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DUAL PINCH ROLL ASSEMBLY

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2 Sheets-Sheet 1

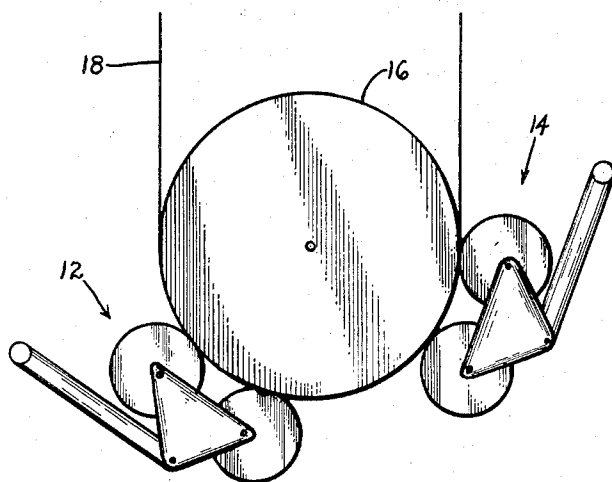


Fig. 1

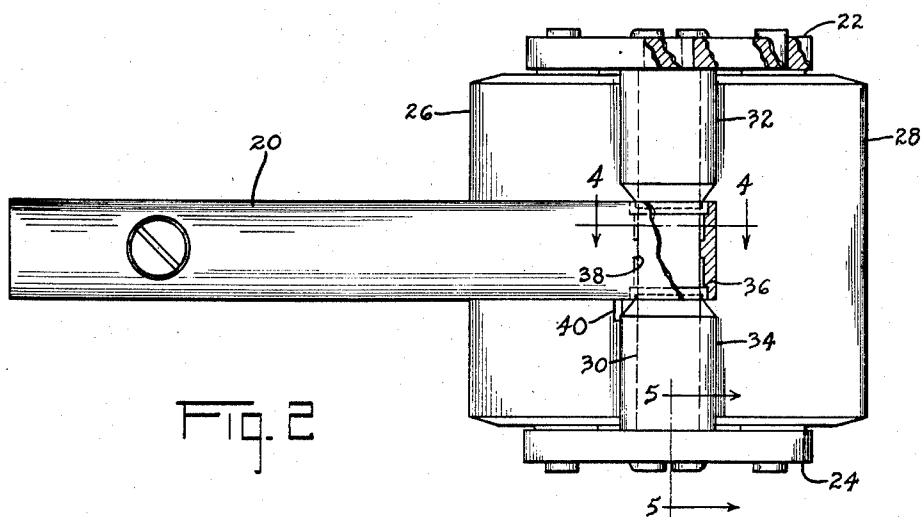


Fig. 2

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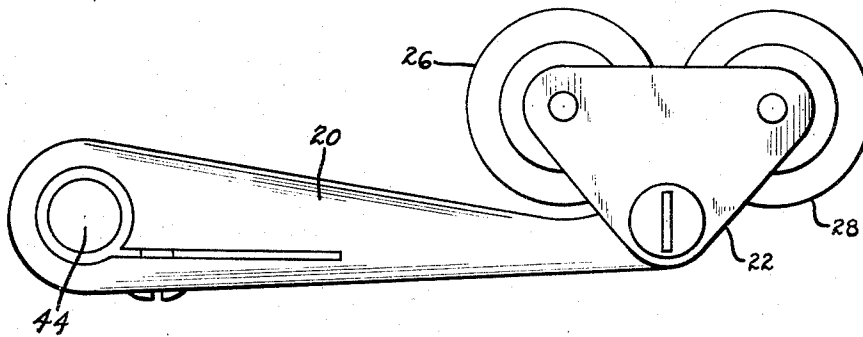


Fig. 3

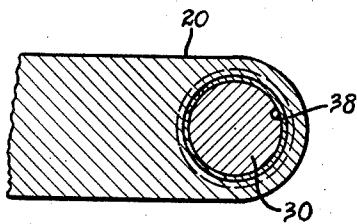


Fig. 4

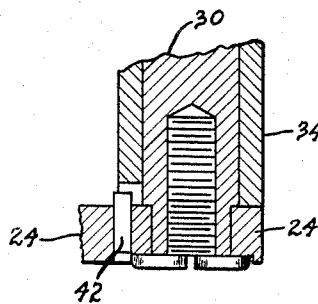


Fig. 5

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DUAL PINCH ROLL ASSEMBLY

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13 Claims. (Cl. 271—2.3)

This invention relates to guide rollers and especially to a self-aligning, pinch-roll assembly.

