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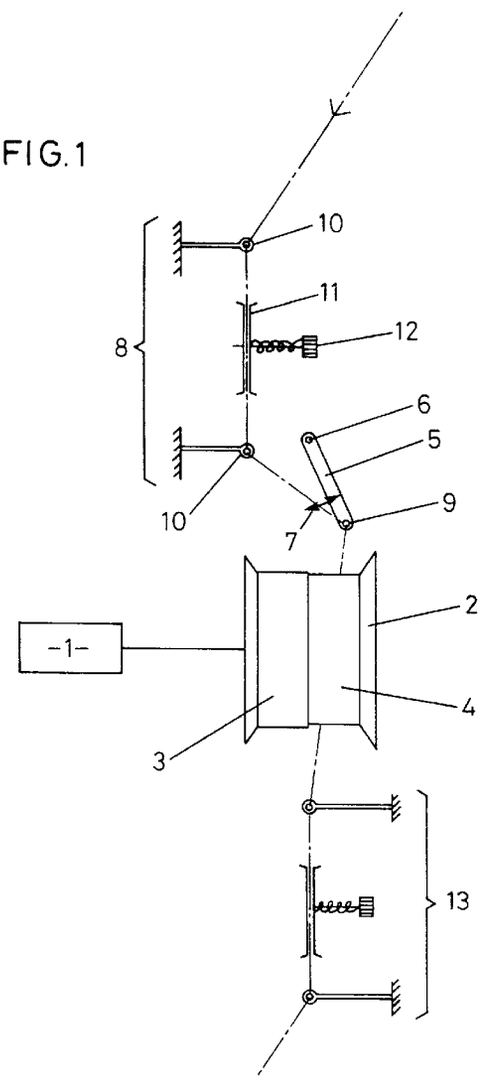
(54) Yarn feed device.

(57) The yarn feed device for textile machinery comprises a yarn assist wheel (2) the outer surface of which is half-covered with rubber to provide axial zones (3) and (4) of relatively high and relatively low frictional characteristics. The wheel is driven by an electric motor (1) at a speed in excess of the maximum estimated demand rate of yarn by associated textile machinery. A yarn tension device (8) is provided on the yarn infeed side to the wheel, and a yarn tension device (13) is provided on the yarn outfeed side. In use the yarn is placed in contact with the surface of the rotating wheel, and can be placed against the low friction surface (4) or the high friction surface (3) by a tension-responsive yarn shipping lever (5) that is responsive to the tension in the yarn between the infeed tensioning mechanism (8) and the wheel (2). When a demand for the yarn exists, the tension in that particular section rises and the yarn is placed on the higher frictional portion of the wheel for assisting its motion towards the knitting machine. The device of the invention enables demand feeding to be provided at substantially constant and very low tension to sock machines which have widely varying and erratic demands for the yarn, and with a very wide range of different yarn types.

FIG.1



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Field of the Invention

The invention relates to the delivery of yarn to textile machines, especially double cylinder or single cylinder circular knitting sock machines, at a constant desired tension and at a feed rate, which may be intermittent or highly variable, dictated by the demand of yarn by the machine.

Prior Art

Double cylinder or single cylinder sock knitting machines tend to have extreme variations in their demand for yarn, as they can be configured to vary the pattern of any knitted structure down the length of the sock, to change colours by placing yarn feeds into and out of action (known as 'striping') and to enter a reciprocatory mode of cylinder movement for the fashioning of toes and heels. Many yarn feed devices have been proposed to cater for this wide variation. None, however, is sufficiently flexible to cater for all machine demand variations and all yarn types.

The need for a yarn feed device in such a machine arises because of the variation in tension in the yarn as it is withdrawn from the storage bobbin on which it is supplied. That tension variation may result from a variation in the tension of the yarn as it was originally wound onto the bobbin, or a variation in the speed of withdrawal from the bobbin which increases as the machine speed increases. If that tension variation is transmitted to the knitted structure, it would at best produce a highly unsatisfactory sock with stitches of different lengths being drawn at different parts of the sock, which would in consequence fall well short of the quality control requirements currently demanded by discerning manufacturers. At worst, the tension variations in the yarn could result in unnecessary and frequent yarn breakages or stopmotion actuations, and consequent machine down time.

