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54 A textile machine provided with a mechanism for rotating a yarn bobbin so as to twist a yarn and a method for operating the same.

57 A method for operating a textile machine and a textile machine for effecting the method, provided with a rotary mechanism, which rotates a supply bobbin having a yarn wound thereon and which twists the yarn withdrawn from the supply bobbin, and a take-up roller, which delivers the twisted yarn, which textile machine comprises:

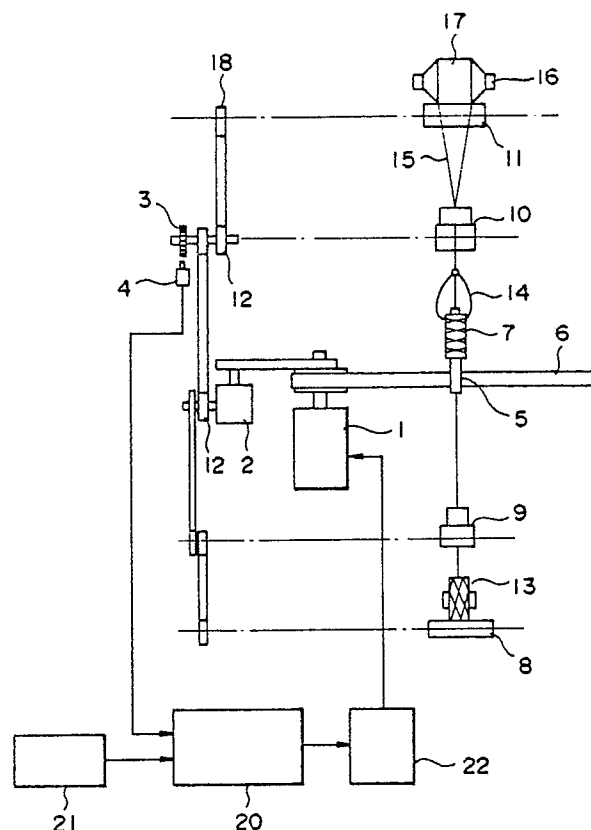
a device for detecting at least one of operating time after start of the textile machine and amount of the withdrawn yarn after start of the textile machine;

a device for calculating the numbers of rotations of the supply bobbin and the take-up roller based on the at least one of operating time and the amount of the withdrawn yarn;

a device for driving the supply bobbin, the driving speed of the driving device being adjustable; and

a device for gradually increasing the number of rotations of the supply bobbin and the number of rotations of the take-up roller in accordance with decrease of a weight of the supply bobbin.

FIG. 1



A TEXTILE MACHINE PROVIDED WITH A MECHANISM FOR ROTATING A YARN BOBBIN SO AS TO TWIST A YARN AND A METHOD FOR OPERATING THE SAME

BACKGROUND OF THE INVENTION

The present invention relates to a textile machine provided with a rotary means, which rotates a supply bobbin having a yarn wound thereon and which twists the yarn withdrawn from the supply bobbin, and a take-up roller, which delivers the twisted yarn, and a method for operating the textile machine.

The textile machine of the present invention includes a covering machine, which is provided with a yarn delivery roller and a rotary mechanism for rotating a wrapping yarn bobbin so as to wrap the wrapping yarn around a core yarn. In such a covering machine, while the core yarn, which is, for example, made of an elastic yarn, is passed through the center of the rotary bobbin, the wrapping yarn, which is supplied from the rotary bobbin and which is, for example, made of a non-elastic yarn, is wrapped around the core yarn so as to produce a covered yarn. The covered yarn is traversed along a winding bobbin by a traverse guide and is wound on the winding bobbin.

Other examples of the textile machine of the present invention are twisting machines, such as an Italian throwing machine and a Hatcho twisting machine, wherein an outer periphery of a wound yarn bobbin is frictionally rotated by a belt or a large pulley so as to twist a yarn withdrawn from the wound yarn bobbin, and the twisted yarn is delivered by a take-up roller and is wound onto a bobbin.

The present invention further provides a method for operating the above-described textile machines, i.e., the covering machine and the twisting machines, such as the Italian throwing machine or the Hatcho twisting machine.

