May 9, 1967 O. HORNA 3,318,502

ROLLER DRIVE FOR NON-MAGNETIC RECORDING TAPE MAGNETICALLY ACTUATED

Filed July 6, 1965 2 Sheets-Sheet 1

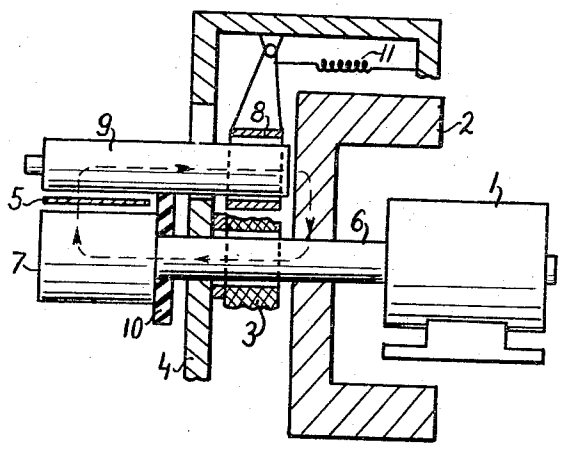


Fig. 1

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2 Sheets-Sheet 2

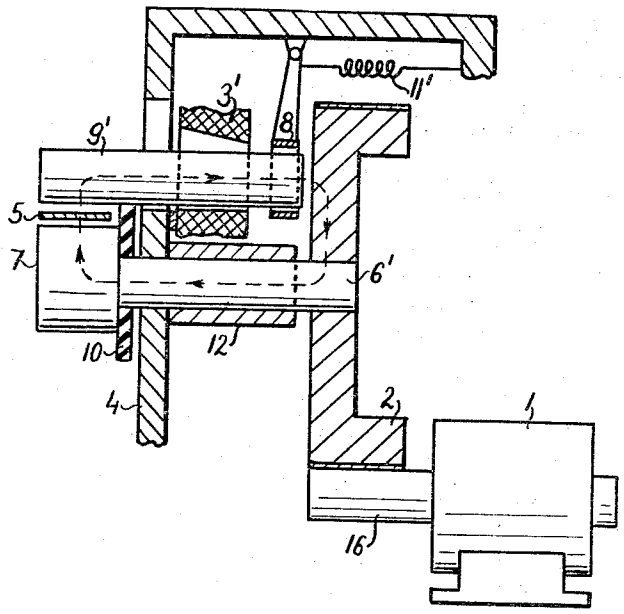


Fig. 2

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United States Patent Office 3,318,502
Patented May 9, 1967

3,318,502

ROLLER DRIVE FOR NON-MAGNETIC RECORDING TAPE MAGNETICALLY ACTUATED

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Filed July 6, 1965, Ser. No. 469,442
Claims priority, application Czechoslovakia, July 17, 1964, 4,165/64
9 Claims. (Cl. 226—180)

This invention relates to roller drives, and particularly to a roller drive for non-magnetic recording tape, such as punched or otherwise perforated tape in which the perforations constitute a record of information.

Precise and rapid reading of recording tape of the type described requires the tape to be stationary during read-out, to be accelerated to full traveling speed within a microsecond or less, and again to be fully arrested within a similar period for the next reading. It is known to drive such tape by means of two rollers which engage the tape therebetween.

The invention aims at providing a tape drive which employs drive rollers in the generally known manner, but which achieves the required high rate of acceleration and deceleration of the tape in a simple manner at low initial cost for the construction of the apparatus, and at low operating cost.

A more specific object of the invention is the provision of a roller drive of the type described in which the rollers are moved toward and away from each other by magnetic forces, and in which the air gaps in the necessary magnetic circuit, and the reluctance of the circuit are held to a minimum, thus requiring relatively little power for energizing the circuit.

Another object is the provision of a roller drive in which the tape engaging rollers may be selected as large in diameter as may be desired without unduly increasing the power requirements of the drive by the energy necessary for accelerating and decelerating the rollers.

A concomitant object is the provision of a roller drive whose rollers may be chosen of relatively large diameter to minimize wear and other damage to the recording tape, particularly its splices, yet without unfavorably affecting the economy of the drive arrangement.

Yet another object is the provision of a roller drive whose motor need not be substantially more powerful than is necessary for accelerating the small mass of the recording tape to be conveyed.

With these and other objects in view, the invention in one of its aspects resides in a drive roller assembly and a pressure roller assembly which are mounted on a common support in respective bearings for rotation about corresponding axes which may be moved relative to each other as is conventional in roller drives.

