Dec. 5, 1967 D. A. E. MATTINGLY 3,355,870

DRIVING TRANSMISSIONS FOR HIGH SPEED ROTARY SPINDLES

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FIG. 1.

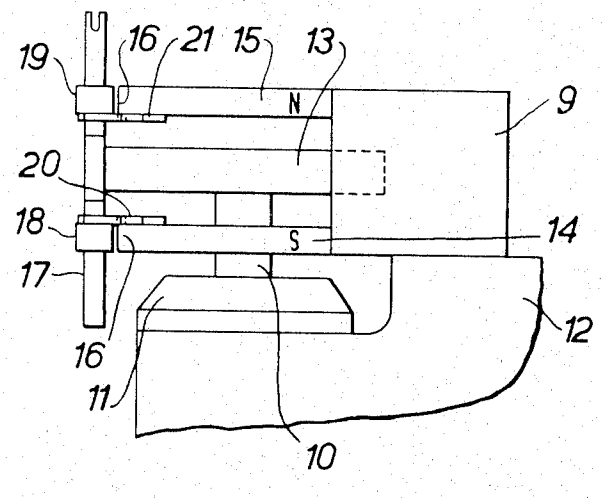
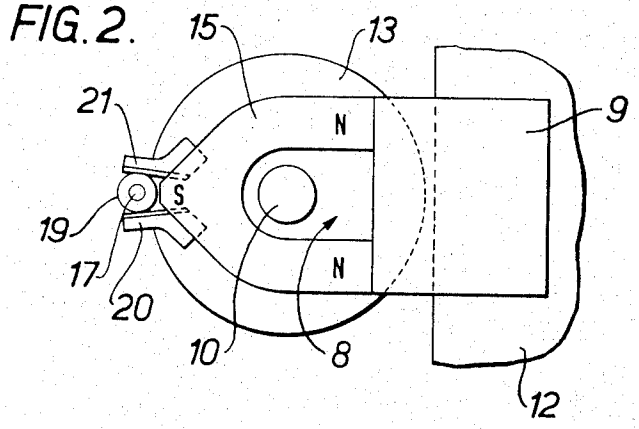


FIG. 2.



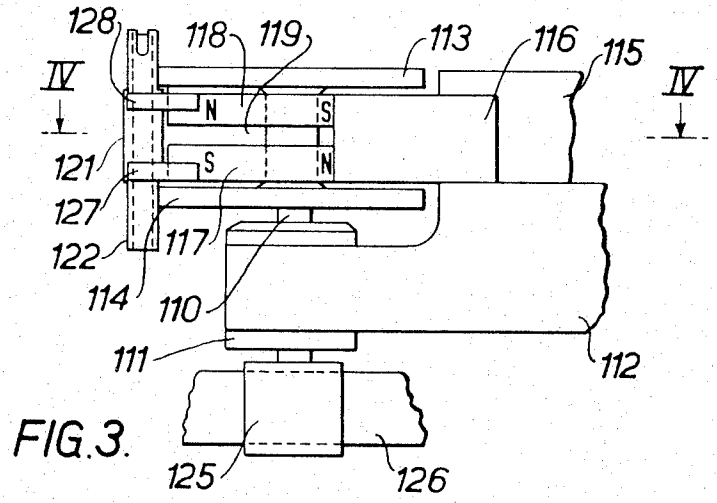


FIG.3.

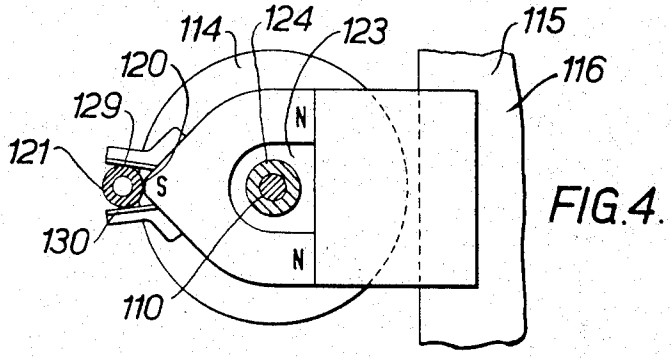
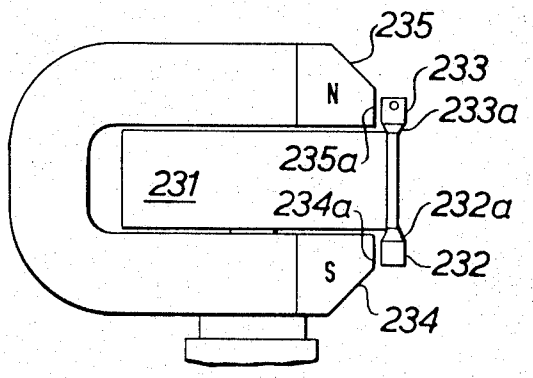