A covered yarn comprises a core yarn, which is, for example, made of an elastic yarn, and a wrapping yarn, which is wrapped around the core yarn and which is, for example, made of a non-elastic yarn. When such a covered yarn is produced, the core yarn, which is, for example, made of an elastic yarn, is rotatably supported on a wound yarn supporting roller. The core yarn is withdrawn from the wound yarn by a delivery roller and a take-up roller.

A hollow bobbin having a wrapping yarn, which is, for example, made of, a non-elastic yarn wound thereon is rotatably supported at a position between the delivery roller and the take-up roller and is rotated by means of a driving belt. Due to the rotation of the wrapping yarn bobbin, the wrapping yarn, which is, for example, made of a non-elastic

yarn, is wrapped around the core yarn which passes through the hollow portion of the wrapping yarn bobbin, and thus a covered yarn is produced.

In a conventional covering machine, the rollers and the wrapping yarn bobbins are always rotated at a constant speed from the start of the covering machine to the stop of the covering machine. Thus, the maximum speeds of the covering machine is limited by the number of rotations of the wrapping yarn bobbin with the maximum wound amount.

Similarly, in a twisting machine, such as an Italian throwing machine or a Hatcho twisting machine, the bobbin having a yarn wound thereon is frictionally rotated by a belt or a large pulley so as to twist the yarn, the bobbin is always rotated at a constant speed from the start of the machine to the stop of the machine. Thus, the maximum speeds of the machine is limited by the number of rotations of the yarn supply bobbin with the maximum wound amount.

The allowable number of rotations of a rotary shaft, which is usually called as a spindle, for a wrapping yarn bobbin or a yarn supply bobbin depends on the spindle maker. When the same spindle is focussed, the allowable number of rotations depends on the amount of yarn wound on the wrapping yarn bobbin or the yarn supply bobbin, and it decreases as the amount of yarn increases.

As described above, conventionally, the driving speed of the rotary mechanism, and accordingly, the driving speed of the yarn withdrawal roller, are determined based on the allowable number of rotations of the yarn supply bobbin, such as, the yarn wrapping bobbin, with the maximum wound amount, and the rotary mechanism and the yarn withdrawal mechanism are always driven at a constant speed from the start to the stop of the textile machine. Thus, the productivity of the conventional textile machine is very low.

OBJECT OF THE INVENTION

It is an object of the present invention to enhance the productivity, which has been low as described above, in the conventional textile machine provided with a rotary means, which rotates a supply bobbin having a yarn wound thereon and which twists the yarn withdrawn from the supply bobbin, and a take-up roller, which delivers the twisted yarn.

SUMMARY OF THE INVENTION

According to the present invention, the above-described object is achieved by a method for operating a textile machine provided with a rotary means, which rotates a supply bobbin having a yarn wound thereon and which twists the yarn withdrawn from the supply bobbin, and a take-up roller, which delivers the twisted yarn, characterized in that the number of rotations of the supply bobbin and the number of rotations of the take-up roller are gradually increased in accordance with decrease of a weight of the supply bobbin caused by withdrawal of the yarn from the supply bobbin.

Further, the present invention provides a textile machine which is suitable to carry out the above-described method, which textile machine provided with a rotary means, which rotates a supply bobbin having a yarn wound thereon and which twists the yarn withdrawn from the supply bobbin, and a take-up roller, which delivers the twisted yarn, which textile machine further comprises:

a means for detecting at least one of operating time after start of the textile machine and amount of the withdrawn yarn after start of the textile machine;

a means for calculating the numbers of rotations of the supply bobbin and the take-up roller based on the at least one of operating time and the amount of the withdrawn yarn;

a means for driving the supply bobbin, the driving speed of the driving means being adjustable; and
a means for gradually increasing the number of rotations of the supply bobbin and the number of rotations of the take-up roller in accordance with decrease of a weight of the supply bobbin.

According to the present invention, as the amount of wound yarn of the supply bobbin decreases, the rotational speed can be increased. Accordingly, the productivity of the textile machine of the present invention, such as a covering machine, an Italian throwing machine and a Hacho twisting machine, can be enhanced.