Truly positive feed devices, which deliver a precisely measured length of yarn at constant tension to each machine needle, cannot cope with the intermittent and widely varying yarn demands of the knitting machine during the course of knitting a sock. Various yarn assist devices have therefore been proposed, some of which can be converted readily into positive feed or virtual positive feed mode.

It is known, for example, to have the yarn touch the outer periphery of a spinning feed wheel having a high friction surface, to assist the yarn on its path to the knitting machine. When a demand for the yarn exists, the yarn is drawn against the wheel which pulls it forward from the bobbin on which it is wound. When the demand falls, the frictional contact between the spinning wheel and the slack yarn is insufficient to draw the yarn from the bobbin and assist it in a forward motion to the knitting machine.

It is also known to wrap the yarn for a number of turns around a driven whell half the axial surface of which is covered by a high friction rubber cladding and the other half of which is smooth metal. The whell is rotated in precise synchronism with the rate of rotation of a knitting machine, and a yarn tension-responsive yarn guide assembly is responsible for feeding the yarn selectively either to the rubber covered part of the whell or to the smooth metal part, depending on whether or not it is desired positively to feed the yarn to the knitting machine. Such a yarn feed device is, however, quite unsuitable for use with a sock machine because when the yarn is passed for a number of turns around the rubber covered part of the whell it experiences substantially positive feed, so that it is necessary to rotate the feed whell in very precise synchronism with the rotation of the knitting machine. That degree of synchronism is simply not possible in the case of a sock machine which, at different stages in the knitting cycle, enters a reciprocatory phase of cylinder movement for fashioning of the toe and heel.

There have been proposals to incorporate a covered or uncovered elastomeric yarn into sock manufacture, to provide the resulting sock with greater stretch and elasticity. One such elastomeric yarn would be that sold under the Registered Trade Mark LYCRA by Du Pont Industries Inc., the yarn being an elastomeric monofilament which is nylon- or cotton - wrapped and has a stretch of well over one hundred percent. No inexpensive yarn feed device is currently available that will cope with the extremely difficult handling characteristics of such a yarn.

The Invention

The invention provides a simple and inexpensive yarn feed device which does not provide positive feed but which does assist the forward motion of the yarn from a bobbin for delivery to a knitting machine at the rate demanded by that knitting machine. The device is well able to cope with the wide and intermittent variation in the yarn demand by double or single cylinder sock machines, to cope with a very wide variety of yarns with substantially different yarn handling cbaracteristics, and to deliver the yarns to the knitting machine at highly uniform delivery tensions.

The invention comprises a yarn feed device for textile machinery, comprising a feed whell drivable by an electric motor to rotate at a peripheral speed in excess of the maximum anticipated rate of demand for yarn by the textile machinery, yarn tension devices located on infeed and outfeed sides of the whell to define a yarn path in which the yarn passes around the whell for an arc of less than 360° in frictional contact with the wheel; and a yarn tension-responsive shipping lever for guiding the yarn between the tension device on the yarn infeed side and the wheel, the shipping lever being movable against the bias of a spring by tension in the length of yarn which it guides,

from a non-yarn-assist position in which it directs the yarn onto a low friction axial zone of the whell, to a yarn-assist position in which it directs the yarn onto a higher friction axial zone on the whell, wherein demand for yarn by the textile machinery results in movement of the shipping lever to its yarn-assist position, resulting in frictional feeding of the yarn to the textile machinery at a rate dictated by the demand of the textile machinery but at a substantially constant tension. The yarn tension devices are preferably associated with yarn guide eyes which define precisely the yarn path in which the yarn passes around the whell. The yarn is preferably in frictional contact with the wheel for an arc of substantially 270°, although the optimum choice of angle will be dependent on the frictional characteristics of the relatively low friction and relatively high friction axial zones of the whell.

