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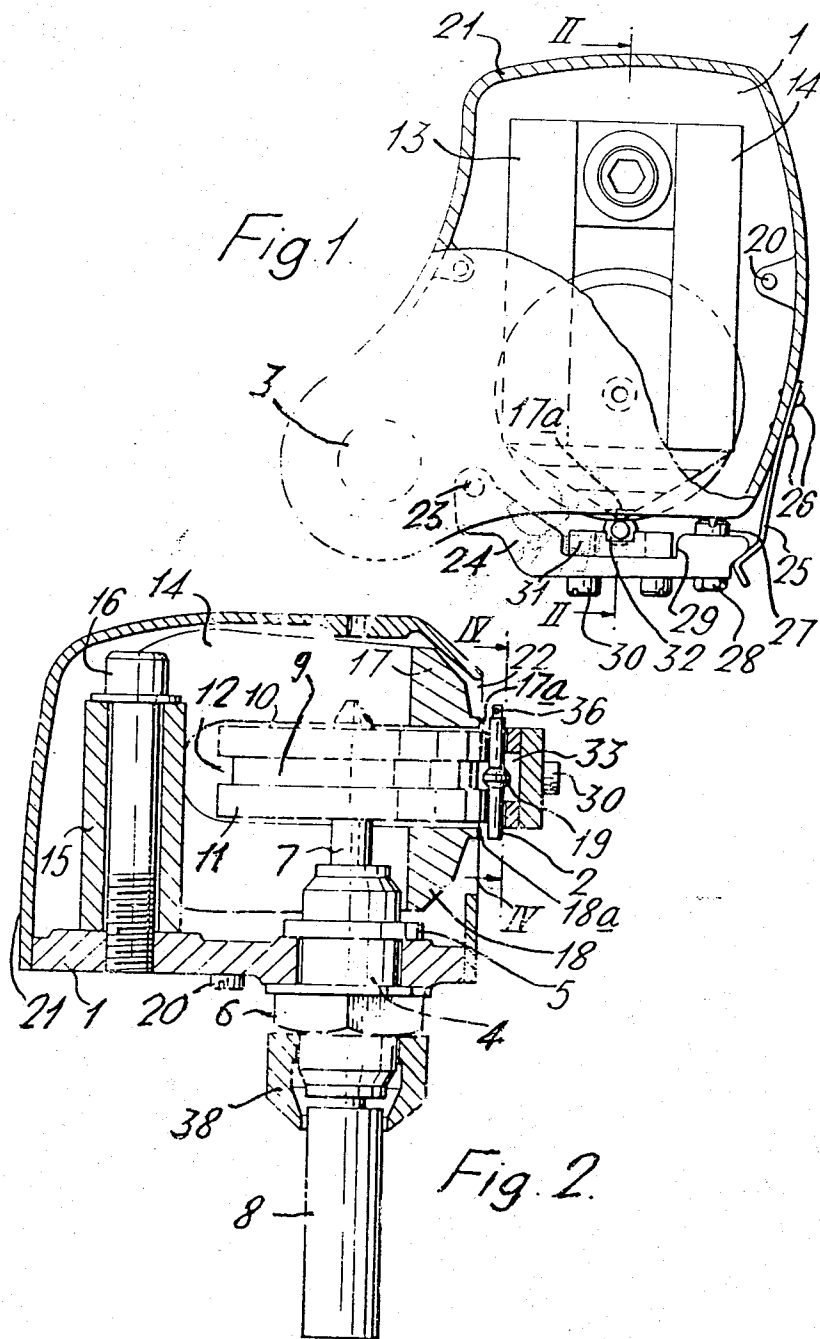
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3,304,706

