Oct. 1, 1968 D. A. E. MATTINGLY 3,403,566

MEANS FOR DRIVING SPINDLES

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FIG.1.

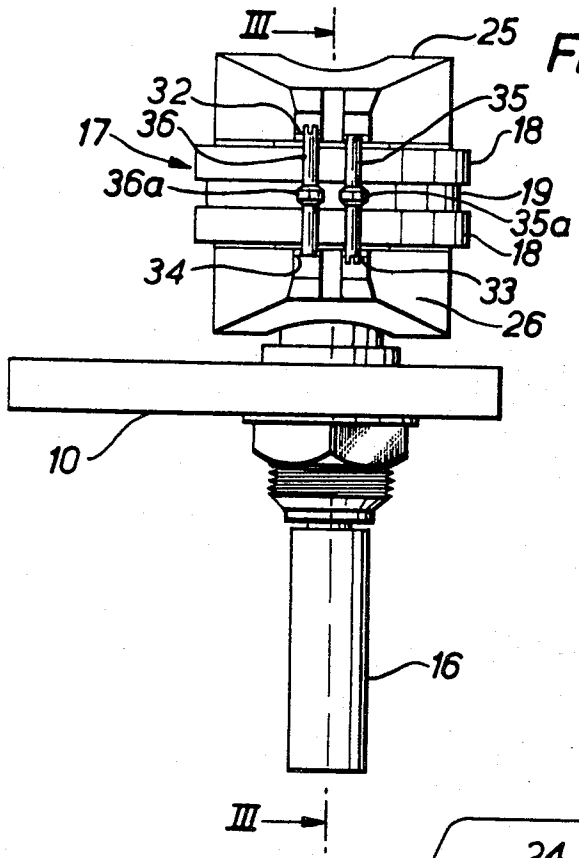
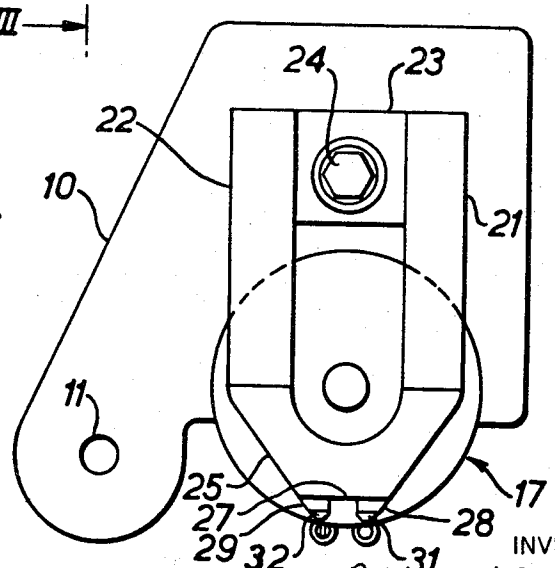


FIG.2.



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MEANS FOR DRIVING SPINDLES

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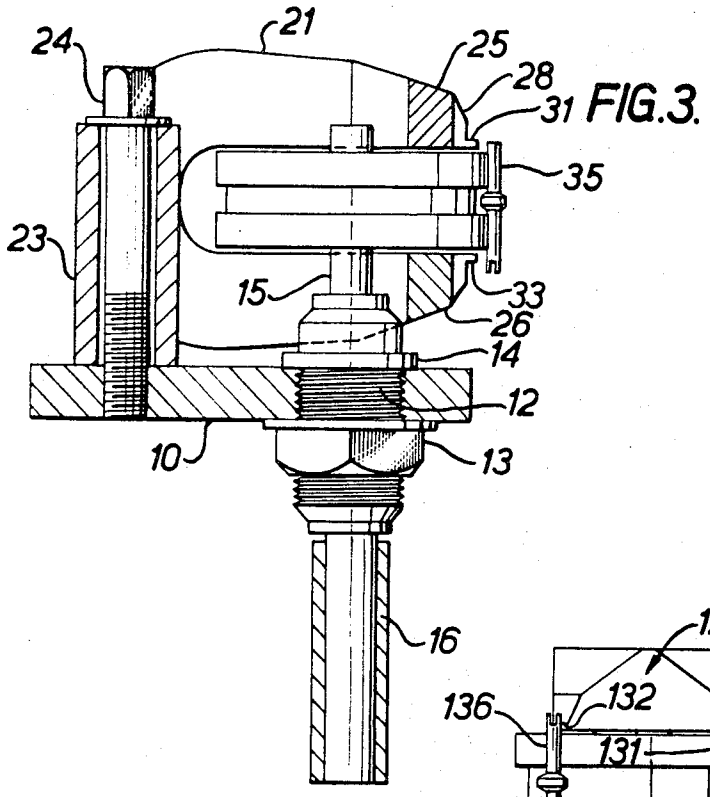