The shipping lever is preferably a simple sprung biased lever, normally biased under the tension of a light spring to a position in which yarn passing from the infeed yarn tension device to the whell is deflected axially to contact the lower friction axial zone of the whell. The yarn outfeed tension device is preferably positioned approximately in line with the function between the axial zones on the whell, so that if the yarn is laid onto the whell on the lower friction axial zone, it will travel around the wheel in that same zone before being withdrawn. Conversely if it is laid onto the whell on the higher friction axial zone, then it will remain in contact with the higher friction surface of the whell until it is withdrawn. The shipping lever should be positioned so that any tension in the yarn passing from the yarn tension device on the infeed side of the whell to the whell induces a lateral movement of the shipping lever against the force of its spring, so that the yarn is laid on the appropriate higher friction axial zone of the whell. An appropriate yarn tension in that particular length of the yarn path need not be substantial, and would be induced by a demand for the yarn by the textile machinery.

The yarn infeed and outfeed tension devices are preferably adjustable to vary the yarn tension. It has been found essential that two such tension devices are necessary for certain yarns if the device is to work effectively.

It has been found that the yarn feed device of the invention is able to accommodate a very wide range of yarn demand speeds over a surprisingly high range of outfeed tensions. Moreover the device of the invention can be modified to accommodate a wide range of yarn types, even covering elastomeric yarns which are notoriously difficult to handle.

The relatively low friction axial zone of the whell is preferably a smooth metallic surface, with the relatively high friction axial zone being provided by a rubber cladding over the whell. The rubber cladding may be removable and replaceable, and replacement of the rubber cladding by a cladding having a different frictional and yarn handling characteristic enables the suitability of the yarn feed device of the invention to be extended over the entire range of yarn types. For example, a smooth surfaced rubber cladding is very suitable for natural and covered elastomeric yarns, whereas a textured surface might be more appropriate for some synthetic yarns. A rubber cladding formed with axial ribs lying along its external periphery is particularly suitable for use with continuous filament synthetic yarns, and preferably the ribs have tapered or rounded ends on the side of the cladding forming a junction with the low friction axial zone of the whell. This tapering or rounding facilitates rapid movement of the yarn onto and off the higher friction clad portion of the wheel in response to movement of the yarn shipping lever.

Depending on the S or Z twist of the yarn, there may be a tendency for the yarn to move axially along the wheel when the demand ceases. The precise positioning of the yarn infeed eye carried by the yarn shipping lever, and the yarn outfeed eye leading to the yarn outfeed tension device, do much to resist that movement, but preferably the direction of rotation of the feed whell is such that where the above tendency exists, the yarn is urged to move in a direction away from the lower friction uncovered part of the whell. To achieve that measure of control, the position of the higher friction rubber cladding is preferably reversible on the whell, and the position and bias of the yarn shipping lever is preferably similarly reversible, or may be duplicated, to accommodate a reversal of the relative positions of the high friction and low friction parts of the whell.

The yarn feed device of the invention lends itself particularly well to the ganging of a number of similar yarn feed wheels, each with its associated infeed and outfeed yarn tension devices and its associated tension-responsive shipping lever, on a common drive shaft of the same electric motor, for driving the whells at the same peripheral speed. A remarkable characteristic of a ganged yarn feed device of this kind is that it can successfully feed two separate yarns at the same time to a single yarn feeder of the knitting machine with which it is used. The two separate yarns, drawn from separate yarn packages, pass through different infeed and outfeed yarn tension devices and over different feed wheels but are then delivered to the same yarn feeder of a knitting machine. It has been found that even yarns with substantially different yarn handling characteristics can be simultaneously delivered in this manner at substantially constant and independently controllable yarn tensions.

Drawings

Figure 1 is a schematic side elevation of a yarn

feed device according to the invention, threaded with yarn;

Figure 2 is a schematic end elevation of the yarn feed device of Figure 1; and

Figure 3 is a schematic side elevation of another yarn feed device according to the invention, incorporating four ganged feed wheels.