APPARATUS FOR DRIVING AND SUPPORTING A SPINDLE

Filed June 16, 1965

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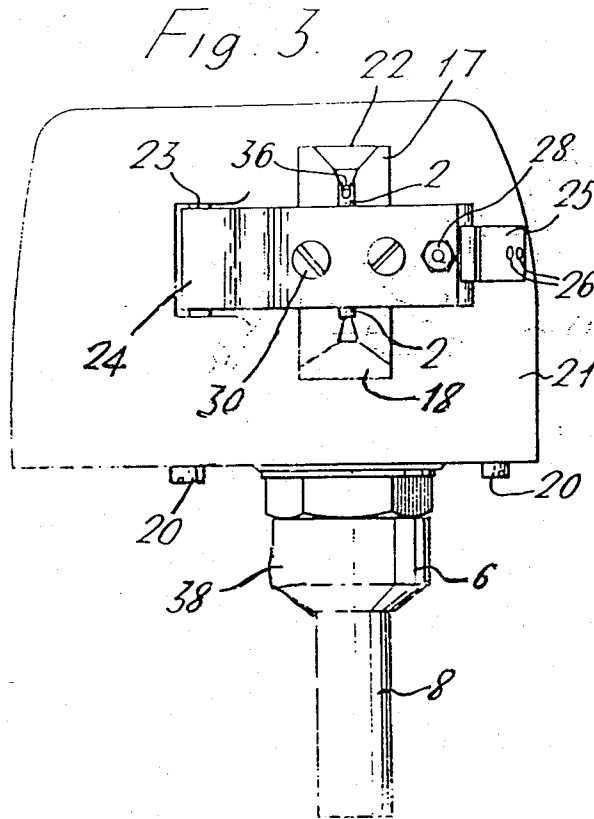
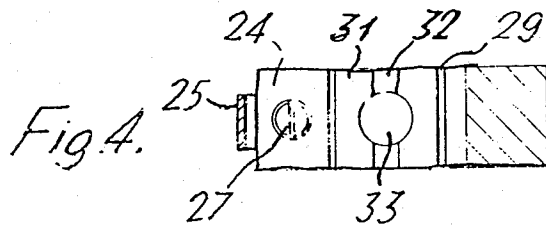
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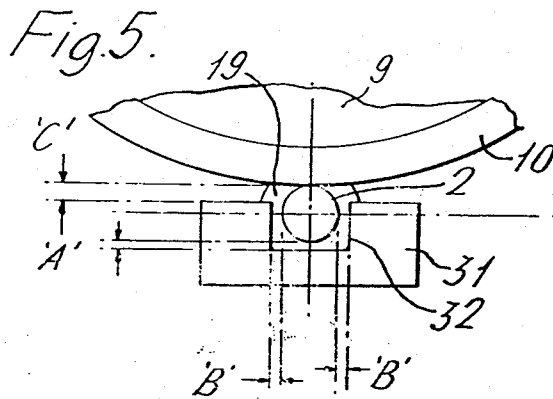
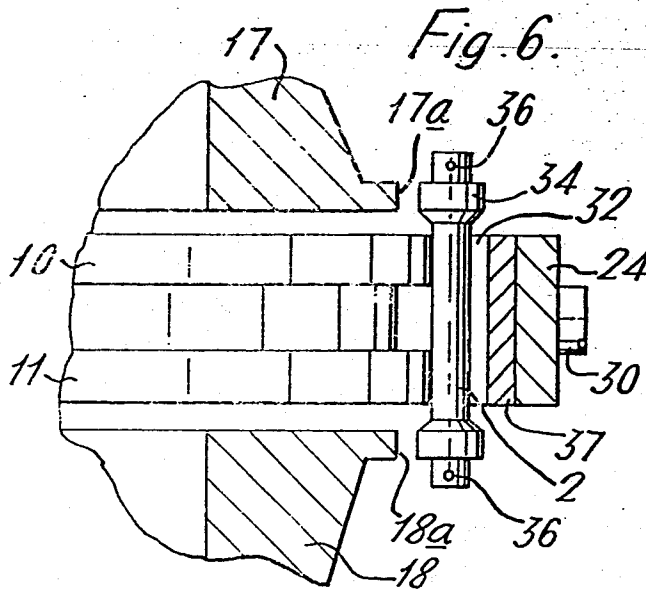
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3 Sheets-Sheet 3



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3,304,706

APPARATUS FOR DRIVING AND SUPPORTING A SPINDLE

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16 Claims. (Cl. 57—77.45)

This invention relates to apparatus for driving and supporting a spindle, and particularly to such apparatus wherein the spindle is rotated at high speed.