In the magnetic recording art where electrical signals are recorded on a roll of tape or film, the tape may be driven by a drive roller or capstan. To obtain the uniformity of drive speed and the absence of torsion in the tape which are essential to distortionless recording, clamping guide rollers are employed.

One or more tensioned guide rollers may be located so as to bear against the drive roller, the tape passing between the drive roller and these pinch-rolls.

If the pinch-roll shaft is not absolutely parallel with the drive roller shaft, the tape is subjected to some skewing action as it passes under the pinch-roll. This causes a transverse weave in the tape which results in distortion of the recorded signals. In addition to this, if a number of tapes are being simultaneously driven by the drive roller, the relative velocities of the tapes may vary. This must be prevented, of course, in applications where the tapes are expected to retain synchronism.

The present invention insures axial parallelism between the drive roller and the pinch-roll without the necessity of employing precision-machined rollers and with a minimum of care and adjustment.

The objects and advantages of the present invention are accomplished by mounting a guide roller so that its longitudinal axis is approximately parallel to that of a driving capstan and compensating for any axial alignment disparities by mounting the guide roller so that it has some freedom of motion in all rotational directions relative to a plane passing transversely through the mid-point of its longitudinal axis. In a typical embodiment, a pair of triangular, flat end plates mount posts which extend between two corresponding apices of each triangular plate. Each post rotatably supports a longitudinal roller.

A third post extends between the triangular end plates at the third apex. This post carries a pair of slidable sleeves, one at each end, and passes through an aperture drilled through a support arm which lies between the two sleeves. The support arm is in contact with the third post only along a narrow band or ridge which is located at the center of the encircling aperture.

The third post, and therefore, the guide rollers which are in a fixed positional relation therewith, have rotational freedom about the contacting ridge at the center of the encircling arm.

The freedom of rotational motion of the assembly permits perfect axial alignment of the driving capstan of a tape recorder, for example, and the guide rollers when the guide roller assembly is pressed against the driving capstan by the action of the support arm. The freedom of movement of the roller assembly is limited by various means since only a small amount of freedom of motion is necessary to compensate for imperfect axial alignment.

A primary object of this invention is to insure axial

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parallelism between a drive roller and a second roller which is tensioned to bear against the drive roller.

Another object is to insure such axial parallelism without the need for precision machining of parts and with a minimum of adjustment.

Yet another object is to provide for uniform motion of a number of tapes which are being driven simultaneously by a single drive roller.

A further object is to minimize the type of distortion in a tape recording which is caused by twisting of the tape by the drive assembly.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a schematic representation of the positional relationship of the driving capstan, the tape and a pair of pinch-roll assemblies embodying the present invention,

Fig. 2 is a partially cut away, elevational view of the pinch-roll assembly,

Fig. 3 is a plan view of the pinch-roll assembly,

Fig. 4 is a cross-sectional view of the end of the pinch-roll arm take on line 4—4 of Fig. 2, and

Fig. 5 is a fragmentary cross-sectional view of the lower stop pin, sleeve and third post taken on line 5—5 of Fig. 2.

In Fig. 1, the use of a pair of pinch-roll assemblies 12 and 14, constructed in accordance with the present invention, is illustrated in relation to a driving capstan 16 and a magnetic tape 18, which may comprise components of a magnetic tape recording machine. As is obvious, the relative positions of the pinch-roll assemblies along the periphery of the driving capstan may be shifted to a considerable extent without any detriment to the operation of the recorder.

Referring to Fig. 2, the pinch-roll assembly comprises a support arm 20 and a roller assembly, the latter consisting of a pair of end plates 22 and 24, preferably triangular in shape, and a pair of guide rollers 26 and 28 mounted therebetween.

Each guide roller may be fabricated from a pair of concentric cylindrical tubes which are fastened together, the outer tube being formed from a compressible material having a high coefficient of friction, such as rubber, and the inner tube being formed from a rigid material such as metal.

The guide rollers 26 and 28 are conventionally mounted for rotation as, for example, by posts or tubes (not shown in the drawings) serving as shafts around which the guide rollers may rotate, the tubes being threaded at both ends to admit screws by means of which the tubes may be affixed between and to the end plates.

A third cylindrical post or tube 30 extends between the third apex of each triangular end plate and is affixed thereto by any conventional means as, for example, by means similar to those employed with the pinch-roll posts.

The third post 30 extends through a circular aperture in one end of the support arm 20 and carries a pair of spacer sleeves 32 and 34, each sleeve adjacent a different one of the end plates. The inner end of each sleeve is tapered to fit into the aperture in the end of the support arm, the aperture sides being formed with shoulders, e. g. 36, against which the end of each sleeve rests. The sleeves act as loosely filling spacers to maintain the support arm 20 at the center of the third post 30.