FIG.4.

FIG.8.



DRIVING TRANSMISSIONS FOR HIGH SPEED ROTARY SPINDLES

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FIG. 5.

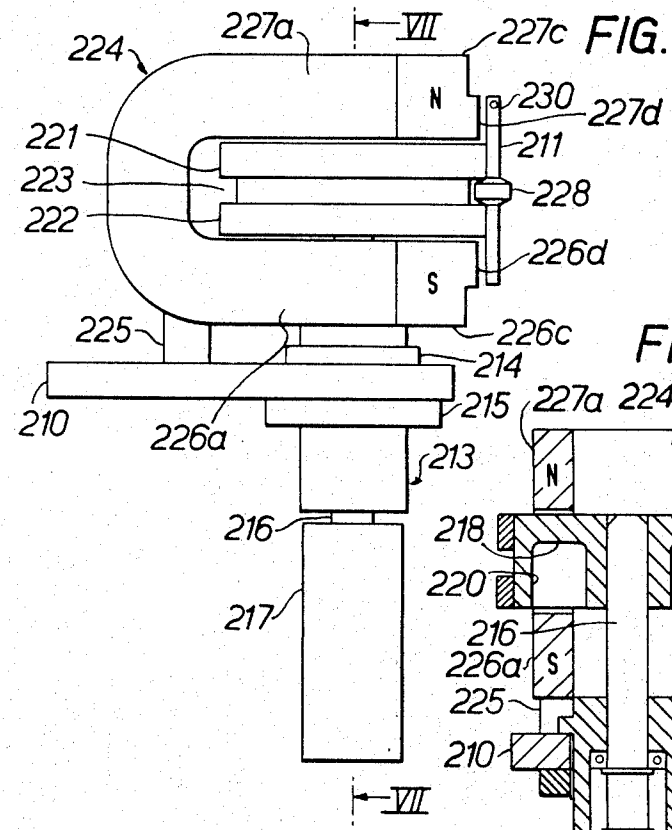


FIG. 7.

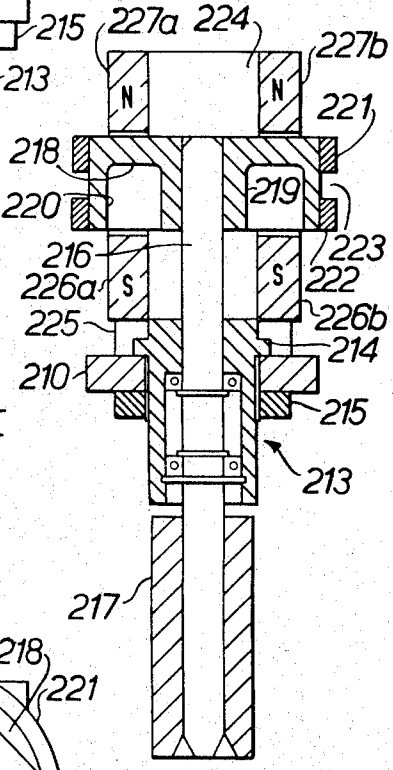
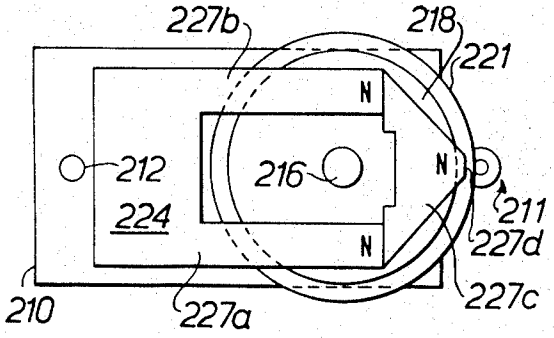


FIG. 6.