FIG. 3.

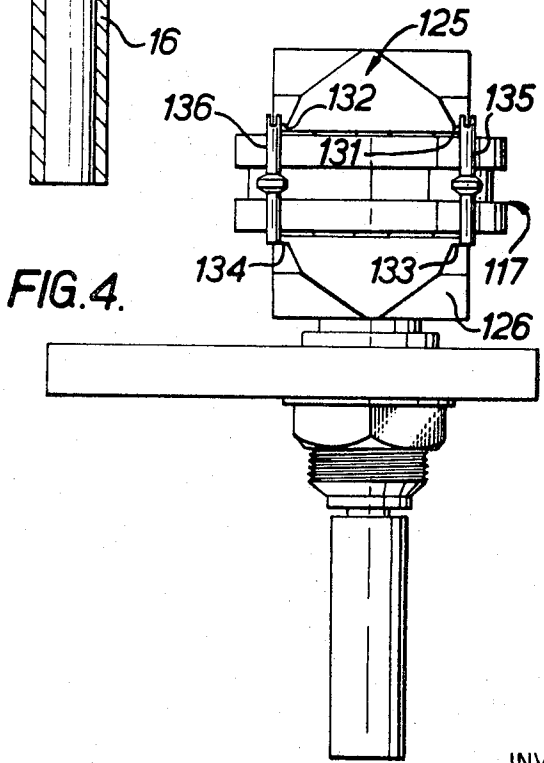


FIG. 4.

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MEANS FOR DRIVING SPINDLES

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FIG. 5.

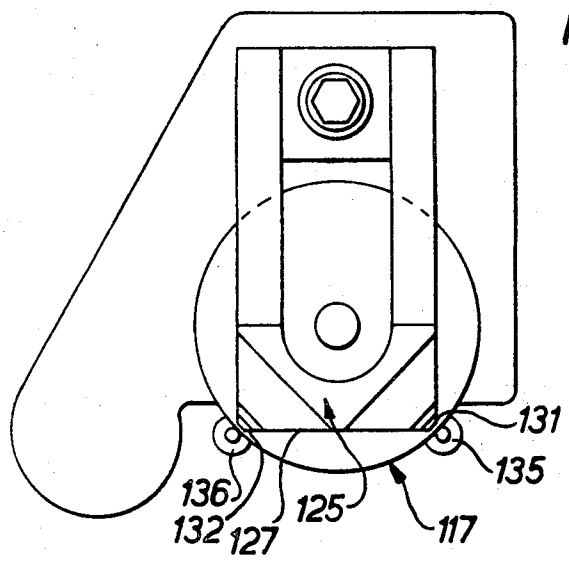
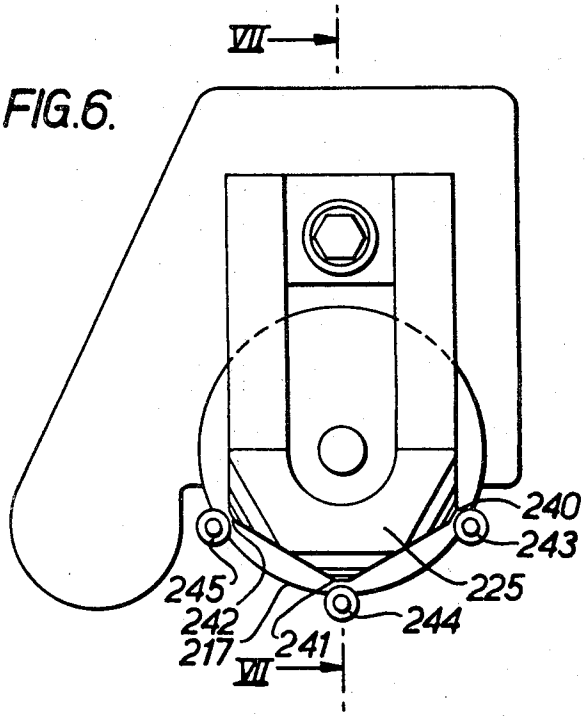


