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Baruffa et al.

(54) **MACHINE AND METHOD FOR PRODUCING WOOL YARN**

(75) Inventors: **Massimiliano Zegna Baruffa**, Cerreto Castello (IT); **Fausto Uberto Bona**, Biella (IT)

(73) Assignee: **MICHELL (HONG KONG) LIMITED**, Hong Kong (HK)

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(57) **ABSTRACT**

A spinning machine for spinning a strand of travelling wool fibers to form a yarn. The machine includes an exit nip, a rotatable spindle for drawing the fiber assembly from the nip while a twist is inserted into the fiber assembly to form a yarn, and a false twisting device, which in use is a travelling continuous belt. The belt has a pair of runs at least one of which is engaged by the twisted yarn as it is drawn past such that a surface surface(s) of the belt imparts a false twist into the yarn. The belt includes a core made from a first material and surrounded by an external portion which is made from a second material, both the core and external portion extending through the belt. Rigidity of the first material is substantially higher than that of the second material.

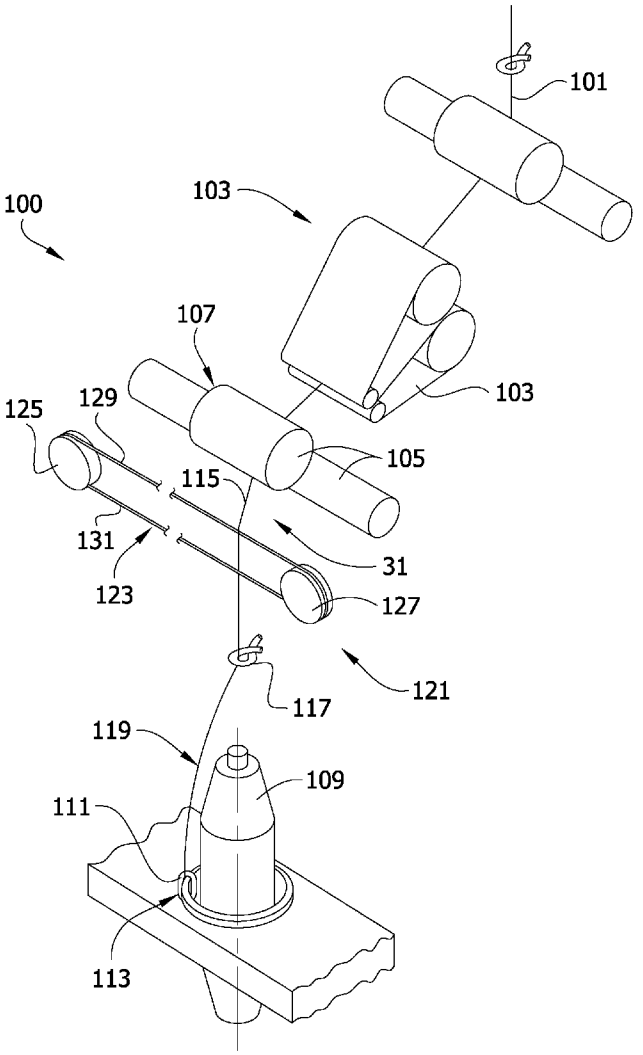


FIG. 1

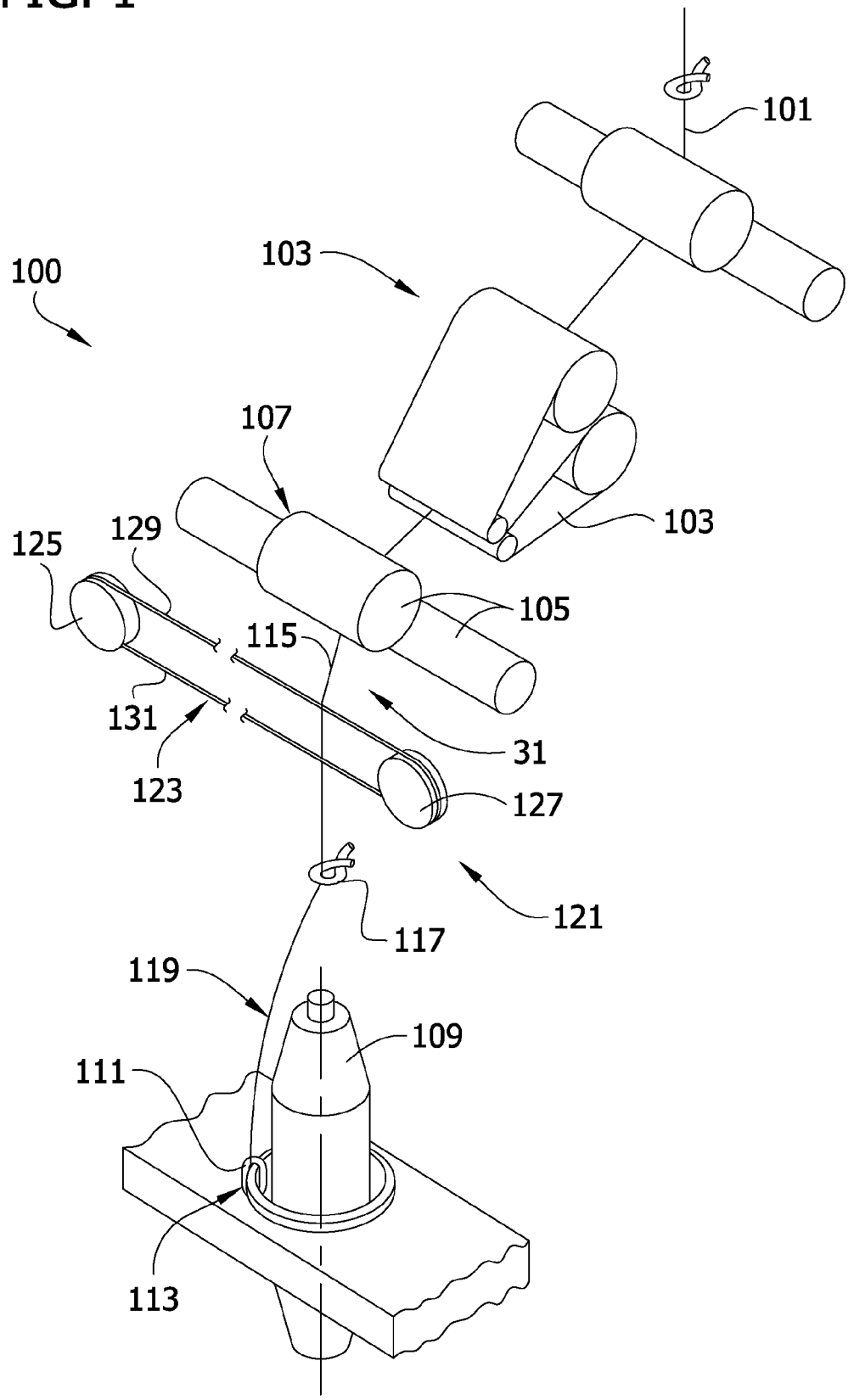
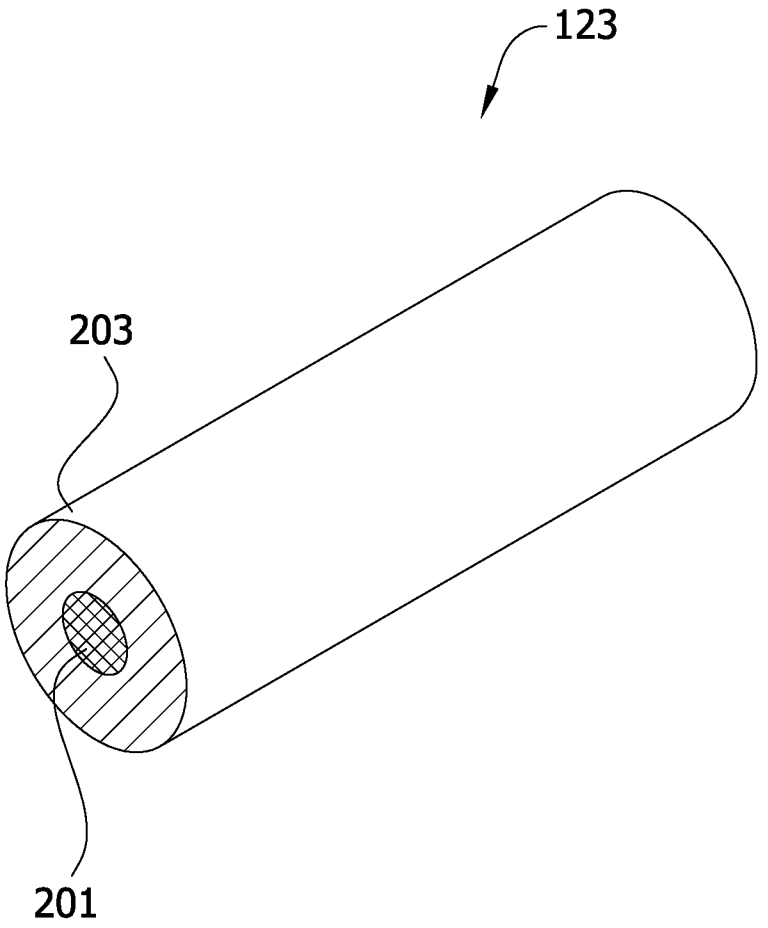