The sides of the support arm aperture are formed with an inwardly extending, narrow central band or ridge 38 and the third post 30 contacts the support arm 20 only along this central band. Since only this one band of con-

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tact exists, the third post 30, and the entire roller assembly, is free to rotate in any direction around a fulcrum point which lies at the junction of the longitudinal axis of the third post and the contact plane. The contact plane is a plane passing through the contact band or ridge 38 transversely to the longitudinal axis of the post 30.

This rotational movement is, of course, eventually limited by contact between the sides of the support arm aperture and the tapered ends of the sleeves 32 and 34. In practice, the amount of such rotational movement which is required for proper functioning of the invention may be quite small.

Rotation of the support arm with respect to the third post 30 as an axis is limited by a pair of stop pins 40 and 42, one of which is affixed to the lower edge of the support arm 20 and the other of which is affixed to the upper edge of the lower end plate 24. The stop pins fit into apertures of somewhat greater width formed in the lower sleeve 34. Thus only a very slight relative movement of the roller assembly with respect to the support arm 20 around the third post 30 as an axis is permitted. The lower stop pin 42 can be seen in the fragmentary cross-section shown in Fig. 5.

In operation, the support arm 20 is mounted so that it rotates about an axis 44 approximately parallel to the driving capstan axis. The support arm 20 can be pivoted about this axis 44 to force the pinch-rolls 26 and 28 against the driving capstan 16, the tape 18 being firmly held between the former and the latter. Any non-parallelism between the rollers and the capstan is compensated for by rotational movement of the roller assembly around the fulcrum point lying in the contact plane passing through the central band 38 of the support arm aperture.

Although it has been found that a dual pinch-roll assembly is preferable, a single pinch-roll may also be satisfactorily employed. Other means of mounting the support arm 20 with respect to the third post 30 so as to obtain a single point of contact may also be employed (e. g., a ball joint mounting).

Obviously many modifications and variations of the present invention are possible in the light 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 described.

We claim:

1. A self-aligning pinch-roll assembly for use with a driving roller comprising, in combination: a roller assembly comprising roller means and means for mounting said roller means for rotation around an axis approximately parallel to the axis of rotation of said driving roller; and means supporting said roller assembly at a single situs, said situs of support lying on a plane passing transversely through the axis of rotation of said roller means at the approximate center of said roller means, said support means adapted to bring said roller means into and out of contact with said driving roller and to permit tilting of said roller means in any direction around said situs of support.

2. A self-aligning pinch-roll assembly for use with a driving roller comprising, in combination: a roller assembly comprising roller means and means for mounting said roller means for rotation around an axis approximately parallel to the axis of rotation of said driving roller; and means supporting said roller assembly comprising shaft means affixed to said means for mounting said roller in such manner that the longitudinal axis of said shaft means is parallel to the axis of rotation of said roller means, a supporting arm and means to maintain said arm at the approximate mid-point of said shaft means, said support means adapted to bring said roller means into and out of contact with said driving means, and said supporting arm formed with an aperture there-through through which said shaft means passes, a plurality of projections on said aperture bounding sides lying in the same plane and extending into said aperture, the

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plane containing the projections constituting the only plane of contact between said arm and said shaft means so that said roller means is permitted to tilt in any direction around a point lying in the contact plane at the approximate center of said projections.

3. A device as set forth in claim 2, wherein said aperture through said supporting arm is circular in cross-section and wherein a line tangent to the extreme tips of said projections would form a circle concentric with the cross-section of said aperture.

4. A device as set forth in claim 3, wherein said means to maintain said arm at the approximate mid-point of said shaft means are a pair of tubular spacers forming concentric sleeves around said shaft means, a different spacer being located on either side of said arm, the end of each spacer nearest said arm being inwardly bevelled so that the spacer extends into the aperture and the bevelled edge of the spacer abuts the confronting edge of the aperture.

5. A self-aligning pinch-roll assembly for use with a driving roller comprising, in combination: a roller assembly comprising roller means and means for mounting said roller means for rotation around an axis approximately parallel to the axis of rotation of said driving roller; and means supporting said roller assembly comprising shaft means affixed to said means for mounting said roller in such manner that the longitudinal axis of said shaft means is parallel to the axis of rotation of said roller means, a supporting arm and means to maintain said arm at the approximate mid-point of said shaft means, said support means adapted to bring said roller means into and out of contact with said driving means, and said supporting arm formed with an aperture there-through through which said shaft means passes, the sides of said aperture being formed with a ridge-like band extending into said aperture along a plane transverse to the axis of said shaft means, said band providing the only contact between said arm and said shaft means so that said roller means is permitted to tilt in any direction around a point lying at the junction of the axis of said shaft means with the plane of contact.