FIG. 6.



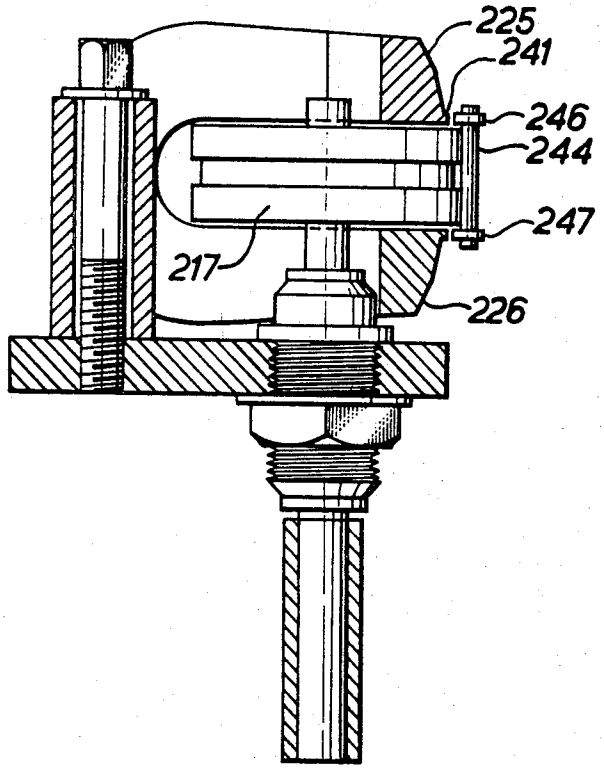
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FIG. 7.



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United States Patent Office 3,403,566 Patented Oct. 1, 1968

3,403,566

MEANS FOR DRIVING SPINDLES

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Filed July 7, 1965, Ser. No. 470,015
Claims priority, application Great Britain, July 8, 1964, 28,140/64
12 Claims. (Cl. 74—210)

ABSTRACT OF THE DISCLOSURE

A false twisting apparatus is provided in which a false twist head includes at least two false twist spindles. The spindles are held magnetically in contact with friction driving means, a pair of pole tips being provided for directing a magnetic field through each respective spindle.

This invention relates to means for driving spindles used in false twisting yarn and the use of such means.

According to one aspect to the invention there is provided a transmission means for supporting and rotating at least two false twist spindles for use in false twisting yarn, said transmission means comprising magnetic means having two limb portions which end in pole pieces of material of high magnetic permeability, each pole piece having at least two tips which are arranged adjacent the ends of the respective spindles, the area of each said tip being small relative to the cross-sectional area of its associated limb portion and such as to concentrate the magnetic flux at said tips to a flux density greater than the flux density of the magnetic flux of said limb portions, and track means into contact with which the spindles are drawn by the magnetic means, the track means passing between said tips of one pole piece and said tips of the other pole piece and contacting the spindles axially inward of but adjacent said tips.