More specifically, since the bobbin is rotated at a low speed when the amount of yarn wound on the yarn supply bobbin, such as the wrapping bobbin, is large, the maximum amount of yarn wound on the yarn supply bobbin, such as the wrapping yarn bobbin, can be increased. Accordingly, the textile machine of the present invention, such as a covering machine, an Italian throwing machine and a Hacho twisting machine, can be operated for a long time without changing a yarn supply bobbin, such as a wrapping yarn bobbin. As a result, the man-hour, which is required for replacement of the yarn supply bobbin, such as the wrapping yarn bobbin, per unit operating time can be lowered, and the productivity can be enhanced.

In addition, conventionally, the amount of the final product, i.e., the package of the processed

yarn, is limited due to the maximum amount of yarn wound on the yarn supply bobbin, such as the wrapping yarn bobbin, and the frequency for replacing the bobbins. Contrary to this, according to the present invention, the weight of the yarn supply bobbin can be increased, and accordingly, since the winding operation can be continued for a long time without replacing the wrapping yarn bobbin or the yarn supply bobbin, the amount of yarn wound on a product package can be enlarged, and the productivity can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be explained in detail with reference to an embodiment wherein the present invention is carried out for production of a covered yarn, wherein:

Fig. 1 is a schematic elevation view of a covering machine according to the present invention;

Fig. 2 is a diagram showing relationship between the weight of a yarn supply bobbin and the curve of number of rotations of a spindle in accordance with the operating method of the present invention;

Fig. 3 is a flow chart showing the operating method of the present invention;

Fig. 4 is a diagram explaining a method for approximating by segments a curve of the present invention showing the relationship between the weight of a yarn supply bobbin and the curve of number of rotations of a spindle; and

Fig. 5 is a diagram showing the allowable number of rotations of a spindle and practically admitted range.

EMBODIMENTS

A covered yarn has such a construction that it comprises a core yarn, which is, for example, made of an elastic yarn, and a wrapping yarn, which is wrapped around the core yarn and which is, for example, made of a non-elastic yarn.

In production of such a covered yarn, a covering machine which is schematically illustrated in Fig. 1 is used.

Referring to Fig. 1, covering machine has, from the lower portion thereof to the upper portion thereof, a feed roller 8, a feed roller 9, a take-up roller 9 and a winding roller 11, rotatably mounted thereon. A plurality of rollers 8, 9, 10 and 11 are disposed along the machine frame of the covering machine, and at one end of the machine frame, the rollers 8, 9, 10 and 11 are connected to a set of change pulleys 12 which determines the twist number and

which constitute a drive mechanism 18.

A belt 6 for driving spindles is horizontally extending along the machine frame between the feed roller 9 and the take-up roller 10 and is driven in one direction by a drive motor 1, the drive speed of which can be adjusted. A number of spindles 5 are rotatably supported between the feed rollers 9 and the take-up rollers 10, and they are rotated by the spindle drive belt 6 with which they are in frictional contact.

The drive motor 1 and the drive mechanism 18 are connected to each other via a reduction gear 2. In place of the connection via the reduction gear 2, the drive mechanism may be driven by a motor disposed separated from the drive motor, and the numbers of rotations of both the drive motors may be simultaneously controlled.

The take-up roller 10 has gear teeth 3 for detecting the number of rotations thereof attached at the end thereof, and a conventionally known sensor 4 of a proximity switch type for detecting number of rotations is disposed on the machine frame so that it faces the gear teeth 3 for detecting the number of rotations.

The sensor 4 for detecting number of rotations is connected to a controller 20, which is connected to a setter 21 for setting the operating speed of the textile machine of the present invention.

The setter 21 is used to previously memorize such data as the initial supply bobbin weight (w_0 g), the thickness of the yarn (d denier), the curve showing the relationship between the numbers of rotations of the yarn supply bobbin 14 and the spindle 5, in other words, the data concerning the weight of the yarn supply bobbin, the number of rotations of the drive motor 1 at the start of the textile machine of the present invention, and the numbers of rotations of the drive motor 1 during winding operation.