101
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107
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123
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119
109
111
113

FIG. 2



MACHINE AND METHOD FOR PRODUCING WOOL YARN

FIELD

[0001] The invention relates to yarn spinning machines and methods, and particularly relates to spinning machines and methods for producing yarns from wool fibers as well as yarns made therefrom.

BACKGROUND

[0002] Proposals have been made to improve quality of yarns made by ring spinning For example, PCT application no. PCT/AU97/00118, which is entitled "Reducing End Breaks in the Spinning of Twisting of Yarn" and filed on Feb. 28, 1997 by Commonwealth Scientific and Industrial Organization and which is incorporated herein by reference (the "118 application"), discloses a method and apparatus for twisting a travelling fiber assembly to form a twisted yarn, in which the strand is draw from a nip and rotated to insert twist into the yarn. Downstream of the nip, the twisted yarn is drawn past and in engagement with an upper and a lower runs of a travelling continuous belt such that both runs rotate the yarn and insert a false twist into the yarn. In this way, incidence of end breaks in ring spinning could be reduced. U.S. patent application Ser. No. 12/222,133 (Publication No. US 2010/0024376), which is entitled "Method and apparatus for Manufacturing Slalom false Twisting on Ring Yarn" and filed on Aug. 4, 2008 and assigned to The Hong Kong Polytechnic University, discloses a yarn spinning mechanism similar to that of PCT application no. PCT/AU97/00118 and is also herein incorporated by reference (the "133 application").

[0003] Nevertheless, it could be appreciated that improvements are desirable for a yarn spinning machine that is more suitable for large scale manufacturing of yarns from wool, especially in that wool fibers have a low coefficient of friction and that the wool yarns are drawn at a much higher speed in a wool spinning machine than that of a cotton yarn spinning machine as typically exemplified in the '133 application.

SUMMARY

[0004] In accordance with one embodiment, a spinning machine for spinning a strand of travelling wool fibers to form a yarn includes an exit nip, a rotatable spindle for drawing the fiber assembly from the nip while inserting a twist into the fiber assembly to form a yarn, and a false twisting device, which in use is a travelling continuous belt. The belt has a pair of runs at least one of which is engaged by the twisted yarn as it is drawn past such that a surface surface(s) of the belt imparts a false twist into the yarn. The belt includes a core made from a first material and surrounded by an external portion which is made from a second material, both the core and external portion extending through the belt. Rigidity of the first material is substantially higher than that of the second material.

[0005] In accordance with a second embodiment, in a method for spinning a strand of travelling wool fibers to form a yarn, the fiber assembly is drawn from a nip while a twist is inserted into the fiber assembly to form a yarn, and downstream of the nip, a false twist is imparted into the yarn by at least one of a pair of runs of a false twisting device, which in use is a travelling continuous belt. The belt includes a core made from a first material and surrounded by an external portion which is made from a second material, both the core and external portion extending through the belt, and rigidity of the first material is substantially higher than that of the second material.

[0006] In accordance with a further embodiment, a yarn is made from a strand of wool fiber by using the aforementioned method.

[0007] Preferably, the rigidity of the first material is at least twice that of the second material.

[0008] Preferably, the core is made by a continuous filament yarn.

[0009] Preferably, the core is made from polyester or polyamide.

[0010] Preferably, the core is made by aramid fiber. More preferably, the external portion is made from polyurethane.

[0011] Preferably, the belt has a substantially smooth surface.