According to another aspect of the invention there is provided a transmission means for supporting and rotating at least two false twist spindles for use in false twisting yarn, said transmission means comprising a permanent magnet system having two pole pieces of material of high magnetic permeability, each pole piece reducing at its end to at least two tongues, a wheel member disposed between the pole pieces and having its periphery protruding slightly past said tongues, the wheel member substantially filling the gap between the pole pieces, each false twist spindle having its ends substantially opposite a pair of said tongues and completing a magnetic circuit between those tongues thereby being drawn into contact with the wheel member, said tongues concentrating magnetic flux at the ends of the false twist spindles, and the arrangement being such as to render the false twist spindles stable and give them axial location at high speeds.

According to yet another aspect of the invention there is provided a transmission means for supporting and rotating at least two false twist spindles for use in false twisting yarn, said transmission means comprising a rotatable member for contacting and rotating said false twist spindles, magnetic means for drawing and holding the false twist spindles against said rotatable member, said magnetic means having two pole pieces between which said rotatable member passes, each pole piece having at least two protrusions arranged so that there is a separate protrusion for and opposite an end of each false twist spindle, each protrusion finishing with a small area opposite and spaced a short distance from the appropriate end of the associated false twist spindle, the arrangement being such that each false twist spindle is held in position both as regards transverse and axial displacement by the appropriate pair of protrusions concentrating magnetic flux at the ends of that false twist spindle and that false twist spindle completing the magnetic circuit between that pair of protrusions.

The protrusions of each pole piece are preferably located close together so that the false twist spindles are disposed side by side.

Each pole piece can taper in a plane at right angles to the axis of rotation of said rotatable member and the protrusions are preferably located at the end of the pole piece.

The protrusions can be formed by small tongues. Each tongue preferably has a width and a height of the order of or less than the diameter of the end of the spindle opposite it.

The diameter of each false twist spindle at its ends is preferably not greater than its diameter intermediate its ends.

The pole pieces can be arranged so that a single plane containing the axis of rotation of said rotatable member bisects both pole pieces.

The false twist spindles can be disposed within an arc of 180 degrees, preferably within an arc of 100 degrees, around the periphery of the rotatable member; in the case of two false twist spindles this arc can advantageously be 40 degrees or less. In this way the false twist spindles are all disposed on one side of the rotatable member. With this arrangement a flight of a driving belt can be employed for engaging and rotating a shaft of the rotatable member, and all the false twist spindles can be arranged on one side of the flight of the belt.

A releasable guard member can extend across the false twist spindles and have a separate cavity for each spindle, the cavities being so dimensioned and disposed that during normal running conditions the spindles are spaced from the walls of the cavities but should any false twist spindle become inadvertently displaced the walls of the associated cavity prevent the false twist spindle from moving beyond the effective zone of the magnetic field whereby said false twist spindle is drawn back into its normal running position by said magnetic field.

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

According to yet a further aspect of the present invention there is provided a method of false twisting yarn in which the yarn is subjected to two false twisting operations, one such false twisting operation being carried out using one of the false twist spindles of any transmission means as described above, and the other false twist operation being carried out using the other or another false twist spindle of that transmission means. The conditions can be such that the resultant crimped yarn is a non-torque crimped yarn.

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

FIGURE 1 is a front elevation of a transmission means according to the present invention;

FIGURE 2 is a plan view of the transmission means of FIGURE 1;

FIGURE 3 is a section on the line III—III in FIGURE 1;

FIGURE 4 is a front elevation of another transmission means according to the present invention;

FIGURE 5 is a plan view of the transmission means of FIGURE 4;

FIGURE 6 is a plan view of yet another transmission means according to the present invention; and

FIGURE 7 is a section on the line VII—VII in FIGURE 6.

The embodiment illustrated in FIGURES 1 to 3 has a plate **10** on which the transmission means is mounted and the plate **10** has a hole **11** by means of which it can be pivoted or bolted to a machine. A roller bearing **12** is secured to the plate **10** by a nut **13** below the plate and a flange **14** of the bearing engaging the upper surface of the plate. A shaft **15** is rotatably mounted in the bearing **12** in such a manner that there can be no axial movement of the shaft relative to the bearing. A sleeve **16** of hard wearing synthetic material is secured on the lower end of the shaft **15** and a wheel **17** is secured on the upper end of the shaft. The wheel **17** is formed as an inverted cylindrical cup of non-magnetic alloy having two tracks **18** of hard rubber-like material secured thereon with a groove **19** left between the tracks.