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DRIVING TRANSMISSIONS FOR HIGH SPEED ROTARY SPINDLES

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20 Claims. (Cl. 57—77.45)

This invention relates to a device for use in false twisting apparatus whereby a false twist spindle can be rotated at high speed.

A spindle for false twisting yarn can be driven in the nip of a pair of wheels having parallel spaced apart axes. With such an arrangement the spindle can be held in said nip by a magnet. However, such as arrangement has the advantage that the direction of rotation of the spindle cannot readily be reversed, and in order to allow said direction of rotation to be reversed it is desirable to have an arrangement whereby either wheel can be separately driven by external driving means, the wheel to be driven depending upon the direction required for the rotation of the spindle.

The present invention is concerned with providing a device for supporting and rotating a false twist spindle whereby, among other things, the above disadvantage can be eliminated and the false twist spindle can readily be rotated in either direction.

The present invention is also concerned with providing a device for enabling a false twist spindle to be rotated at a very high speed, for example at over 180,000 revolutions per minute, and with suitable constructions at speeds over 350,000 revolutions per minute. As will be understood from the examples described later, such very high speeds can be obtained with some constructions according to the present invention which are both simple and robust and which represent a substantial improvement in false twist devices.

According to one aspect of the present invention there is provided for use in false twist apparatus, a device for supporting and rotating a false twist spindle for imparting false twist to yarn, said device comprising track means for contacting and rotating the false twist spindle, magnetic means having at least two pole pieces spaced apart in the general direction of the axis of the false twist spindle, the track means being rotatable about a single axis substantially parallel to the axis of rotation of the false twist spindle and the track means protruding a small distance beyond the pole pieces to space the false twist spindle a small distance from the pole pieces, the pole pieces magnetically acting upon the parts of the false twist spindle opposite them to draw the false twist spindle against the track means and hold the false twist spindle in that position, the track means being disposed relative to the pole pieces so that the track means does not pass through the small gaps between the pole pieces and the parts of the false twist spindle opposite the pole pieces.

The small gaps between the pole pieces and the parts of the false twist spindle opposite the pole pieces are preferably of the order of 0.03 inch or less, and for vary high speeds can advantageously be in the range 0.02 to 0.01 inch.

Said track means can comprise a wheel member disposed between the pole pieces. Said track means can comprise two wheels disposed between the pole pieces, the two wheels being mounted on a common shaft.

In one arrangement said track means can comprise at least two wheels mounted on a common shaft with the pole pieces disposed between the two wheels.

Said track means when mounted on a single shaft can have the shaft rotatably supported in a single bearing. With this arrangement the shaft can pass through the bearing and have the track means mounted on a portion of the shaft on on side of the bearing and have a portion of the shaft on the other side of the bearing adapted to be driven by a belt of a false twist apparatus.

The false twist spindle can have one or more shoulders adapted to be capable of engaging one or more shoulders of said track means to limit axial movement of the false twist spindle should the false twist spindle be inadvertently displaced axially.

The false twist spindle can be formed with a collar opposite each pole piece.

The magnetic means can be in the form of a horseshoe magnet arrangement with a hole through at least one limb of the horseshoe magnet arrangement with a shaft for driving said track means passing through the hole.

According to another aspect of the present invention there is provided a device for supporting and rotating a false twist spindle, said device comprising a wheel member mounted on a rotatable shaft, a horseshoe magnet arrangement having two limbs each ending in a pole piece, the wheel member being disposed between said two limbs and having its periphery protruding slightly beyond said pole pieces which are arranged apart in a direction substantially parallel to the axis of rotation of said wheel member, the pole pieces magnetically acting upon the false twist spindle on opposite sides of said wheel member to draw the false twist spindle against said wheel member and hold the false twist spindle in that position with a small gap between each pole piece and the part of the spindle opposite it.