[0012] Preferably, the belt travels at a first speed and the yarn travels at a second speed, and a ratio of the first and second speeds is in the range of 2-6. In an embodiment, the ratio of the first and second speeds is in the range of 3-5, more preferably in the range of 3.5-4.5.

[0013] Preferably, the core and external portion are fixedably attached to each other.

[0014] Preferably, the belt is arranged such that the two runs thereof travelling in opposite directions intersect the yarn path, the yarn passing behind one of the runs and in front of the other run, and wherein both runs are engaged by the twisted yarn as it is draw past for imparting two false twists into the yarn by the runs respectively.

BRIEF DESCRIPTION OF DRAWINGS

[0015] FIG. **1** is a diagrammatic perspective view of a single spindle segment of a yarn spinning machine according to one embodiment of the present invention and shown in operation; and

[0016] FIG. **2** is a perspective view of a portion of a belt that can be used in the exemplary embodiment of FIG. **1**.

DETAILED DESCRIPTION

[0017] FIG. **1** shows an exemplary single spindle segment **100** of a yarn spinning machine suitable for producing yarns from wool fibers according to one embodiment of the present invention. It is understood that in practice, such a wool yarn spinning machine may include hundreds of such spindle segments.

[0018] As shown in FIG. **1**, a roving **101** of wool fibers is firstly drafted by a delivery or drafting section **103**, which includes a double apron **103** and front drafting rollers **105** defining a nip **107**. A rotatable take-up spindle **109** which includes a ring **111** and a traveller **113** draws the drafted strand **115** from nip **107** through a yarn guide **117** and winds it up as wool yarn **119** onto the spindle **109**, while inserting twist into the yarn by its rotation. This twist travels back to the nip **107** at a diminishing and locally fluctuating level.

[0019] A false twist mechanism **121** is located between the nip **107** and yarn guide **117** for asserting false twists into the yarn towards the nip **107** as could be appreciated in the art. In this embodiment of the present invention, the false twist mechanism **121** includes a continuous belt **123** of a generally circular cross section with a relatively smooth external surface while exhibiting appropriate surface friction. Similarly to the one of the '118 application, the belt **123** is mounted about a drive and an idler pulleys, **125**, **127**, which define a

plane that intersects the yarn travel path from the nip **107** to the yarn guide. Further, in the exemplary embodiment, the yarn is drawn around and in contact with the front of the upper run **129** and the back of the lower run **131** such that when the spindle and belt are moving during the operations, each run imparts a false twist into the yarn towards the nip **107**.

[0020] FIG. **2** illustrates a portion of the belt according to one embodiment of the present invention. The belt **123** has a core **201** surrounded by an external portion (exterior) **203**, both extending along the length of the belt **123**. In the exemplary embodiment, the core and external portion are made from different materials, and the core is made from (comprises) a first material which has a rigidity which is substantially higher than that of the second material from which the exterior is made, for example which is at least twice of the external portion. In addition, both materials exhibit certain flexibility such that the belt can be wound around the pulleys to form the upper and lower runs. Furthermore, the external portion is in close contact with the core and is prevented from slipping away from the core by way of, for example, friction therebetween or glue.

[0021] In one embodiment, the core is made by a continuous filament yarn. In another embodiment, the core is made from polyester or polyamide. In a further embodiment, the core is made by aramid fiber, and the external portion is made from polyurethane. Such a belt exhibits a relatively low elongation at break and a high working tension as compared to a conventional belt made from rubber. The residual elasticity of the present belt is sufficient to compensate oscillations caused by the motor (not shown) that moves the belt and to keep the belt in contact with the pulleys. Commercially available examples of such belts include PU 85 A green roughened, reinforced aramid fiber belt and PU 85 A sapphire smooth, hydrolysis resistant, reinforced aramid fiber belt available from BEHA Innovation GmbH of Germany.

[0022] In one embodiment, the belt travels substantially perpendicular to the yarn travelling path, the belt and yarn travel at a first and a second speed respectively, and a ratio of the first speed to the second speed is in a range of 2-6, preferably 3-5, and more preferably 3.5-4.5. By controlling this ratio, quality of the wool yarns thus produced can be further improved.

[0023] In one embodiment of the invention, the yarn travels at a speed of about 20 m/minute, such as between about 20 m/min less 15% and about 20 m/minute plus 15%; and the belt travels at a speed of about 80 m/minute, such as between about 90 m/min less 15% and about 80 m/minute plus 15%.