A horse-shoe magnet arrangement is formed by two parallel horse-shoe permanent magnets **21, 22** connected together by a brass member **23** to which they are secured by adhesive and through which a bolt **24** passes to secure the horse-shoe magnet arrangement to the plate **10**. The upper North poles of the magnets **21, 22** are bridged by a North pole piece **25** and the lower South poles of the magnets **21, 22** are bridged by a South pole piece **26**. The pole pieces are made of soft iron having a high magnetic permeability. As best seen in FIGURE 2, the pole piece **25** tapers to a front edge **27** from which projects two protrusions **28, 29** with a small gap between them. The protrusions **28, 29** are sharply stepped down and terminate in small tongues **31, 32** respectively of small height—the stepping down of the protrusion **28** and the tongue **31** can be clearly seen in FIGURE 3. The pole piece **26** is similarly shaped and has protrusions which terminate in tongues **33, 34**.

The wheel **17** is disposed between the upper and lower limbs of the magnets **21, 22** and substantially fills the gap between the pole pieces (as best shown in FIGURE 3). The periphery of the wheel **17** protrudes just beyond the tongues **31, 32, 33** and **34** of the pole pieces **25** and **26**.

Two false twist spindles **35, 36** are located with their ends opposite the tongues **31, 33** and **32, 34**, respectively, and are thereby drawn into engagement with the wheel **17**, the arrangement being such that both spindles are parallel to the axis of rotation of the wheel **17**. Each spindle has a ridge at approximately the centre of its length and the ridges **35*a*, 36*a*** engage freely in the groove **19**. The spindles are of such length that the ends of the spindles are opposite but do not protrude axially past the tongues **31, 33, 32, 34**, except for that end part of each false twist spindle that contains a sapphire pin around which yarn passes in operation. In FIGURE 1 a slotted end part of the spindle **36** containing the sapphire pin is shown extending just above the upper tongue **32** and the corresponding end part of the spindle **35** containing the sapphire pin is shown extending just below the lower tongue **33**. The reason for this is because the amount of metal removed from those end parts of the false twist spindles to accommodate the sapphire pins severely reduces the capacity of those end parts to pass magnetic flux.

In operation the sleeve **16** is contacted and rotated by a flight of a belt of a false twist machine thereby rotating the wheel **17** which rotates the two false twist spindles **35** and **36**. The spindles are held in position by the magnetic flux from the tongues acting on the ends of the spindles and passing through the spindles. The small tongues are believed to concentrate the magnetic flux from the magnets and by concentrating magnetic flux over a small area opposite each end of each spindle, the spindles **35, 36** are thereby held in position both in the axial and transverse directions. The width across the extremity of each tongue is less than the diameter of the end of the spindles and the vertical height of each tongue is also less than the diameter of the end of the spindles **35, 36**, thus enabling the concentrated magnetic flux to be focused at the ends of the spindles. The ridges **35*a*, 36*a*** serve to limit any axial movement of the spindles should they be inadvertently displaced axially, for example during threading up with yarn or due to the affect of a knot in the yarn as the knot passes through the bore of the spindle and around its sapphire pin.

The spindles **35, 36** are arranged side by side with a small gap between them and as can be seen from FIGURE 2, the spindles are disposed within an arc of 20 degrees around the periphery of the wheel **17**. With this arrangement it has been surprisingly found that the spindles are more stable at very high speeds than when the spindles are arranged further apart, for example, as in FIGURE 5. With the embodiment shown in FIGURES 1, 2 and 3 the two spindles **35, 36** have been rotated at very high speeds in the range 400,000 to 600,000 revolutions per minute and speeds approaching 1,000,000 r.p.m. are believed to be obtainable.