According to yet another aspect of the present invention there is provided a device for supporting and rotating a false twist spindle, said device comprising a wheel member mounted on a rotatable shaft, a magnetic means having two pole pieces spaced apart in a direction substantially parallel to the axis of rotation of said wheel member, said wheel member being disposed between them, the pole pieces magnetically acting upon the false twist spindle on opposite sides of said wheel member to draw the false twist spindle against said wheel member and hold the false twist spindle in that position with a small gap between each pole piece and the part of the spindle opposite it, said wheel member having a groove around its periphery and the false twist spindle having a ridge intermediate its length which ridge protrudes into said groove.

The present invention also contemplates a false twist apparatus incorporating a plurality of devices as described above, particularly an arrangement where a number of such devices are arranged to be capable of being simultaneously driven by a driving belt of the false twist apparatus.

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

FIGURE 1 is a side elevation of one embodiment;

FIGURE 2 is a plan view on a larger scale of the embodiment shown in FIGURE 1;

FIGURE 3 is a side elevation of another embodiment;

FIGURE 4 is a section on the line IV—IV in FIGURE 3;

FIGURE 5 is an elevation of a further embodiment;

FIGURE 6 is a top plan view of the embodiment in FIGURE 5;

FIGURE 7 is a section on the line VII—VII in FIGURE 5; and

FIGURE 8 is part of an elevation similar to FIGURE 5 of yet another embodiment.

Referring to the embodiment shown in FIGURES 1 and 2, a driving shaft **10** is mounted in a fixed bearing

11 carried by a bracket 12. The driving shaft may either constitute the shaft of an electric motor or may have fixed to it a pulley (not shown) which is engaged by a driving belt. The shaft also has fixed to it a driving wheel 13 which may be formed from hard rubber or a rubber-like plastics material such as polyurethane.

The driving wheel 13 is disposed between two separately formed permanent magnet plates 14, 15 which are secured to a soft iron separator 9. The parts of the plates which engage the separator are of opposite polarity. The plates 14, 15 and the separator 9 form a horseshoe magnet arrangement.

As will be seen from FIGURE 2 the part of each plate which extends away from the separator tapers to a comparatively narrow pole face 16. At least the lower magnet plate 14 is formed with a slot or hole 8 through which the driving shaft 10 extends to the driving wheel 13 disposed between the two magnet plates 14 and 15.

The wheel 13 engages a part of a hollow false twist spindle 17 between two collars 18 and 19. The collars are circular and are of such a diameter that when the spindle is in engagement with the driving wheel 13 (forming said track means) there is a small air gap between them and the pole pieces 16 of the magnetic means.

This arrangement of the magnet and spindle, which forms an armature, tends to hold the spindle in one position regardless of the direction of rotation of the wheel 13. However, in order to safeguard against and so limit any possible wander around the axis of the driving wheel of the spindle and also to limit any inadvertent up or down movement of the spindle, two locators 20, 21 of tungsten carbide can be mounted on the magnet plates as shown in FIGURES 1 and 2.

Referring to the embodiment shown in FIGURES 3 and 4, a driving shaft 110 is mounted in a bearing 111 on a fixed part 112 of the apparatus, and which driving shaft has secured thereto two wheels 113, 114 which may be formed from hard rubber or rubber-like plastics such as polyurethane. Secured also to the part 112 by means of a suitable clamp 115 is a block 116 of soft iron which extends between the two wheels 113 and 114 and has secured thereto two permanent magnets 117, 118, those parts of which that engage the block 116 being of opposite polarity.

The parts of the magnet extending away from the block are separated by an air gap 119 and each of them as viewed in plan tapers to provide a comparatively narrow pole face 120 opposite an enlarged portion 121 on the hollow false twist spindle 122. Each of the magnet parts as viewed in plan is formed with a slot or hole 123 through which extends a hub portion 124 fixed to the spindle 110 and to which hub portion are secured the wheels 113, 114.

The spindle 110 has secured to it a pulley 125 which is driven by a belt 126 of a false twist apparatus, the belt 126 being arranged to similarly drive a plurality of such spindles 110.