Figures 1 and 2 illustrate a first embodiment of a feed wheel according to the invention. A constant speed electric motor 1 drives a yarn feed wheel 2 at a peripheral speed from 10% to 50% in excess of the maximum rated demand rate of yarn from an associated knitting machine (not shown). The feed whell 2 is covered over half of its axial length with a thin cladding 3 of rubber material, the other half 4 of the axial length of the wheel 2 being left uncovered. The frictional characteristics of the covered and uncovered portions 3 and 4 of the wheel are such that the rubber covered portion 3 has a relatively high frictional characteristic as compared with the uncovered portion 4 which is simply a smooth polished metal surface of the wheel 2. Above the wheel a yarn shipping lever 5 is pivotally mounted at 6 and lightly biased by spring means (not shown) to the position shown in Figure 1. The angular movement of the shipping lever 5 is illustrated by the double-headed arrow 7, from which it will be seen that the lever can be moved from the position illustrated in which it feeds yarn to the uncovered half 4 of the whell to a position in which it feeds the yarn to the rubber covered half 3 of the wheel. Angular movement of the shipping lever 5 is under the control of yarn tension, and in particular the tension between a yarn infeed tension device 8 and the guide eyelet 9 of the shipping lever 5. The yarn path is shown as a chain-dotted line in the drawings.

The yarn infeed tension device 8 comprises a pair of yarn guide eyes 10 between which is a pair of conventional yarn tensioning spring loaded cymbals 11. As is well-known in the art, a thumbscrew 12 is provided for manually varying the tension to be transmitted to the yarn by the cymbals 11. A similar yarn tensioning device 13 is provided at the yarn outfeed side of the feed whell 2, and in practice the yarn tensioning device 13 is operated at the lower tension.

Figure 1 illustrates the yarn path in developed view, and reference must be made to Figure 2 to perceive how the yarn passes around the whell 2 for substantially 270°. Also illustrated in Figure 2 is the latch blade 14 of a stopmotion device (not shown) for detecting when the yarn becomes wrapped around the whell 2, giving rise to potential breakages. Normally the yarn will be withdrawn from the whell 2 towards the knitting machine in the direction of the double headed arrow 15, following the path shown in obain-dotted lines. However when the demand for yarn ceases, and particularly if the yarn infeed tensioning device 8 is set at a low tension, the yarn can cling to the rotating wheel 2 and be carried round towards the blade 14. The space between the blade 14 and the surface 3 of the wheel 2 is set to be extremely small, so that build-up yarn carried round on the whell causes the blade 14 to be lifted, which unlatches the blade and causes it to trip to a position actuating the stopmotion assembly.

Figure 3 illustrates both a four-ganged arrangement of yarn feed whells on the drive shaft of a single electric motor, and the preferred use of a ribbed rubber cladding for the whell when the device is intended for use with certain fine synthetic yarns.

In general, the elevation of Figure 3 corresponds to that of Figure 1, and a similar range of reference numerals has been used in Figure 3 but increased by 100. In Figure 3 a single electric motor 101 drives four feed wheels 102, 102′, 102″ and 102‴. Each feed wheel is associated with its own yarn shipping lever 105 and its own yarn infeed and yarn outfeed tensioning devices 108 and 113. In Figure 3 the four yarn shipping levers 105 to 105‴ are shown as being pivotally mounted on a cover sheet 120 which extends as a shield over all four feed wheels 102 to 102‴ and serves to prevent the rotating wheels being fouled either by an operator's fingers or by loose ends of yarn falling from the yarn bobbins which are located above the yarn feed device.

In Figure 3 yarns are shown threaded on the right-hand pair of wheels, with a demand for yarn existing at the right-most wheel 102 ‴ but not at the wheel 102″. The shipping lever 105‴ has therefore been pulled to the right by the tension in the yarn, so that the yarn is placed on the high friction rubber covered portion 104‴ of the wheel. The shipping lever 105" has not been similarly influenced by yarn tension, so that the yarn is placed on the low friction uncovered portion 103″ of the wheel 102″. The result is that the wheel 102″ rotates freely without driving the yarn, whereas the wheel 102‴ frictionally engages the yarn and assists it in its path towards the knitting machine.

Figure 3 shows how different rubber claddings can be used for different yarns. The rubber cladding 104‴ is smooth and untextured, and is suitable for natural fibre and covered elastomeric yarns. The rubber cladding 104″ is provided around its outer periphery with a series of axial outstanding ribs 121 which provide a better yarn assist characteristic for synthetic nonofilament yarns. The nose portion of each rib 121 is tapered (or may be rounded) in the direction of the uncovered half 103″ of the associated wheel, which has been found to provide very rapid transfer of the yarn onto and off the rubber covered portion 104″ of the whell in response to movement of the shipping lever 105″.