The controller 20 accommodates a mechanism for detecting the time after start of the operation of the textile machine, which mechanism is usually referred to as a clock mechanism. The controller 20 is further provided with a mechanism for detecting the length l (m) of the withdrawn supply yarn after start of the operation calculated on the basis of the integrated numbers of rotations n (rpm) of the take-up roller 10 which are detected by the sensor 4 and the peripheral length of the take-up roller 10.

In addition, the controller 20 includes a calculating mechanism, which calculates first the weight of the withdrawn yarn $1d/9,000$ (g) based on the withdrawn yarn length l (m) which has been detected by the yarn length detecting mechanism and the yarn thickness (d denier) which has been previously memorized, and which then calculate the weight of supply yarn bobbin at that time w_0 -

$1d/9,000$ (g) by subtracting the weight of the withdrawn yarn from the initial weight of the supply bobbin (w_0 g).

Further, the controller 20 calculates the number of rotations of the spindle at that time from the curve showing the number of rotations of the spindle based on the yarn feeding speed which is detected by the sensor 4 for detecting the number of rotations and the weight of the yarn supply bobbin.

The controller 20 is connected to the above-described drive motor 1 via an inverter 22, and it can alter the number of rotations of the drive motor 1 by controlling the inverter 22 based on the number of rotations of the spindle which has been calculated in the controller 20.

The operation of the covering machine illustrated in Fig. 1 will now be explained. A core yarn 13, which is, for example, made of an elastic yarn and which is wound on a bobbin, is rotatably supported on a feed roller 8.

When the start switch is pushed on, the drive motor 1 is started. Thus, the spindle 5 is rotated at a predetermined initial spindle speed, and the take-up roller 10 is driven at a speed corresponding to the initial spindle speed via the reduction gear 2 and the drive mechanism 18. When the initial speed is reached, the operation start switch is pushed on, and the core yarn 13 is withdrawn from the core yarn bobbin 13 by means of the feed roller 9 and the take-up roller 10.

A hollow bobbin 7 having a wrapping yarn 14, which is, for example, made of a non-elastic yarn, wound thereon is rotatably supported on the spindle 5 at a position between the feed roller 9 and the take-up roller 10, and the spindle 5 is in frictionally contact with the spindle driving belt 6 and is rotated by the latter. Due to the rotation of the wrapping yarn bobbin 7, the wrapping yarn, which is, for example, made of a non-elastic yarn 14, is wrapped around the core yarn 13, which is passing through the hollow portion of the wrapping yarn bobbin 7, and thus a covered yarn is produced.

The covered yarn 15 is fed over a bar guide and is traversed to and fro by a traverse guide of a traverse device (not shown).

A winding bobbin 16 is rotatably supported by a package support device (not shown) and is driven by the winding roller 11.

The covered yarn 15 is traversed by the traverse guide and is wound onto the winding bobbin 16 to form a package 17.

An example of the relationship between the weight of the wrapping yarn bobbin 7 which is supported on a commonly utilized spindle 5 and the allowable number of rotations of the spindle 5 is illustrated in Fig. 5.

In Fig. 5, the hatched portion indicates the

practically admitted range. In practical use, the figures smaller than the allowable number of rotations are selected in order to prolong the lifetime of the bearings.

In a conventional operation, a certain fixed condition in the hatched range is selected, and the textile machine is operated under the condition. For example, when the maximum weight of the wrapping yarn bobbin is 500g in a covering machine, the operation of the covering machine is started at a spindle speed between 16,000 and 28,000rpm, and the number of rotations of the spindle is kept at the initial speed until completion of the operation.

Contrary to this, in the operating method of the present invention illustrated in Fig. 2, the number of the rotations of the spindle 5 is gradually increased along a line connecting a point A, which shows a speed of 22,000rpm at a maximum weight of 500g, and a point B, which shows a speed of 40,000rpm at a weight of 50g, as the wrapping yarn 14 is exhausted. Should the allowable number of rotations of the bearings be 40,000rpm, the number of rotations is kept constant, i.e., 40,000rpm for the weight less than 50g.

In order to carry out the method of the present invention, before the start of the operation, the controller 22 memorizes the initial weight (w_0 g) of the wrapping bobbin 14, the thickness of the yarn (d denier), the curve showing the relationship between the numbers of rotations of the wrapping yarn bobbin 14 and the spindle 5. An example for memorizing the curve, as illustrated in Fig. 4, the curve showing the relationship between the numbers of rotations of the wrapping yarn bobbin 14 and the spindle 5 is approximated by segments connecting five points A, B, C, D and E.