According to one aspect of the present invention there is provided an arrangement for transmitting a drive to a spindle comprising transmission means having at least one track for contacting and rotating the spindle, means yieldably urging the spindle into a normal running position whereby the spindle is in driving engagement with said transmission means and a guard having its operative surface or surfaces dimensioned and disposed so that movement of the spindle out of its normal running position is arrested at a position such that said yieldable means returns the spindle into said normal running position. The operative surface or surfaces of the guard can arrest movement of the spindle out of driving engagement with the transmission means and transverse to its normal running position.

The track or tracks can be formed on the periphery of a wheel or wheels. There can be provided two or more wheels arranged co-axially.

The guard can be disposed with its operative surface or surfaces spaced from the spindle when the spindle is in its normal running position. The guard can be adjustable to adjust the distance by which its operative surface or surfaces are spaced from the spindle in its normal running position; the guard can be releasable from its operating position to provide access to the spindle. The operative surface or surfaces of the guard can extend generally parallel with the axis of rotation of the spindle and may extend along the length or lengths of the spindle which are contacted by each track.

The yieldable means can comprise magnetic means and the magnetic means may comprise a permanent magnet the poles of which are spaced apart in the axial direction of the spindle, the magnetic field passing through the spindle and drawing it into contact with the transmission means, a small air gap existing between the spindle and the tips of the pole pieces adjacent the spindle. The magnetic means can comprise a horseshoe magnet or an assembly functioning as a horseshoe magnet.

The distance by which the guard is spaced from the spindle can be a function of the width of the guard in the axial direction of the spindle relative to the distance between the outer edges of the track or tracks, and the size of the air gap between the spindle and the tips of the pole pieces, so as to prevent movement of one end of the spindle effecting movement of the other end of the spindle such as to cause that other end of the spindle to contact the tip of the pole piece adjacent thereto.

The guard can be spaced from the spindle by a distance not more than three times the distance by which the spindle is spaced from the tips of the pole pieces when the spindle is in the normal running position.

The guard can be disposed so as to arrest movement of the spindle in the direction away from the magnetic means at a position where the flux density of the magnetic field is not less than one ninth of the flux density of the magnetic field at the normal running position of the spindle.

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The pole pieces can be tapered to form small tips adjacent the spindle said tips co-operating with the spindle to magnetically restrain or minimise axial movement of the spindle relative to the pole pieces.

The spindle can be a false twist spindle having at least one cross bar around which yarn to be false twisted passes; the spindle can be provided with a cross bar adjacent each end of the spindle.

The operative surface or surfaces can be formed in a pad of suitable material and the pad secured to the guard.

In the case where the yieldable means is magnetic means, the pad, if any, and the guard are preferably formed of a non-magnetic material. The operative surface or surfaces of the guard are formed from a material having a low co-efficient of friction. The operative surface or surfaces of the guard can be formed from cloth reinforced plastic board.

According to another aspect of the present invention there is provided a false twist head comprising transmission means, a rotatable spindle, said spindle being drawn into driving engagement with said transmission means by a magnetic field, and a guard spaced from the spindle and so dimensioned and disposed relative to said spindle as to prevent movement of the spindle away from the transmission means beyond the effective zone of the magnetic field, whereby the spindle is urged into driving engagement with the transmission means by said magnetic field.

According to a further aspect of the present invention there is provided a false twist head comprising magnetic means having two tapered pole pieces, a shaft having at least one wheel mounted thereon, the wheel being disposed between the pole pieces, a false twist spindle magnetically drawn by said magnetic means into contact with the periphery of said wheel such that the axis of rotation of the spindle is substantially parallel to the axis of rotation of the wheel and such that a small air gap exists between the spindle and the pole pieces, co-operating shoulders on the wheel and the spindle for limiting axial movement of said spindle relative to said wheel, a guard and releasable means for retaining the guard in its operative position, the guard being so dimensioned and disposed that when in said operative position it is spaced from said spindle when the spindle is in contact with the periphery of said wheel by a distance such that movement of the spindle away from the wheel beyond the effective zone of the magnetic field is prevented whereby when said spindle is in contact with the guard the spindle is drawn back into contact with the wheel by said magnetic field.