With this arrangement, although the magnetic field produced by the magnet system will tend to maintain the spindle in a fixed position, safety locators 127, 128 may, if desired, be secured to the two magnet portions 117 and 118, respectively. Such locators can have portions 129, 130 disposed on opposite sides of the spindle so as to limit any possible wander of the spindle circumferentially.

The two axially spaced wheels 113, 114 overlap the shoulders of the enlarged armature portion 121 of the false twist spindle 122 so that should the spindle 122 be inadvertently moved axially, for example due to a knot in the yarn passing through the spindle, then any such axial movement will be limited.

In the embodiment of the invention shown in FIGURES 5 to 7 there is a bracket 210 on which the device for supporting and driving a false twist spindle 211 is mounted. The bracket has a hole 212 through which it can be bolted or pivoted to the frame of an apparatus (not shown) for false twisting yarn, such as the false twist apparatus described in British patent specification No. 788,944 or No. 908,111, this embodiment shown in FIGURES 5 to 7 then taking the place of each false twist head shown in these apparatuses. A bearing 213 passes through and is secured to the bracket 210, the bearing having a flange 214 held against the upper surface of the bracket by a nut 215 tightened against the underside of the bracket. A shaft 216 is rotatably mounted in the bearing 213 which is of a type that prevents axial movement of the shaft 216 relative to the bearing. On the lower end of the shaft 216 is secured a sleeve 217 of hard wearing synthetic material. On the upper end of the shaft 216 is secured an inverted cup shaped member 218 of a light weight non-magnetic alloy, the member 218 having an internal boss 219 (see FIGURE 7) in which the upper end of the shaft 216 is non-rotatably secured. The member 218 has a cylindrical part 220 on the outside of which are secured two bands 221, 222 of hard wearing rubber-like synthetic material. The bands 221, 222 are spaced apart so that there is a groove 223 between them.

A powerful horseshoe magnet 224 is securely mounted on the bracket 210 by means of a support 225 and the upper part of the bearing 213. The lower limb of the magnet is in the form of two fingers 226*a*, 226*b* to enable the shaft 216 to pass between them. For symmetry, the upper limb of the magnet is in the form of similar fingers 227*a*, 227*b*. The fingers 226*a*, 226*b* are connected by a South pole piece 226*c*, and the fingers 227*a*, 227*b* are connected by a North pole piece 227*c*. Both pole pieces are identical and taper, as shown in FIGURE 2, to a very narrow flat 226*d*, 227*d* which is stepped down to approximately half the thickness of the respective pole piece, as shown in FIGURE 5.

The cylindrical part 220 with the bands 221, 222 thereon is disposed between the limbs, and also the pole pieces 226*c*, 227*c*, of the magnet and almost fills the space between the limbs, as shown in FIGURES 5 and 7.

The spindle 211 has a small diameter relative to its length and at its centre has a ridge 228 with slightly tapered shoulders so that the ridge decreases in axial length as it protrudes outwards. The ridge 228 engages in the groove 223 with a small clearance between the shoulders of the ridge and the sides of the groove. The spindle is engaged by the bands 221, 222 on each side of the ridge 228, the spindle being drawn against the bands by the pole pieces 226*c*, 227*c* magnetically acting upon the ends of the spindle, the magnetic circuit being completed through the spindle. The ends of the spindle finish half way across the pole pieces; as shown in FIGURE 5 the ends of the spindle do not protrude past the stepped down portions 226*d*, 227*d* of the pole pieces. The diameter of the ends of the spindle is approximately equal to the narrow flat at the tip 226*d*, 227*d* of each tapered pole piece, as shown in FIGURE 6.

In operation, the sleeve 217 is engaged and rotated by a flight of a moving endless belt (not shown). The bands 221, 222 are thereby rotated and these in turn rotate the spindle 11. Due to the large diameter of the bands 221, 222 relative to the diameter of the spindle 211, the spindle 211 is rotated at a rate many times that of the sleeve 17, for example at least 8 times or even more than 25 times. The spindle can thus be rotated at a high speed, but is held in position by the magnetic fields concentrated at the narrow tips 226*d*, 227*d* of the pole pieces acting upon the ends of the spindle. This concentration of strong magnetic fields at the narrow tips 226*d*, 227*d* prevents the spindle from moving away from its desired axis of rotation, no other retaining means being essential. Should the spindle 211 be inadvertently displaced axially, then axial movement of the spindle 211 is limited by a shoulder of the ridge 228 contacting one or other of the shoulders formed by the sides of the groove 223. Due to the slight taper of each shoulder of the ridge 228 away from the corresponding side of the groove 223, the shoulders on the ridge 228 will only contact small portions of the ex-

tremity of the sides of the groove so that the parts that contact will be moving at approximately the same peripheral speed.