After start of the operation, the number of rotations is detected by the sensor 4, and as described above, in the controller 22, the yarn length withdrawn from the wrapping yarn bobbin 14 after start of the operation is calculated in accordance with the following equation.

Yarn Length (m) = Integrated number of rotations $\times$ π $\times$ Diameter of Take-up Roller (m)

π stands for the ratio of the circumference of a circle to its diameter.

Then, the weight w (g) of the wrapping yarn bobbin at that time is calculated in the controller in accordance with the following equation using the length of the withdrawn yarn.

Weight of Wrapping Yarn Bobbin (g) = Initial Weight of Wrapping Yarn Bobbin w_0 (g) - Yarn Length (m) $\times$ d (denier)/9,000

The set number of rotations of the spindle 5 is determined utilizing the wrapping yarn bobbin weight w (g) which has been calculated in a foregoing manner and the number n (rpm) of rotations

of the spindle which was detected by the sensor 4 in accordance with the curve which has been previously memorized in the controller 20 and which shows the relationship between the weight of the wrapping yarn bobbin 14 and the number of rotations of the spindle 5. Based on the set number of rotations of the spindle 5, an output is emitted to the inverter 22 so as to drive the drive motor 1 at a predetermined speed, and accordingly, to rotate the spindle 5 and the take-up roller 10 at predetermined speeds.

The above-described detection of the number of rotations and the determination of the number of rotations of the spindle are repeated, and the numbers of rotations of the wrapping yarn bobbin 7 and the take-up roller 10 are gradually increased in accordance with the decrease of the weight of the wrapping yarn due to the withdrawal of the wrapping yarn 14 from the wrapping yarn bobbin 7.

When the remaining amount of the wrapping yarn bobbin 7 becomes substantially zero, the drive motor 1 is stopped. The winding bobbin 17 is doffed after the covering machine becomes standstill, and the wrapping yarn bobbin 7 having covered yarn wound thereon is replaced by a new one, and the above-described procedures are repeated.

In an alteration, a wrapping yarn bobbin 7 may have a maximum amount of about 1,000g wound thereon which is remarkably larger than that of the above-described wrapping yarn bobbin, i.e., 500g. The number of rotations at the start of winding operation is set at 15,000rpm, which is indicated by point C and which is considerably smaller than that of point A, i.e., 22,000rpm. After start, the number of rotations of the spindle is increased along a curve connecting points A and C. In this case, the average production can be almost the same as that obtained by constantly driving a wrapping yarn bobbin with the maximum amount of 500g at 22,000rpm, and the size of the winding bobbin can be enlarged.

Although the explanation was done with reference to embodiments of a covering yarn, the present invention is also applicable to twisting machines, such as an Italian throwing machine and a Hachō twisting machine.

According to the present invention, as the amount of wound yarn of the supply bobbin decreases, the rotational speed can be increased. Accordingly, the productivity of the textile machine of the present invention, such as a covering machine, an Italian throwing machine and an Hachō twisting machine, can be enhanced.

More specifically, since the bobbin is rotated at a low speed when the amount of yarn wound on the yarn supply bobbin, such as the wrapping bobbin, is large, the maximum amount of yarn wound on the yarn supply bobbin, such as the

wrapping yarn bobbin, can be increased. Accordingly, the textile machine of the present invention, such as a covering machine, an Italian throwing machine and a Hachō twisting machine, can be operated for a long time without changing a wrapping yarn bobbin or a yarn supply bobbin. As a result, the man-hour, which is required for replacement of the yarn supply bobbin, such as the wrapping yarn bobbin, per unit operating time can be lowered, and the productivity can be enhanced.

In addition, conventionally, the amount of the final product, i.e., the package of the processed yarn, such as the covered yarn, is limited due to the maximum amount of yarn wound on the yarn supply bobbin, such as the wrapping yarn bobbin, and the frequency for replacing the bobbins. Contrary to this, according to the present invention, the weight of the yarn supply bobbin can be increased, and accordingly, since the winding operation can be continued for a long time without replacing the yarn supply bobbin, such as the wrapping yarn bobbin, the amount of yarn wound on a product package can be enlarged, and the productivity can be enhanced.