A releasable pivoted guard member can be arranged to extend across the two spindles **35, 36**, the guard member surrounding each spindle for the major part of the length of the spindle. A separate cavity for each spindle can be formed in the guard member, each cavity accommodating the central ridge of a spindle and a part of the spindle on each side of its ridge. The cavities should preferably be so dimensioned and disposed that during normal running conditions the two spindles are spaced from the walls of the cavities, but should either spindle become inadvertently displaced the walls of the associated cavity prevent that spindle from moving beyond the effective zone of the magnetic field acting upon that spindle whereby that spindle is drawn back into its normal running position by said magnetic field. This arrangement also eliminates any risk of the two spindles touching during operation.

A false twist head as shown in FIGURES 1 to 3 could process two yarns simultaneously. The two yarns could either both pass through the spindles **35, 36** in the same direction and so be false twisted in the same direction, or the yarns could pass in opposite directions so that one would receive a Z twist and the other an S twist; with the spindles orientated as in FIGURE 1, one yarn would preferably be passed upwards through the spindle **36** and the other yarn downwards through the spindle **35**. It would be possible to pass the same yarn firstly through one spindle in one direction and then through the other spindle in the opposite direction to produce a yarn having superimposed S and Z twist and with suitable heating arrangements to produce a non-torque crimped yarn.

When a plurality of these false twist heads are arranged along one side of a false twist machine, then to produce two-fold yarn, that is a yarn having S twist combined with a yarn having Z twist, this can be achieved by running all the yarns in the same direction through the spindles and having the spindles of adjacent false twist heads rotating in opposite directions. This can be readily achieved by disposing the shafts (**16, 15**) of the driving wheels **17** of adjacent false twist heads on opposite sides of the flight of the belt driving the shafts **16, 15**. One false twist head will then be producing two S twist yarns and the adjacent false twist head will be producing two Z twist yarns and so on along the false twist machine. One S twist yarn from one false twist head can then be combined with one Z twist yarn from the adjacent false twist head to produce a two fold yarn, and the other S twist yarn from said one false twist head can be combined with the other Z twist yarn from said adjacent false twist head to produce another two fold yarn. The combination of the S twist yarn with the Z twist yarn to produce the two fold yarn can be achieved in the known manner of winding the S and Z twist yarns simultaneously on to the same take-up package.

The embodiment shown in FIGURES 4 and 5 is similar to that described in relation to FIGURES 1 to 3, the

main difference being the shape of the pole pieces **125** and **126** so that the two false twist spindles **135** and **136** are spaced further apart and are disposed at an angle of 90 degrees around the periphery of the wheel **117**. As best seen in FIGURE 5, the pole piece **125** has a straight front edge **127** and the corners at each end of this front edge are flattened and tapered back in an upward direction (see also FIGURE 4). The bottom part of each flattened corner is formed with a tongue **131, 132** of small height. The pole piece **126** is similarly shaped and has tongues **133, 134** formed at the top parts of its flattened corners.

The embodiment shown in FIGURES 6 and 7 is similar to that of FIGURES 4 and 5, the main difference being that the pole pieces **225, 226** have been modified to each have three protrusions terminating in tongues **240, 241** and **242** so that three spindles **243, 244** and **245** can be accommodated and simultaneously driven. The spindles are different, each having no centre ridge but instead having flanges **246** and **247** at its ends (see FIGURE 7). The flanges are located opposite the corresponding tongues and the height of each flange is approximately equal to the height of the tongue it is opposite, as can be seen from FIGURE 7 in relation to spindle **244**. The wheel **217** engages the spindles between their flanges. The flanges are intended to aid the concentration of the magnetic flux acting upon the ends of the spindles **243, 244** and **245**; however, it has been found that this design of false twist spindle is less stable at very high speeds than the design of false twist spindle shown in FIGURES 1 to 5.