It will be noticed that during rotation of the spindle **211**, a small air gap exists between the tip of each pole piece and the corresponding end of the spindle, as best seen in FIGURE 5, and no moving part passes through these air gaps.

When yarn is to be false twisted it is drawn upwards or downwards through the bore in the spindle **211**, the yarn passing once or more around the sapphire pin **230** across the upper end of said bore. The sleeve **217** can be rotated in either direction depending upon which direction it is desired to twist the yarn.

In the above embodiment, the diameter of the bands **221, 222** was 2 inches, the diameter of the spindle **211** was 0.125 inch, the diameter of the ridge **228** was 0.25 inch, the length of the spindle **211** was 1.125 inches, and the small air gap between each pole piece and the corresponding end of the spindle was 0.03 inch. The spindle was made of low carbon steel having a high magnetic permeability. The bands **221, 222** were made of polyurethane elastomer.

In this embodiment, the bands **221, 222** can be viewed either as two axially spaced apart wheels, or, considering the cylinder **220**, as one wheel having a groove therein.

With this embodiment, the spindle **211** was rotated at very high speeds from 400,000 to 600,000 revolutions per minute.

FIGURE 8 shows another embodiment which is similar to that shown in FIGURES 5 to 7, and only the differences to the embodiment in FIGURES 5 to 7 will be described.

The inverted cup shaped member mounted on the rotatable shaft is encircled by a single band **231** of hard wearing synthetic material. The spindle has an enlargement **232, 233** at each end, each enlargement being opposite the narrow tip of the corresponding tapered pole piece and spaced therefrom by a small air gap. The inner shoulders **232*a*, 233*a***, of the enlargements are tapered as shown and the band **231** engages substantially the whole length of the spindle between the shoulders **232*a*, 233*a***.

What I claim is:

1. Transmission means for supporting and rotating a false twist spindle for use in false twisting yarn, said transmission means comprising track means for contacting and rotating the spindle, magnetic means for drawing the spindle into contact with the track means, said magnetic means having two limb portions which end in pole pieces, each limb portion having two fingers connected by the appropriate pole piece, the fingers being spaced apart in a direction perpendicular to the axis of the spindle and forming a part of a permanent magnet system, the pole pieces being spaced apart with the track means passing between them and a shaft for supporting the track means passing through the space between the fingers of at least one limb portion.

2. A device as claimed in claim **1** in which said track means comprises a wheel member disposed between the pole pieces.

3. A device according to claim **2**, said wheel member being in the form of a cup shaped member having a cylindrical portion and a base portion and including a boss carried by said base portion for mounting said wheel for rotation and said wheel having a track disposed on said cylindrical portion, and the outer extremities of the track in the axial direction of the spindle being arranged to contact the spindle axially inward of and adjacent said tips of the pole pieces.

4. A device as claimed in claim **1** in which said track means comprises two wheels disposed between the pole pieces, the two wheels being mounted on a common shaft.

5. A device as claimed in claim **1** in which said track means comprises at least two wheels mounted on a common shaft and the pole pieces are disposed between the two wheels.

6. A device as claimed in claim **1**, wherein said track means comprise a wheel member having a groove around its periphery, the false twist spindle having a ridge intermediate its length which ridge protrudes into said groove.

7. A device according to claim **1**, including means depending from said pole pieces for locating said spindle and for preventing axial and lateral displacement thereof.

8. A device according to claim **7** wherein said spindle includes collars adjacent its ends and said locating means extends from each pole piece between said collars.