6. A device as set forth in claim 5, wherein the cross-section of said aperture and the locus of the edge of said ridge are circular in shape.

7. A device as set forth in claim 6, wherein said means to maintain said arm at the approximate mid-point of said shaft means are a pair of tubular spacers forming concentric sleeves around said shaft means, a different spacer being located on either side of said arm, the end of each spacer nearest said arm being inwardly bevelled so that the spacer extends into the aperture and the bevelled edge abuts the confronting edge of the aperture.

8. A self-aligning pinch-roll assembly for use with a driving roller comprising, in combination: a supporting arm mounted to pivot at one end about an axis approximately parallel to the axis of rotation of the driving roller, and having an aperture through the other end thereof extending parallel to said pivot axis, a plurality of convexities on said aperture bounding sides lying in a single plane and extending into said aperture; and a guide roller assembly comprising means for mounting a pair of spaced, shaft-like posts with their longitudinal axes approximately parallel to the axis of rotation of the driving roller, roller means rotatably mounted on one said post, and spacing means mounted on said other post, said other post passing through said aperture in said supporting arm and said spacing means mounted so as to maintain said supporting arm in position at the approximate center of said other post, the latter being in contact with said supporting arm only along the plane in which said convexities lie, said plane being transverse to the longitudinal axis of said other post, so that said guide roller assembly is free to rotate about a fulcrum point lying at the junction between the longitudinal axis of said other post and said transverse

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contact plane, such free rotation of the guide roller assembly acting to align the axis of the roller-mounting post in parallel with the driving roller axis when the supporting arm is pivoted to press said roller means against the driving roller.

9. A self-aligning pinch-roll assembly for use with a driving roller comprising, in combination: a supporting arm mounted to pivot at one end about an axis approximately parallel to the axis of rotation of the driving roller, and having an aperture through the other end thereof, the aperture-bounding sides of said supporting arm being formed with an inwardly extending, ridge-like band therearound; and a guide roller assembly comprising means for mounting a pair of spaced, shaft-like posts with their longitudinal axes approximately parallel to the axis of rotation of the driving roller, roller means rotatably mounted on one post, and spacing means mounted on the other post, said other post passing through said aperture in said supporting arm and said spacing means mounted so as to maintain said supporting arm at the approximate center of said other post, said other post being in contact with said supporting arm only along the ridge-like band so that said guide roller assembly is free to rotate about a fulcrum point lying at the junction between the longitudinal axis of said other post and a plane passing transversely through said other post at its region of contact with said ridge-like band, such free rotation of the guide roller assembly acting to align the axis of the post mounting said roller means in parallel with the driving roller axis when the supporting arm is pivoted to press said roller means against the driving roller.

10. A device as set forth in claim 9, wherein said roller means is a cylindrically shaped roller.

11. A device as set forth in claim 9, wherein the cross-section of said aperture through said supporting arm and the locus of the edge of said ridge-like band form concentric circles.

12. A device as set forth in claim 9, wherein said spacing means are a pair of tubular spacers forming concentric sleeves around said other post, a different spacer

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being located on either side of said arm, the end of each spacer nearest said arm being inwardly bevelled so that the spacer extends into the aperture and the bevelled edge of the spacer abuts the confronting edge of the aperture.

13. A self-aligning pinch-roll assembly for use with a driving roller comprising, in combination: a supporting arm having an aperture through one end thereof, the aperture-bounding sides of said arm being formed with an inwardly extending ridge-like band, the locus of the inner end of the ridge being circular in shape; and a guide roller assembly comprising a pair of triangular end plates, a trio of shaft-like posts separating and affixed to said end plates, one at each apex of the correspondingly paralleled triangular plates, a pair of cylindrical rollers, each rotatably mounted on a different one of said posts, the third post passing through the aperture in said supporting arm, a pair of tubular spacers forming concentric sleeves around said third post, a different spacer being mounted on either side of said arm to maintain it at the approximate center of said third post, the end of each said spacer nearest the supporting arm being inwardly beveled so that the spacer extends into the aperture and the bevelled edge of the spacer abuts the confronting edge of the aperture, the guide roller assembly being maintained in such position that the longitudinal axes of said posts are approximately parallel to the rotational axis of said driving roller, said ridge-like band providing a plane of contact which constitutes the only contact between said supporting arm and said third post, so that said guide roller assembly is free to tilt in any direction around a fulcrum point lying at the junction of the longitudinal axis of said third post and a plane transverse to the longitudinal axis of said third post passing through said ridge-like band, said supporting arm being movable to bring said rollers into firm contact with said driving roller.

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