Although no latched blade 14 is shown in either Figure 1 or Figure 3, it will be understood that four such blades could be used in Figure 3, one per wheel, for stopping the knitting machine immediately a fault

is sensed.

Claims

1. A yarn feed device for textile machinery, comprising a feed wheel (2) drivable by an electric motor (1) to rotate at a peripheral speed in excess of the maximum anticipated rate of demand for yarn by the textile machinery; yarn tension devices (8,13) located on infeed and outfeed sides of the wheel (2) to define a yarn path in which the yarn passes around the wheel for an arc of less than 360° in frictional contact with the wheel; and a yarn tension-responsive shipping lever (5) for guiding the yarn between the tension device (8) on the yarn infeed side and the wheel (2), the shipping lever (5) being movable against the bias of a spring by tension in the length of yarn which it guides, from a non-yarn-assist position in which it directs the yarn onto a relatively low friction axial zone (4) of the wheel, to a yarn-assist position in which it directs the yarn onto a relatively high friction axial zone (3) on the wheel, wherein demand for yarn by the textile machinery results in movement of the shipping lever (5) to its yarn-assist position, resulting in frictional feeding of the yarn to the textile machinery at a rate dictated by the demand of the textile machinery but at a substantially constant tension.

2. A yarn feed device according to claim 1, wherein the relatively low friction axial zone (4) of the wheel is a smooth polished surface of the wheel, and the relatively high friction axial zone (3) is created by a rubber cladding over the wheel.

3. A yarn feed device according to claim 2, wherein the rubber cladding covers approximately half the axial extent of the wheel.

4. A yarn feed device according to claim 2 or claim 3, wherein the rubber cladding is removable and replaceable.

5. A yarn feed device according to claim 4, wherein rubber claddings with different frictional and yarn handling characteristics are provided, for selection of the most suitable cladding for any individual yarn to be fed.

6. A yarn feed device according to claim 5, wherein the rubber claddings include a smooth surfaced rubber cladding for use with natural and covered elastomeric yarns.

7. A yarn feed device according to claim 5 or claim 6, wherein the rubber claddings include a textured or non-circular rubber cladding for use with synthetic yarns.

8. A yarn feed device according to claim 7, wherein the rubber cladding for synthetic yarns is externally ribbed, the ribs (121) lying in the axial direction, and each rib on the rubber cladding has a rounded or tapered end on the side of its junction with the low friction axial zone of the wheel.

9. A yarn feed device according to any preceding claim, wherein the yarn tension devices (8,13) are yarn tension cymbals for varying the yarn infeed and outfeed tensions.

10. A yarn feed device according to any preceding claim, further comprising a sensor blade (14) latchable to a position closely adjacent the surface of the wheel (2) at a radial position not intended in use to be contacted by the yarn, so that if yarn adheres to the surface of the wheel in use causing a build-up of yarn turns on the wheel, the blade will be unlatched to trigger a stopmotion device of the textile machinery.