Each roller assembly has three portions. One is the journal portion received in the associated bearing. A second portion has an exposed contact face about the axis, and there is a third portion. The three portions are axially spaced from each other, and one of the roller assemblies, which may be either the drive roller assembly or the pressure roller assembly, has yet a fourth axial portion which is interposed between the second and third portions and is enveloped by a conductive coil. A magnetic circuit which includes the gap between the contact faces is closed between the third portions of the two rollers by a magnetizable member. The drive roller is driven in the usual manner.

Other features and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood from the following detailed

description of preferred embodiments when considered with the attached drawing in which:

FIG. 1 shows a roller drive of the invention in elevational section; and

FIG. 2 shows a modified roller drive in a view similar to that of FIG. 1.

Referring now to the drawing, and initially to FIG. 1, there is seen an electric motor 1 mounted on a supporting frame 4 in a manner not shown in detail, only a small portion of the frame being illustrated in the drawing. The frame 4 consists of bronze or other nonmagnetic material. The output shaft 6 of the motor 1 is journaled in a bearing provided in the frame 4, and its free end carries a cylindrical drive roller 7 and a flat annular rubber disc 10. The axial portion of the shaft 6 between the bearing and the motor 1 carries a heavy flywheel 2. A magnet coil 3 is fixedly mounted on the frame 4 coaxially with the shaft 6 and envelopes a portion of the shaft 6 between the flywheel 2 and the bearing in the frame 4.

A bronze bearing 8 is pivotally mounted on the frame 4 for angular movement in a plane which includes the axis of the shaft 6. A helical tension spring 11 tends to pivot the bearing 8 counterclockwise, as viewed in FIG. 1, so that a cylindrical pressure roller 9 which is journaled in the bearing 8 is held in abutting engagement with the rubber disc 10 by the tension of the spring 11. In the illustrated inoperative position of the apparatus, a gap is formed between respective contact faces on the drive roller 7 and on a corresponding radially aligned portion of the pressure roller 9, and is wide enough to accommodate a tape 5 with ample clearance, the tape being shown in transverse section.

The radial spacing of the axes of the rollers 7, 9 is such that the axis of the pressure roller 9 intersects the radial face of the flywheel 2 in all positions of the apparatus. The frame 4 is provided with a large opening for passage of the pressure roller 9 to facilitate assembly and maintenance work, but the angular movement of the pressure roller 9 during operation of the apparatus is limited to a few degrees. The gap between the end face of the pressure roller 9 and the radial flywheel face is therefore very small.

The roller drive illustrated in FIG. 1 is operated as follows:

The drive roller 7 is rotated at uniform speed by the motor 1. The pressure roller 9 is rotated at a similar speed by its frictional engagement with the edge of the rubber disc 4. The motor 1 need not be much more powerful than necessary to overcome bearing friction and the like. Rotary energy is stored in the flywheel 2 while the drive is in the illustrated position.

When it is desired to actuate movement of the tape 5, the coil 3 is energized, thereby producing a magnetic circuit in the shaft 6, the drive roller 7, the pressure roller 9 and the flywheel 2, all of which are made of ferrous material such as solid or laminated iron, and are magnetizable. The magnetic circuit is indicated by a broken line and arrows.

The pressure roller 9 is drawn to the drive roller 7, and the tape 5 is gripped between the rollers. The small amount of energy required for accelerating the tape is derived to a small part from the pressure roller 9 which slows down as the rubber disc 10 is compressed by the magnetic attraction between the rollers, and mainly from the flywheel 2. Tape movement starts practically instantaneously at full speed.

The magnetic flux passes axially through the shaft 6 and through most of the roller 7 and the roller 9, and is mainly radial in the flywheel 2. There is no magnetic interaction between the shaft 6, the pressure roller 9 and the bearings in which the journal portions of the shaft and

of the roller are received. Bearing friction is not affected by a magnetic field.

The diameters of the rollers **7**, **9** may be selected large enough to minimize tape wear and the danger of breaking the tape during passage of splices between the rollers. The resulting relatively great weight of the rollers is beneficial in the drive arrangement of the invention.

Relatively large tolerances are permissible in the construction of the drive arrangement since dimensions are not overly critical, not even in the bearing **8**. The reluctance of the gap between the pressure roller **9** and the flywheel **2** may be held to a minimum by placing the roller **9** axially close to the flywheel, but also by making the radial end face of the roller **9** very large as compared to the spacing between that face and the opposite radial face of the flywheel.

It will be appreciated that the shaft **6** and the pressure roller **9**, are axially secured in their respective bearings in a convenitonal manner, but the necessary axial securing means have not been shown for the sake of clarity.

Many modifications may be made in the roller drive illustrated in FIG. 1 without departing from the scope of this invention, and FIG. 2 is merely illustrative of such modifications.