The invention also includes within its scope an apparatus for false twist crimping yarn having an arrangement for transmitting a drive to the spindle, or spindles, substantially as herein described.

By way of example, embodiments of the present invention will now be described with reference to the accompanying diagrammatic drawings in which:

FIGURE 1 is a plan view of a false twist head having part of the cover cut away;

FIGURE 2 is a sectional elevation along the line II—II in FIGURE 1;

FIGURE 3 is a front elevation of the false twist head shown in FIGURES 1 and 2;

FIGURE 4 is a view of the inside of the guard taken along the line IV—IV in FIGURE 2;

FIGURE 5 is a plan view similar to FIGURE 1 on an enlarged scale and showing only a track, a spindle and the pad; and

FIGURE 6 is a sectional elevation similar to FIGURE 2 on an enlarged scale showing an alternative arrangement with some of the transmission members omitted.

Referring to FIGURES 1 to 4, there is a bracket 1 on which the transmission means for driving a false twist spindle 2 is mounted. The bracket has a hole 3 through which it can be bolted or pivoted to the frame of an apparatus (not shown) for false twisting yarn. A bearing 4 passes through and is secured to the bracket 1, the bearing having a flange 5 held against the upper surface of the bracket by a nut 6 tightened against the underside of the bracket 1. A cover 38 protects the bearing in operation. A shaft 7 is rotatably mounted in the bearing 4 which is of a type that prevents axial movement of the shaft relative to the bearing. On one end of the shaft 7 is secured a sleeve 8 of hard wearing synthetic material; on the other end of the shaft 7 is secured a cylindrical cup-shaped member 9 of a light weight non-magnetic alloy to the outside of which are secured two bands 10 and 11 of hard wearing rubber like synthetic material, the bands 10 and 11 being spaced apart to form a groove 12 between them. The parts 1 and 4 to 11 comprise the transmission means.

A pair of powerful horseshoe magnets 13 and 14 are spaced apart by and secured by an adhesive to a non-magnetic support block 15 which is securely mounted on the bracket 1 by means of a set screw 16, the shaft 7 passing between the two magnets 13 and 14, and the cylindrical member 9 substantially filling the space between limbs of the magnets. The magnets are arranged with like poles adjacent, like poles being joined by pole pieces 17 and 18 passing each side of the cylindrical member 9. The pole pieces are identical and tapered as shown to form flats 17a and 18a of short length in the axial direction of the spindle and of narrow width.

The spindle 2 has a small diameter relative to its length and has at its centre a ridge 19 with tapered shoulders, the ridge entering the groove 12 with a small clearance normally between the shoulders of the ridge and the groove, the spindle being engaged on each side of the ridge by the bands 10 and 11 against which it is drawn by the pole pieces 17 and 18 acting magnetically upon the spindle. The lower end of the spindle does not extend beyond the flat 18a and that part of the spindle extending beyond the flat 17a has a slot cut into it and across the slot a sapphire crosspin 36 extends. The portion of the spindle extending beyond the flat 17a, therefore, is substantially reduced in its capacity to pass magnetic flux. The magnetic circuit acting on the ends of the spindle draws the spindle into its operating position in engagement with the bands 10 and 11, axial movement of the spindle being limited by a shoulder on the ridge 19 contacting a side of the groove 12.

Secured to the bracket 1 by screws 20 is a cover 21 having portions cut away at 22 (FIGURE 2) through which the tips of the pole pieces 17a and 18a and the bands 10 and 11 protrude. Pivoted to the cover 21 at 23 is a guard 24 of non-magnetic material, the guard being retained in the operating position as shown by a releasable spring clip 25 secured to the cover 21 by rivets 26. A screw 27 threadably mounted within the guard 24 abuts the cover 21 to provide means for adjusting the position of the guard relative to the bands 10 and 11, the screw 27 being locked in the desired position by a nut 28.