With each of the illustrated false twist heads it will be noticed that the false twist spindles are all to one side of the driving wheel and so off the flight of the belt driving the shaft of the driving wheel. In this way the false twist spindles can all be arranged to be readily accessible for threading up.

It will be appreciated that the various pole pieces shown in the drawings could be modified to accommodate more than three spindles if desired.

What is claimed is:

1. A transmission means for supporting and rotating at least two false twist spindles for use in false twisting yarn, said transmission means comprising magnetic means having two limb portions which end in pole pieces of material of high magnetic permeability, each pole piece having at least two tips which are arranged adjacent the ends of the respective spindles, the area of each said tip being small relative to the cross-sectional area of its associated limb portion and such as to concentrate the magnetic flux at said tips to a flux density greater than the flux density of the magnetic flux of said limb portions, and track means into contact with which the spindles are drawn by the magnetic means, the track means passing between said tips of one pole piece and said tips of the other pole piece and contacting the spindles axially inward of but adjacent said tips.

2. A transmission means for supporting and rotating at least two false twist spindles for use in false twisting yarn, said transmission means comprising a permanent magnet system having two pole pieces of material of high magnetic permeability, each pole piece reducing at its end to at least two tongues, a wheel member disposed between the pole pieces and having its periphery protruding slightly past said tongues, the wheel member substantially filling the gap between the pole pieces, each false twist spindle having its end substantially opposite a pair of said tongues and completing a magnetic circuit between those tongues thereby being drawn into contact with the wheel member, said tongues concentrating magnetic flux at the ends of the false twist spindles, and the arrangement being such as to render the false twist spindles stable and give them axial location at high speeds.

3. A transmission means for supporting and rotating at least two false twist spindles for use in false twisting yarn, said transmission means comprising a rotatable member for contacting and rotating said false twist spindles, magnetic means for drawing and holding the false twist spindles against said rotatable member, said magnetic means having two pole pieces between which said rotatable member passes, each pole piece having at least two protrusions arranged so that there is a separate protrusion for and opposite an end of each false twist spindle, each protrusion finishing with a small area opposite and spaced a short distance from the appropriate end of the associated false twist spindle, the arrangement being such that each false twist spindle is held in position both as regards transverse and axial displacement by the appropriate pair of protrusions concentrating magnetic flux at the ends of that false twist spindle and that false twist spindle completing the magnetic circuit between that pair of protrusions.

4. A transmission means as claimed in claim **3** in which the protrusions of each pole piece are located close together so that the false twist spindles are disposed side by side.

5. A transmission means as claimed in claim **4** in which each pole piece tapers in a plane at right angles to the axis of rotation of said rotatable member and the protrusions are located at the end of the pole piece.

6. A transmission means as claimed in claim **3** in which the protrusions are formed by small tongues.

7. A transmission means as claimed in claim **6** in which each tongue has a width and a height of the order of or less than the diameter of the end of the spindle opposite it.

8. A transmission means as claimed in claim **3** in which the diameter of each false twist spindle at its ends is not greater than its diameter intermediate its ends.

9. A transmission means as claimed in claim **3** in which the pole pieces are arranged so that a single plane containing the axis of rotation of said rotatable member bisects both pole pieces.

10. An apparatus for false twisting yarn including a plurality of transmission means as claimed in claim **3**.

11. A transmission means for supporting and rotating two false twist spindles for use in false twisting yarn, said transmission means comprising track means for contacting and rotating the spindles, magnetic means for drawing the spindles into contact with the track means, the magnetic means having two limb portions which end in pole pieces, the pole pieces being spaced apart with the track means passing between them, the pole pieces reducing to tips, each tip having two small tongues projecting therefrom, and each tongue being disposed opposite an end of a said spindle whereby the two spindles are drawn side by side against said track means.

12. A transmission means as claimed in claim **11** in which each limb portion has two fingers connected together by the appropriate pole pieces, the fingers being spaced apart in a direction at right angles to the axes of the spindles and forming part of a permanent magnet system, and a shaft for supporting the track means passing through the space between the fingers of at least one limb portion.

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