The motor **1** of the modified embodiment of the invention is provided with an output shaft **16** which is in circumferential frictional engagement with a flange on the flywheel **2**. The shaft **6'** which supports the flywheel is journaled in a sleeve bearing **12** fixedly attached to the frame **4**. The free end portion of the shaft **6'** carries the drive roller **7** and the disc **10** as described hereinabove with reference to FIG. 1. The journal portion of the drive roller **9'** is received in the pivotally mounted bearing **8** and is urged into engagement with the rubber disc **10** by the spring **11**. A portion of the roller **9'** near the bearing **8** passes through a coil **3'** which is fixedly mounted on the frame **4** and whose central opening is shaped to permit the pressure roller **9'** to be swung counterclockwise from the illustrated position for changing the tape **5**, and for similar operations.

The modified embodiment of the invention permits the use of a motor **1** which rotates at a speed much higher than the desired rotary speed of the drive roller **7**. Its mode of operation is otherwise closely similar to that of the first-described roller drive.

Many other modifications and variations of the roller drive of the invention will readily suggest themselves to those skilled in the art on the basis of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically disclosed.

What is claimed is:

1. A roller drive comprising, in combination:

(a) a support;

(b) first and second bearing means mounted on said support for movement relative to each other, said bearing means respectively having a first axis and a second axis;

(c) first and second roller means,

(1) each roller means having a journal portion received in said first and second bearing means respectively for rotation about said axes; a contact portion having an exposed contact face about the associated axis; and another portion,

(2) said three portions of each roller means being spaced in the direction of the associated axes, and

(3) said first roller means having a fourth portion axially interposed between said contact portion and said other portion thereof,

(4) said faces of said contact portions moving toward and away from a tape engaging position during said relative movement of said bearing means, said faces being spacedly adjacent each other when in said position thereof;

(d) magnetizable means interposed between said other portions of said roller means to constitute with said roller means a magnetic circuit having a gap between said contact faces;

(e) conductive coil means mounted on said support and covering said fourth position of said first roller means for inducing magnetic flux in said circuit when electric current is passed through said coil means; and

(f) actuating means for actuating rotation of one of said roller means.

2. A drive as set forth in claim **1**, wherein said magnetizable means include a flywheel mounted on said one roller means for rotation therewith about the associated axis, said flywheel having a face portion radially spaced from the last-mentioned axis and adjacent the other portion of the other roller means.

3. A drive as set forth in claim **1**, further comprising yieldably resilient means urging said contact portions to move into a predetermined inoperative position in which said contact faces are farther removed from each other than in said tape engaging position.

4. A roller drive comprising, in combination:

(a) a support;

(b) two bearings on said support having respective axes;

(c) yieldably resilient means engaging one of said bearings for angularly moving said axes relative to each other toward a predetermined position;

(d) two roller means, each roller means having a journal portion received in an associated one of said bearings for rotation about the axis of the receiving bearing, and two axially spaced portions outside said bearing, one of said spaced portions having a contact face about the associated axis in spaced radial alignment with a corresponding contact face on the other roller means when said axes are in said predetermined position, said contact faces defining a gap therebetween;

(e) a coil substantially coaxially covering a portion of one of said roller means axially intermediate said spaced portions thereof, said coil being energizable by electric current to induce magnetic flux in said one roller means;

(f) magnetic circuit closing means interposed between said portions of said two roller means axially spaced from said portions having said contact faces for sequential axial passage of said flux through said roller means between said spaced portions and through said gap; and

(g) actuating means for actuating said rotation of one of said roller means.

5. A drive as set forth in claim **4**, wherein at least said spaced portions of said roller means and the portions thereof axially connecting said spaced portions are of magnetizable material.

6. A roller drive comprising, in combination:

(a) a support;

(b) a first bearing mounted on said support and having a fixed axis;

(c) a second bearing having a second axis and mounted on said support for angular movement of said second axis toward and away from said first axis;

(d) first roller means and second roller means, each roller means having a journal portion received in the corresponding one of said bearings for rotation about the corresponding axis, and a pair of axially terminal portions spaced from said journal portion in opposite axial directions, one member of each pair having a contact face about the associated axis in radial alignment with the contact face on the other roller means, said roller means being of magnetizable material, and said contact faces defining a first gap;

(e) a flywheel of magnetizable material on the other member of said pair of terminal portions of said

first roller means, said flywheel having a radially extending face intersecting said second axis and defining a second gap with the other member of said pair of terminal portions of said second roller means;

(f) a conductive coil substantially coaxially covering an axial portion of one of said roller means intermediate said pair of terminal portions of said one roller means; and

(g) actuating means for actuating rotation of said flywheel about said first axis.

7. A drive as set forth in claim 6, wherein said coil is fixedly mounted on said support, and said one roller means rotatably passes through said coil.

8. A drive as set forth in claim 7, wherein said one roller means is said first roller means.

9. A drive as set forth in claim 7, wherein said one roller means is said second roller means.

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