The guard 24 is provided with a recess 29 in which is secured by screws 30 a pad 31 formed of cloth reinforced plastic board; in the pad 31 is a channel or groove 32 (see FIGURE 4) through which the spindle 2 extends, a hole 33 in the pad providing clearance for the ridge 19 on the spindle.

In operation the sleeve 8 is engaged and rotated by a flight of an endless belt (not shown). The cylindrical member 9 and the bands 10 and 11 secured thereto are thereby rotated and these in turn rotate the spindle 2. Due to the large diameter of the member 9 relative to the diameter of both the spindle 2 and the sleeve 8, the spindle is rotated at a speed many times that of the sleeve 8.

When the spindle is in the normal running-position as shown in FIGURE 2 the spindle completes the magnetic circuit between the tips of the pole pieces 17a and 18a a small air gap existing between the tips of the pole pieces and the spindle.

The spindle can thus be rotated at a high speed being held in position against the bands 10 and 11 by the magnetic field of the magnets 13 and 14 concentrated at the tips of the pole pieces. Abnormal axial movement of the spindle is limited by the shoulders of the ridge 19 engaging the sides of the groove 12; the shoulders of the ridge 19 are tapered as shown to reduce the area of the contacting surfaces and hence reduce wear on the surfaces due to the differing speeds at different diameters of these contacting surfaces.

Yarn passes through the hollow spindle 2 passing around the cross bar 36 as is well known in false twisting practice.

As shown in FIGURE 5 the faces of the groove 32 in the pad 31 form the operative surfaces of the guard and are spaced away from the spindle so that under normal running conditions the spindle does not contact the guard. Under abnormal conditions such as a sudden increase in tension in the yarn passing through the spindle or a knot or other irregularity in the yarn, the strength of the magnetic field may be overcome or partially overcome and the spindle moves either out of driving engagement with one or both tracks or transverse to its normal running position. The operative surfaces arrest the movement of the spindle it is still within the effective zone of the magnetic field. Thus, when the cause of the abnormal condition has ended or passed the spindle is drawn back to its normal running position by the magnetic field. When the abnormal condition effective to dislodge the spindle from its running position lasts only for an extremely short period of time, for example an instantaneous increase and decrease in tension, the spindle may bounce or rebound off the guard, this rebound assisting the magnetic field to return the spindle to its normal running position.

In some instances it is possible for the abnormal condition to dislodge only one end of the spindle from its normal running position. When this occurs the operation of the guard is as before, that end of the spindle which has contacted the guard being drawn back into its normal position by the magnetic field. It will be appreciated, however, that movement of one end of the spindle will affect the position of the opposite end of the spindle. Where the movement of one end of the spindle is away from the track, the spindle pivoting about an outer edge of one of the bands, it is preferable that the opposite end of the spindle does not contact the pole piece adjacent the point of pivoting since the wear on either the spindle or the pole piece, or both, would be high. The friction resulting from such contact would also cause the spindle to slow down considerably with consequent slipping between the bands and the spindle. Also, slowing down of the spindle in this way would lead to varying characteristics in the false twisted yarn. The distance A by which the guard is spaced from the spindle is therefore preferably arranged to prevent this condition arising.

The distance B by which the sides of the groove 32 are spaced from the spindle is at least equal to the distance A and preferably twice distance A. A greater clearance is preferable in this transverse direction to allow for small changes in the running position of the spindle without the spindle contacting the guard. Movement of the spindle in this direction does not disengage the spindle from the driving bands.

The distance C between the bands 10 and 11 and the nearest edge of the groove 32 should be less than the diameter of the spindle at that point and preferably less than the radius of the spindle at that point, to prevent the spindle from becoming caught therebetween.

In the embodiment described the pad 31 was formed of copper filled graphite which provided operative surfaces to the groove 31 having a low co-efficient of friction.