[0024] It has been found that the afore-described embodiment is more suitable for large scale manufacturing of yarns from wool fibers through adoption of a belt having a reinforced core in the false twisting mechanism.

[0025] In the preceding description, various aspects of claimed subject matter have been described. For purposes of explanation, specific numbers, systems and/or configurations were set forth to provide a thorough understanding of claimed subject matter. However, it should be apparent to one skilled in the art having the benefit of this disclosure that claimed subject matter may be practiced without the specific details. In other instances, well-known features were omitted and/or simplified so as not to obscure claimed subject matter. While certain features have been illustrated and/or described herein, many modifications, substitutions, changes and/or equivalents will now occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and/or changes as fall within the true spirit of claimed subject matter.

What is claimed is:

1. A spinning machine for spinning a strand of travelling wool fibers to form a yarn, comprising:
- an exit nip;
- a rotatable spindle for drawing the fiber assembly from the nip while inserting a twist into the fiber assembly to form a yarn; and
- a false twisting device, which in use is a travelling continuous belt, including a pair of runs at least one of which is engaged by the twisted yarn as it is drawn past such that at least one surface of the belt imparts a false twist into the yarn,
- wherein the belt includes a core made from a first material and surrounded by an external portion made from a second material, both the core and external portion extending through the belt, and wherein rigidity of the first material is substantially higher than that of the second material.

2. The spinning machine of claim **1**, wherein the rigidity of the first material is at least twice that of the second material.

3. The spinning machine of claim **2**, wherein the core is made by a continuous filament yarn.

4. The spinning machine of claim **3**, wherein the core is made from polyester or polyamide.

5. The spinning machine of claim **3**, wherein the core is made from aramid fiber.

6. The spinning machine of claim **5**, wherein the external portion is made from polyurethane.

7. The spinning machine of claim **3**, wherein the belt has a substantially smooth surface.

8. The spinning machine of claim **7**, wherein the belt travels at a first speed and the yarn travels at a second speed, and wherein a ratio of the first and second speeds is in the range of 2-6.

9. The spinning machine of claim **8**, wherein the ratio of the first and second speeds is in the range of 3-5.

10. The spinning machine of claim **9**, wherein the ratio of the first and second speeds is in the range of 3.5-4.5.

11. The spinning machine of claim **1**, wherein the core and external portion are fixedably attached to each other.

12. The spinning machine of claim **1**, wherein the belt is arranged such that the two runs thereof travelling in opposite directions intersect the yarn path, the yarn passing behind one of the runs and in front of the other run, and wherein both runs are engaged by the twisted yarn as it is draw past for imparting two false twists into the yarn by the runs respectively.

13. A method for spinning a strand of travelling wool fibers to form a yarn, comprising
- drawing the fiber assembly from a nip while inserting a twist into the fiber assembly to form a yarn; and
- downstream of the nip, imparting a false twist into the yarn by at least one of a pair of runs of a false twisting device, which in use is a travelling continuous belt,
- wherein the belt includes a core made from a first material and surrounded by an external portion made from a second material, both the core and external portion extending through the belt, and wherein rigidity of the first material is substantially higher than that of the second material.

14. The method of claim **13**, wherein the rigidity of the first material is at least twice that of the second material.

15. The method of claim **14**, wherein the core is made by a continuous filament yarn.

16. The method of claim **15**, wherein the core is made from polyester or polyamide.

17. The method of claim **14**, wherein the core is made from aramid fiber.

18. The method of claim **17**, wherein the external portion is made from polyurethane.

19. The method of claim **13**, wherein the belt travels at a first speed and the yarn travels at a second speed, and wherein a ratio of the first and second speeds is in the range of 2-6.

20. The method of claim **19**, wherein the ratio of the first and second speeds is in the range of 3-5.

21. The method of claim **20**, wherein the ratio of the first and second speeds is in the range of 3.5-4.5.

22. The method of claim **13**, wherein the core and external portion are fixedably attached to each other.

23. The method of claim **13**, wherein the belt is arranged such that the two runs thereof travelling in opposite directions intersect the yarn path, the yarn passing behind one of the runs and in front of the other run, and wherein both runs are engaged by the twisted yarn as it is draw past for imparting two false twists into the yarn by the runs respectively.

24. A yarn made from a strand of wool fiber by using any method of claims **13-23**.

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