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Claims

1. A method for operating a textile machine provided with a rotary means, which rotates a supply bobbin having a yarn wound thereon and which twists said yarn withdrawn from said supply bobbin, and a take-up roller, which delivers said twisted yarn, characterized in that the number of rotations of said supply bobbin and the number of rotations of said take-up roller are gradually increased in accordance with decrease of a weight of said supply bobbin caused by withdrawal of said yarn from said supply bobbin.

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2. A method according to claim 1, wherein said textile machine is a covering machine, said supply bobbin has a hollow portion and has wrapping yarn wound thereon, and a core yarn passes through said hollow portion.

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3. A textile machine provided with a rotary means, which rotates a supply bobbin having a yarn wound thereon and which twists said yarn withdrawn from said supply bobbin, and a take-up roller, which delivers said twisted yarn, which textile machine comprises:

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a means for detecting at least one of operating time after start of said textile machine and amount of said withdrawn yarn after start of said textile machine;

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a means for calculating the numbers of rotations of said supply bobbin and said take-up roller based on said at least one of operating time and said amount of said withdrawn yarn;

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a means for driving said supply bobbin, the driving speed of said driving means being adjustable; and a means for gradually increasing said number of rotations of said supply bobbin and said number of rotations of said take-up roller in accordance with decrease of a weight of said supply bobbin.

4. A machine according to claim 3, which is a covering machine, said supply bobbin is a hollow bobbin and has wrapping yarn wound thereon.