FIG.1

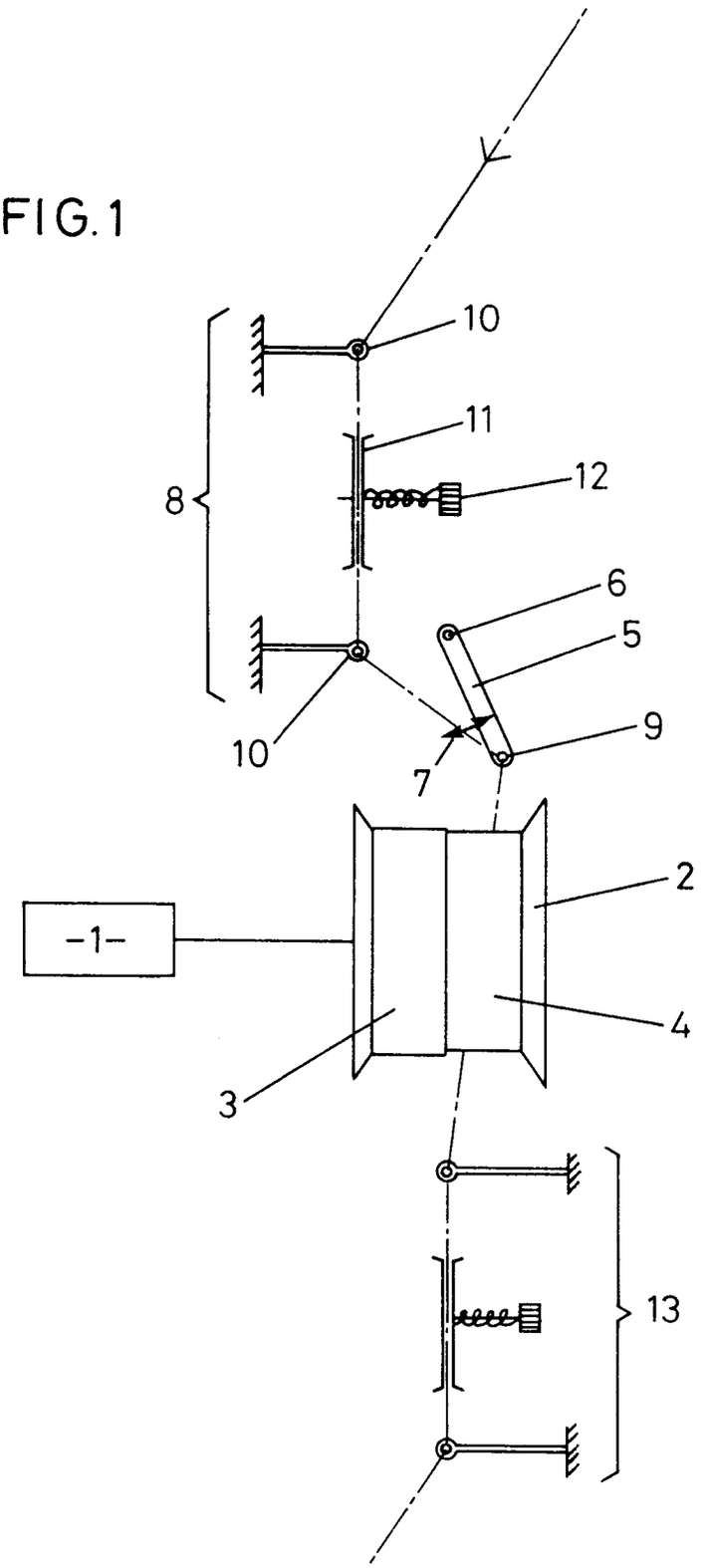

FIG. 2

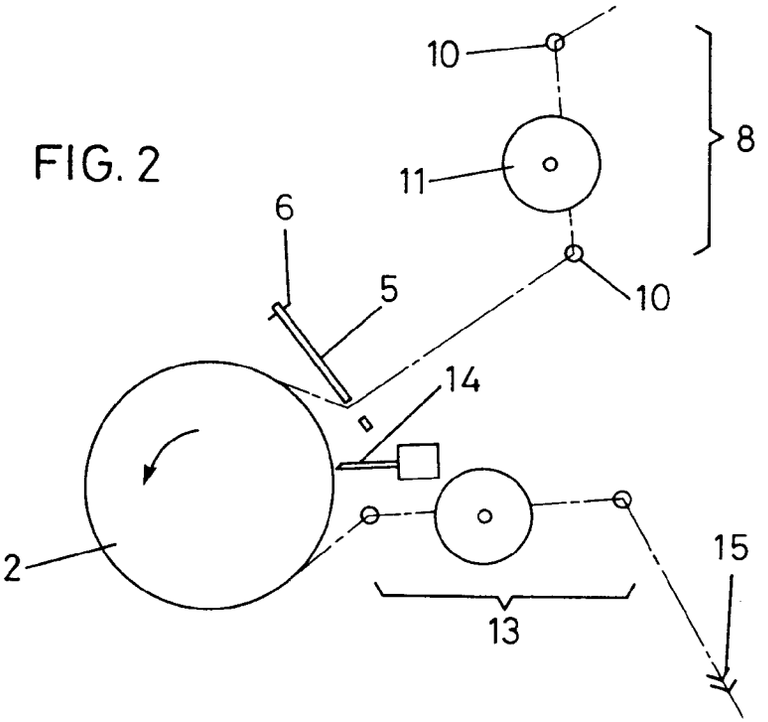
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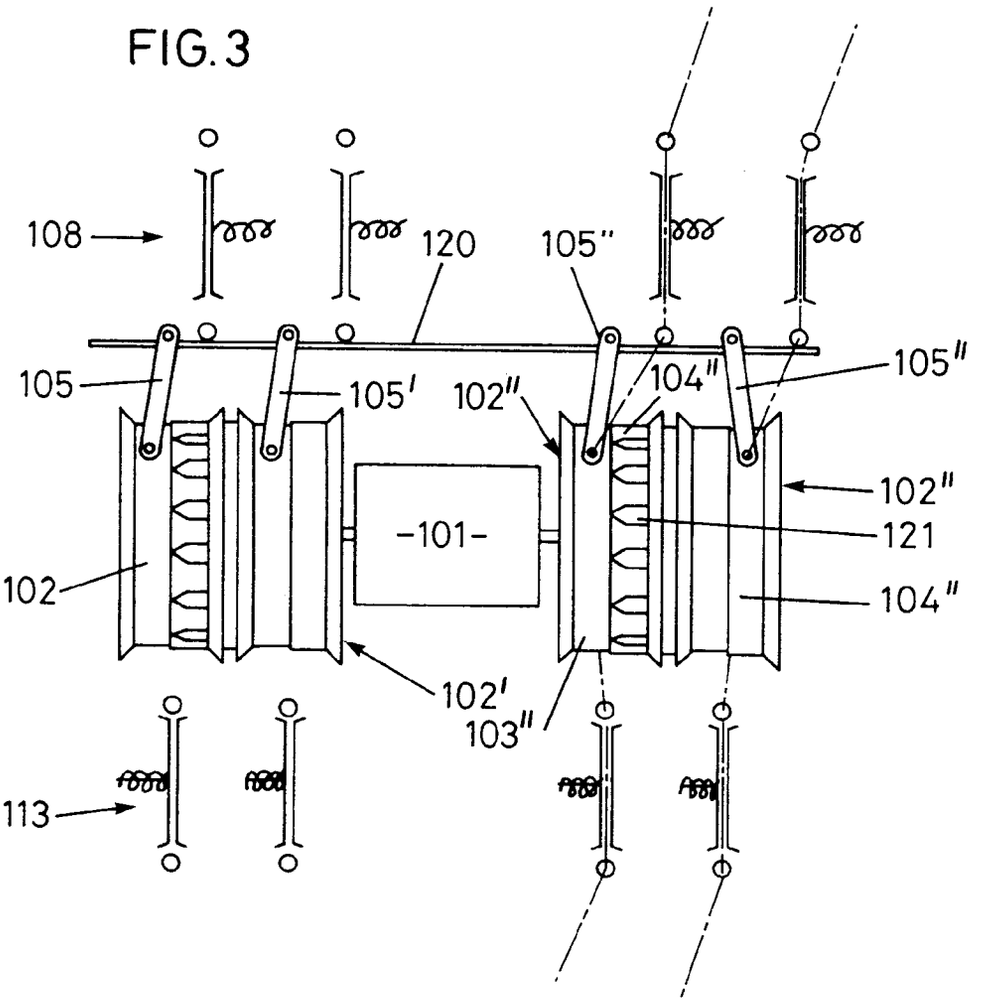
FIG. 3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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 9619

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	FR-A-1 241 501 (JOURAVEL) * page 3, right column, line 23 - page 4, left column, line 13; figure 7 *	1,2	D04B15/48
A	US-A-2 949 756 (CURTIS) * column 2, line 30 - column 4, line 52; figures 1-6 *	1,2,9	
A	FR-A-2 141 482 (INSTITUT TEXTILE DE FRANCE) * page 4, line 16 - line 35; figure 1 *	1,2,3,9	
A	BE-A-720 732 (FRANZ MORAT GMBH) * page 3, line 25 - page 5, line 2; figure 1 *	1,2,4,5,6	
A	FR-A-1 133 959 (G. STIBBE & CO. LTD)		
A	GB-A-2 065 723 (STEVCOKNIT INC.)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D04B
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 JANUARY 1992	VAN GELDER P.A.

CATEGORY OF CITED DOCUMENTS

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