of electromagnet 33 by lead 77. Slidable in a central bore 78 in switch block 71 is a plunger 79, having a tiltable member 80 pinned at its upper end. Plunger 79 and member 80 are of conducting material, and are electrically connected together. They are connected to one terminal of a source of current 81 as by ground connections

82. The other terminal of the source of current 81 is connected to the free terminals of electromagnets 33 and 34, and of motor 8 by a common lead 83.

The lower end of plunger 79 carries a contact 85 adapted to engage contact 73, while member 80 carries contacts 86 and 87 adapted respectively to engage contacts 72 and 74. A compression 88 normally maintains all contacts out of engagement. If member 80 is manipulated so as to push plunger 79 down without tilting member 80, contacts 73, 85 only will be engaged. This will energize motor 8 and leave clutches 33 and 44 in engagement. Thus, as previously described, turntable 5 will be driven at a progressively changing speed and the stylus head will follow the sound groove across the record. If now, while maintaining plunger 79 pressed in, member 80 is tilted to the right about its pivot, causing contact 87 to engage contact 74, electromagnet 33 will be energized in addition to motor 8, causing clutch 26 to be disengaged and the stylus head to back space, as previously described. On the other hand, if member 80 is tilted to the left, contact 86 will engage contact 72, energizing magnet 44 and disengaging clutch 39. This causes the stylus head to advance rapidly as previously set forth. The switch is so arranged that contacts 72—86 and 74—87 can not be engaged simultaneously.

What is claimed is:

1. In a variable ratio transmission, a pair of rollers having diverging axes, an idler engaging the surfaces of said rollers and forming a driving connection between the rollers, means to drive one of said rollers, means whereby the other roller is operatively connected to a load, and means including a threaded member to cause the idler to advance along the surfaces of the rollers as a function of the rotation of said rollers.

2. In a variable ratio transmission, a pair of rollers having diverging axes, an idler engaging the surfaces of said rollers and forming a driving connection between the rollers, means to drive one of said rollers, means whereby the other roller is operatively connected to a load, means, rotatably supporting the idler including a threaded member, the idler threadedly engaging said member and being coaxial therewith, said member being so located that the idler is always in contact with the rollers, and whereby the idler is caused to rotate on said member and to travel along its axis.

3. In a variable ratio transmission, a pair of rollers having diverging axes, an idler engaging the surfaces of said rollers and forming a driving connection between the rollers, means to drive one of said rollers, means whereby the other roller is operatively connected to a load, means, rotatably supporting the idler, including a threaded member, the idler threadedly engaging said member and being coaxial therewith, said member being so located that the idler is always in contact with the rollers, means to cause relative rotation between the idler and said member, and means whereby said relative rotation may be optionally in either direction to cause the travel of the idler along its axis to be reversed.

4. In a variable ratio transmission, a pair of rollers having diverging axes, an idler engaging the surfaces of said rollers and forming a driving connection between the rollers, means to drive one of said rollers, means whereby the other roller is operatively connected to a load, means, rotatably supporting the idler including a

threaded member, the idler threadedly engaging said member and being coaxial therewith, said member being so located that the idler is always in contact with the rollers, whereby the idler is rotated with respect to said member, means to rotate said member, means to vary the rate of rotation of the member, and means to vary the rate of rotation of the idler with respect to the member, whereby the rate of movement of the idler along the member may be varied.

5. In a variable-ratio transmission including a pair of rollers, one of said rollers being tapered, one of said rollers being operatively connected to a load, the other roller being connected to a source of power, a threaded member, means rotatably supporting said member, means whereby said member is driven by said source of power, an idler structure threadedly engaging said member and rotatably supported thereby, said structure having a surface frictionally engaging the roller surfaces and coaxial with the member, the speed of rotation of the threaded member being different from the speed of rotation of the idler, whereby the idler is caused to move along said member, and means to alter the speed of the driven roller whereby the speed of rotation of the idler with respect to the member is altered and the rate of movement of the idler structure is changed.

6. In a variable ratio transmission including a pair of rollers, one of said rollers being tapered, one of said rollers being operatively connected to a load, the other roller being connected to a source of power, a threaded member, means rotatably supporting said member, means whereby said member is driven by said source of power, an idler structure threadedly engaging said member and rotatably supported thereby, said structure having a surface frictionally engaging the roller surfaces and coaxial with the member, the

speed of rotation of the threaded member being normally less than the speed of rotation of the idler, whereby the idler is caused to move along said member, and means to reduce the speed of the idler below that of the member whereby the direction of its movement along the member is reversed.

7. In a variable ratio transmission including a pair of rollers, one of said rollers being tapered, one of said rollers being operatively connected to a load, the other roller being connected to a source of power, a threaded member, means rotatably supporting said member, means whereby said member is driven by said source of power, an idler structure threadedly engaging said member and rotatably supported thereby, said structure having a surface frictionally engaging the roller surfaces and coaxial with the member, the speed of rotation of the threaded member being normally less than the speed of rotation of the idler, whereby the idler is caused to move along said member, and means to reduce the speed of said member, whereby the rate of movement of the idler therealong due to its rotation is increased.

8. A variable ratio transmission connecting a load with a source of power, said transmission including a pair of rollers, one of which has a surface of varying diameter, the other having a surface of constant diameter, and an idler, adapted to form a driving connection between the rollers, the ratio of said transmission depending on the axial position of said idler, means to alter the position of the idler, and means forming a connection between the idler and the head, whereby the position of the head with respect to the turntable is altered in response to movement of the idler.

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