FIG. 1

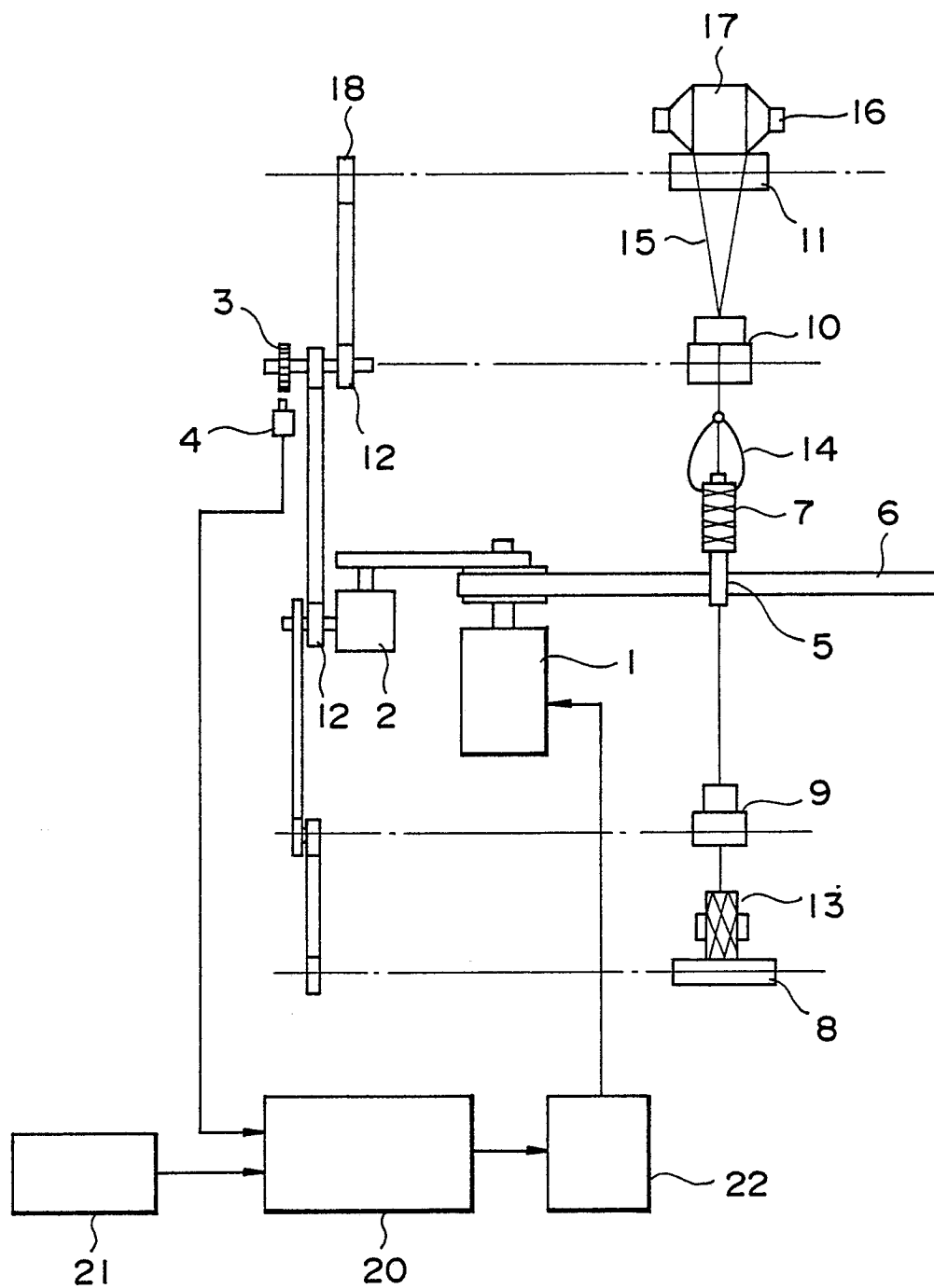


FIG. 2

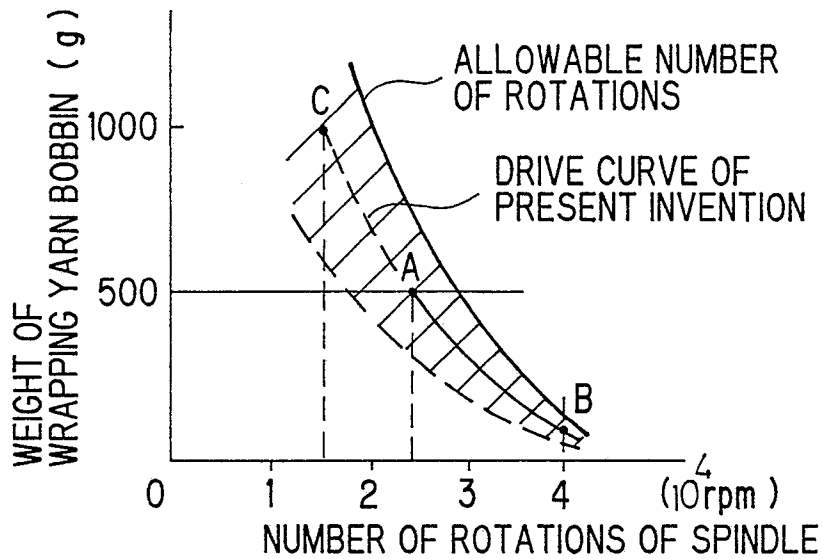


FIG. 4

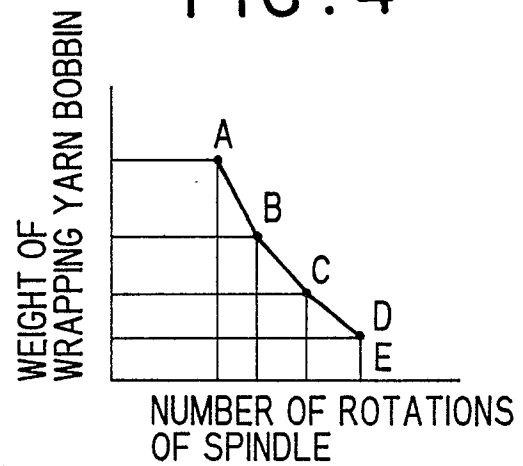


FIG. 5

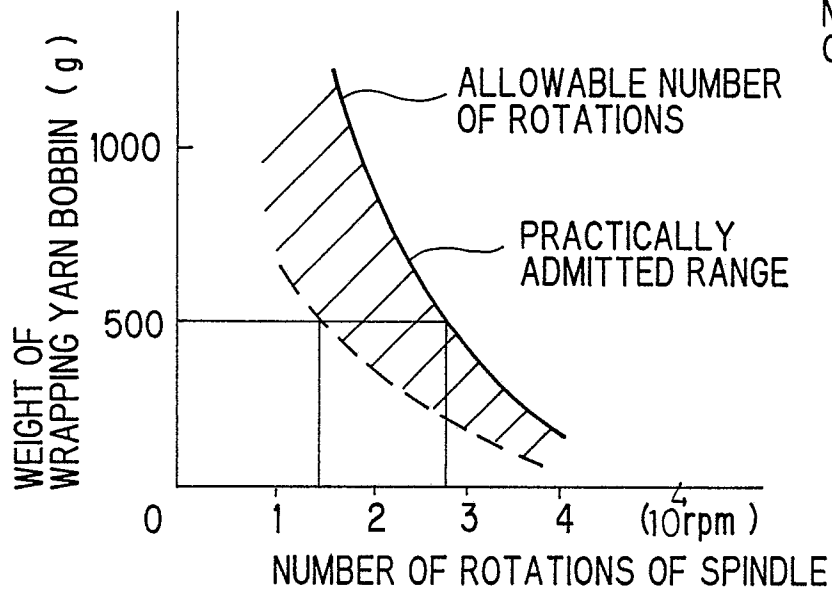
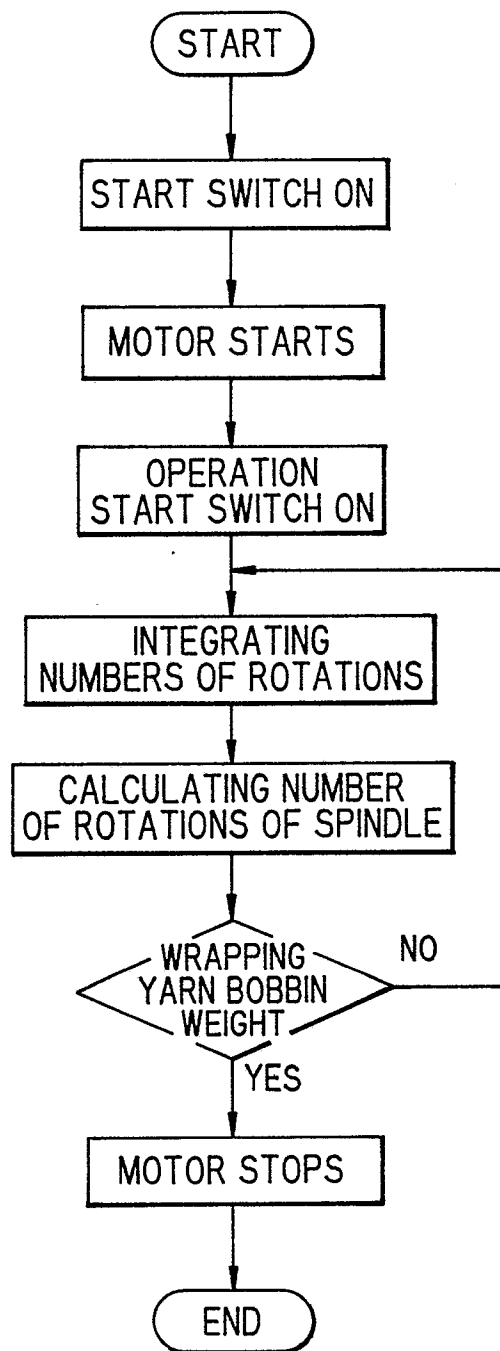


FIG. 3





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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	DE-A-3713350 (VEB KOMBINAT TEXTIMA) * claims 1-4 * ---	1, 3	D01H1/34
A	US-A-2803107 (J.R. LONG) * column 1, lines 15 - 55 * ---	1, 3	
A	DE-A-1952909 (ZINER TEXTILMASCHINEN GMBH) * page 3, lines 3 - 7 * ---	1, 3	
A	US-A-3377793 (H. WHITTAKER) * column 1, lines 28 - 38 * -----	1, 3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D01H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23 NOVEMBER 1989	Examiner HOEFER W. D.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document			