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tion, combined with reasonable wearing and strength properties. In this embodiment the spindle was 0.125 inch diameter and 0.937 inch overall length; in the normal running position the spindle was 0.020 inch from the tips of the pole pieces and the bottom of the groove 32 forming an operative surface of the guard was 0.018 inch from the spindle (distance A in FIGURE 5). The length of the guard in the axial direction of the spindle was 0.750 inch; the groove 32 was 0.087 inch deep and was 0.188 inch wide giving a side clearance of 0.032 inch between the spindle and the sides of the groove 32 (distance B in FIGURE 5) and distance C was therefore 0.056 inch. FIGURE 6 shows an alternative arrangement wherein the false twist spindle 2 again has a smaller diameter relative its length but is increased in diameter at two locations along its length to form peripheral flanges 34 and 35 spaced apart to coincide with the spacing apart of the pole pieces. The pole pieces are tapered in the same manner as shown in FIGURES 1 and 2 but the tips are also reduced in length to form flats 17a and 18a corresponding to the axial length of the flanges 34 and 35. The spindle is engaged by the bands 10 and 11, the spindle being drawn against the bands by the pole pieces 17 and 18 magnetically acting through the peripheral flanges of the spindle, the magnetic circuit being completed through the spindle. Axial movement of the spindle is restrained during normal operation by the concentrated magnetic field from the tips 17a and 18a of the pole pieces passing through the peripheral flanges on the spindle, abnormal axial movement being limited by the inner shoulders of the flanges 34 and 35 contacting one of the other of the shoulders at the edge of the bands 10 or 11. The inner shoulders of the flanges may be tapered as shown, a clearance existing between the shoulders and the edges of the bands. In this embodiment the cylindrical member 9 may conveniently be provided with a single track for contacting and rotating the spindle. When the spindle 2 is in the operating position as shown in FIGURE 6, a gap exists between the tips of the pieces 17a and 18a and the peripheral flanges 34 and 35 on the spindle.

The spindle 2 has a cross pin 36 across its bore at each end of the spindle around each of which is passed the yarn to be false twisted.

The guard 24 has a pad 37 secured thereto by screws 30 as before, the groove 32 extending the length of the pad in the axial direction of the spindle.

In operation, a gap exists between the flanges 34 and 35 and the tips of the pole pieces and movement of the spindle out of the normal running position shown in FIGURE 4 is arrested by the operative surfaces formed by the groove 32 in the pad 37. It is again preferable that the operative surfaces of the guard should be spaced from the spindle such as to prevent the ends of the spindle, and in this embodiment the flanges 34 and 35, from contacting tips of the pole pieces at any time.

Apparatus according to this embodiment was constructed having a spindle 0.110 inch diameter with flanges 0.175 inch diameter spaced 0.725 inch apart and equidistant from each end of the spindle, the overall length of the spindle being 1.000 inch. The width of the flanges was 0.060 inch and the width of the tips of the pole pieces corresponded; the flanges were spaced 0.010 inch from the tips of the pole pieces and the guard, 0.750 inch long in the axial direction of the spindle was disposed so that the bottom of the groove 32 was 0.025 inch from the spindle (distance A in FIGURE 5), the groove being 0.087 inch deep and 0.187 inch wide giving a side clearance of 0.038 inch between the spindle and the sides of the groove 32 (distance B in FIGURE 5). Distance C was 0.048 inch.

Apparatus constructed according to each of the embodiments has proved capable of operating at speeds of the spindle 2 of 300,000 r.p.m. to 600,000 r.p.m. or more when false twisting yarn, the spindle being arrested by

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the guard and returned to its normal running position by the magnetic means whenever it was dislodged therefrom.

What is claimed is:

1. Apparatus for transmitting a drive to a spindle comprising transmission means having at least one track for contacting and rotating the spindle, supporting means yieldably urging the spindle into a normal running position in driving engagement with the transmission means, and guard means having operative surfaces dimensioned and disposed to arrest movement of the spindle out of said normal running position at a position where the yieldable supporting means returns the spindle into said normal running position.
2. Apparatus according to claim 1 in which the guard means is provided with an operative surface in a plane substantially parallel with the plane of the tangent to the spindle at its line of contact with the transmission means, which surface arrests movement of the spindle out of driving engagement with the transmission means.
3. Apparatus according to claim 2 in which the guard means is provided with at least one operative surface in a plane transverse to the plane of the tangent to the spindle at its line of contact with the transmission means to arrest movement of the spindle transverse to its normal running position.
4. Apparatus according to claim 3 including releasable means to retain the guard means in its operating position, said releasable means being releasable to provide access to the spindle.
5. Apparatus according to claim 4 in which the yieldable supporting means comprise magnetic means.
6. Apparatus according to claim 5 in which the magnetic means comprises permanent magnet means having poles, said poles having tips spaced apart in the axial direction of the spindle, the magnetic field passing through the spindle and drawing it into driving engagement with the transmission means, a small air gap existing between the tips of the poles and the spindle.
7. Apparatus according to claim 6 in which the distance by which the guard means is spaced from the spindle when the spindle is in the normal running position is related to the width of the guard means in the axial direction of the spindle relative to the distance between the outer edges of the track means driving the spindle, and the size of the air gap between the spindle and the tips of the poles, so as to prevent movement of one end of the spindle effecting movement of the opposite end of the spindle such that said opposite end contacts the tip of the pole adjacent thereto.
8. Apparatus for transmitting a drive to a spindle comprising transmission means having at least one wheel, track means formed of the periphery of said wheel, magnetic means having pole pieces for drawing the spindle into driving engagement with the track means in which position the spindle is spaced from the tips of the pole pieces of the magnetic means, guard means having an operative surface formed thereon and disposed so that the operative surface is spaced from said spindle when the spindle is in driving engagement with the track means by a distance not more than three times said distance by which the spindle is spaced from the tips of the pole pieces.
9. Apparatus according to claim 8 in which the guard means is provided with adjustable means to vary the distance by which the operative surface of the guard means is spaced from the spindle.
10. Apparatus according to claim 9 in which the operative surface of the guard means extends generally parallel with the axis of rotation of the spindle.
11. Apparatus according to claim 10 in which the operative surface of the guard means extends along the length of the spindle which is contacted by the track means.
12. Apparatus for transmitting a drive to a spindle comprising track means rotatable about a single axis,

magnetic means provided with pole pieces spaced apart so that the pole pieces draw the spindle into its normal running position in driving engagement with track means, the pole pieces being adjacent the ends of the spindle and a small air gap existing between the spindle and the pole pieces, guard means spaced from the spindle and having at least one operative surface formed thereon to arrest movement of the spindle out of driving engagement with the track means in a direction away from the magnetic means, said surface being disposed away from the magnetic means at a position where the flux density is not less than one ninth of the flux density at the normal running position of the spindle.

13. Apparatus according to claim 12 in which the guard means is formed from non-magnetic material.

14. Apparatus according to claim 13 in which the guard means includes a pad of cloth reinforced plastic board in which the operative surfaces are formed by a slot.

15. A false twist head comprising transmission means, a rotatable spindle, means providing a magnetic field to draw said spindle normally into driving engagement with said transmission means, and guard means spaced from the spindle and so dimensioned and disposed relative to said spindle as to prevent movement of the spindle away from the transmission means beyond the effective zone of the magnetic field in response to an abnormal condition so that thereafter the spindle is urged back into driving engagement with the transmission means by said magnetic field.

16. A false twist head comprising magnetic means having two tapered pole pieces, a shaft having at least one wheel mounted thereon, the wheel being disposed between the pole pieces, false twist spindle means normally magnetically drawn by said magnetic means into con-

tact with the periphery of said wheel such that the axis of rotation of the spindle means is substantially parallel to the axis of rotation of the wheel and such that a small air gap exists between the spindle means and the pole pieces, co-operating shoulders on the wheel and the spindle means for limiting axial movement of said spindle means relative to said wheel, a guard means and releasable means for retaining the guard means in its operative position, the guard means being so dimensioned and disposed that when in said operative position it is spaced from said spindle means when the spindle means is in contact with the periphery of said wheel by a distance such that movement of the spindle means away from the wheel beyond the effective zone of the magnetic field is prevented by contact of said guard means with said spindle means so that the spindle means thereafter is drawn back into contact with the wheel by said magnetic field.

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