9. For use in false twist apparatus, a device for supporting and rotating a false twist spindle for imparting false twist to yarn, said device comprising a rotatable magnetizable spindle, a rotating member having peripheral surface means extending generally perpendicularly to the general plane of said rotating member for frictionally engaging a portion of said spindle for rotating the same, magnetic means for retaining said spindle in relative oriented and driving engagement with said surface means, said magnetic means surrounding the axis of rotation of said rotating element and extending toward said spindle, means for supporting said rotating member and said magnetic means about the axis of rotation of said rotating member, said magnetic means comprising magnetic flux-directing portions terminating adjacent said spindle and being reduced in size in planes perpendicular to and passing through the axis of said spindle to form small tips lying in a plane common with the axis of rotation of said track means and said spindle.

10. The device of claim **9** wherein said magnetic flux-directing portions comprise pole pieces spaced apart in the general direction of the axis of said rotating member, said rotating member being disposed between the pole pieces and protruding slightly beyond the pole pieces.

11. A device as claimed in claim **10**, said wheel member being in the form of a cup shaped member having a cylindrical portion and a base portion and including a boss carried by said base portion for mounting said wheel for rotation and said wheel having a track disposed on said cylindrical portion, and the outer extremities of the track in the axial direction of the spindle being arranged to contact the spindle axially inward of and adjacent said tips of the pole pieces.

12. A device according to claim **11**, in which said track for contacting the spindle comprises two annular bands axially spaced apart along the cylindrical portion of cup, and in which the spindle has a ridge adapted to protrude into the gap between said two annular bands.

13. A device according to claim **11**, in which said cup shaped member is thin walled and is formed of a lightweight non-magnetic alloy.

14. A device according to claim **11**, in which said cup shaped member is disposed in an inverted position.

15. The device according to claim **10** wherein said spindle includes collars adjacent its ends and said locating ends extend from each pole piece between said collars.

16. For use in false twist apparatus, a device for supporting and rotating a false twist spindle for imparting false twist to yarn, said device comprising a rotatable magnetizable spindle, a rotating member having peripheral surface means extending generally perpendicularly to the general plane of said rotating member for frictionally engaging a portion of said spindle for rotating the same, magnetic means for retaining said spindle in relative oriented and driving engagement with said surface means, said magnetic means surrounding the axis of rotation of said rotating element and extending toward said spindle, means for supporting said rotating member and said magnetic means about the axis of rotation of said rotating member, said magnetic means comprising magnetic flux-directing portions terminating adjacent said spindle, said rotating member comprising

a wheel in the form of a cup-shaped member having a cylindrical portion and a base and including a boss carried by said base portion for mounting said wheel for rotation, and said wheel having a track disposed on said cylindrical portion, the outer extremities of the track in the axial direction of the spindle being arranged to contact the spindle axially inward of and adjacent said magnetic flux-directing portions.

17. A device according to claim **16**, in which said track for contacting the spindle comprises two annular bands axially spaced apart along the cylindrical portion of said cup, and in which the spindle has a ridge adapted to protrude into the gap between said two annular bands.

18. A device according to claim **16**, in when said cup-shaped member is thin walled and is formed of a light-weight non-magnetic alloy.

19. A device according to claim **16**, in which said cup-shaped member is disposed in an inverted position.

20. For use in false twist apparatus, a device for supporting and rotating a false twist spindle for imparting false twist to yarn, said device comprising a rotatable magnetizable spindle, a rotating member having peripheral surface means extending generally perpendicularly to the general plane of said rotating member for frictionally engaging a portion of said spindle for rotating the same, magnetic means for retaining said spindle in relative oriented and driving engagement with said surface means, said magnetic means surrounding the axis of rotation of said rotating element and extending toward said spindle, means for supporting said rotating member and said magnetic means about the axis of rotation of said rotating member, said magnetic means comprising magnetic flux directing portions terminating adjacent said spindle, and means depending from said pole pieces for locating said spindle and for preventing axial and radial displacement thereof.

References Cited

UNITED STATES PATENTS

3,058,289	10/1962	Raschle	57—77.3
3,059,408	10/1962	Hippe et al.	57—77.46
3,115,743	12/1963	Brodtmann	57—77.45
3,142,953	8/1964	Gassner et al.	57—77.45
3,232,037	2/1966	Crouzet	57—77.45

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