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(54) **PROCESS TO SET THE OPTIMAL WORKING HEIGHT BETWEEN THE ENTRY POINT AND THE EXIT POINT OF THE THREAD IN A TWISTING MACHINE AND/OR THREAD SPINNING MACHINE, AND TWISTING MACHINE AND/OR THREAD SPINNING MACHINE THAT APPLIES SUCH PROCESS**

(57) Process to set the optimal working height between the thread entry point and the thread exit point in a twisting and/or thread spinning machine, and a twisting and/or thread spinning machine that applies such process, comprising: identifying the variation of tension of the thread produced by the variation of the winding diameter (d) of the thread (8) on the bobbin (5), depending on the position of the rocker (6), or the winding diameter of the thread on the bobbin (5); carrying out the displacements from the thread entry point (PE) and/or from the thread exit point (PS) to obtain a distance (LB) between both in which the variations of tension counter each other.

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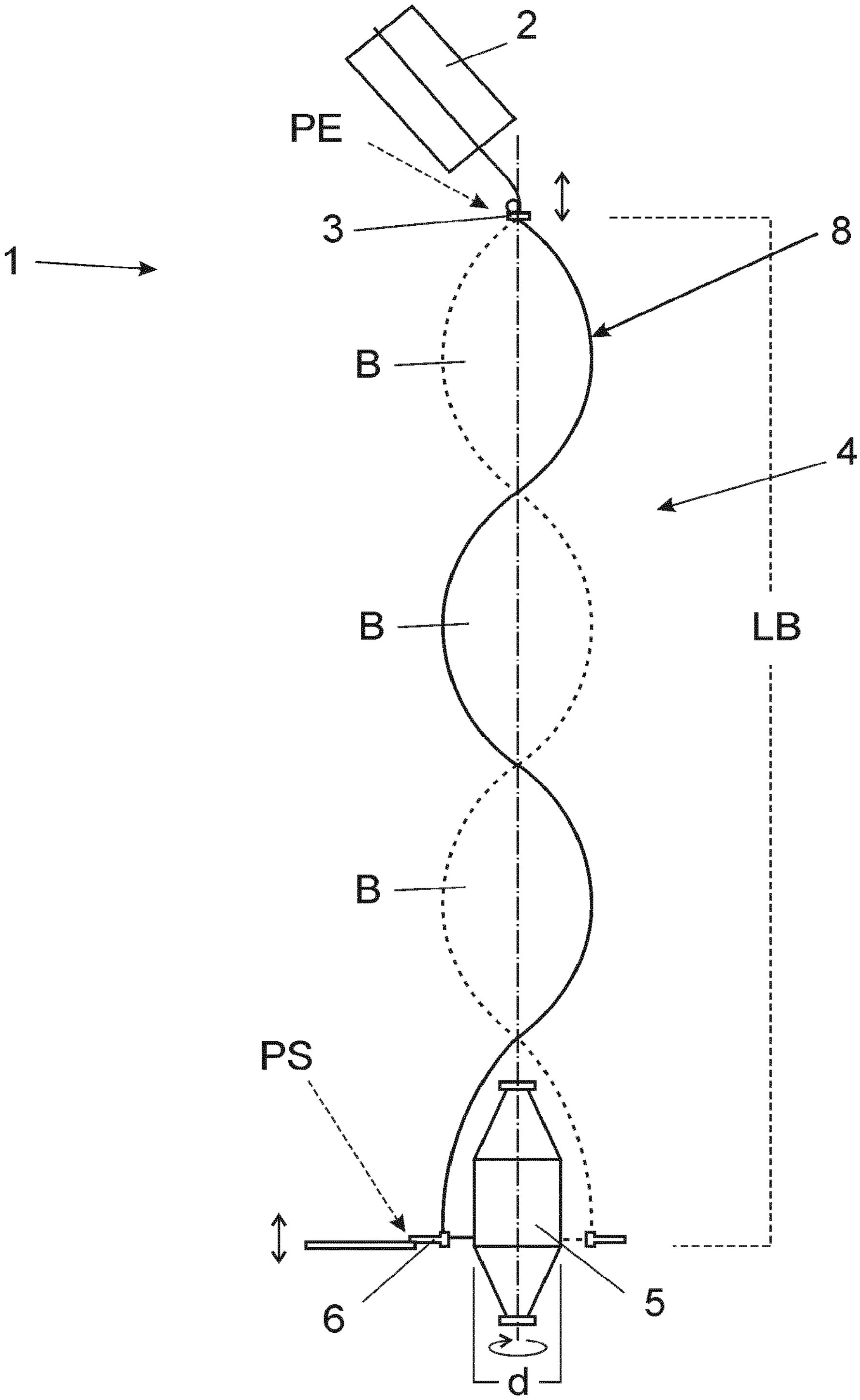

FIG. 1

Description

OBJECT OF THE INVENTION

[0001] The invention, as stated in the title of this specification, refers to a process to set the optimal working height between the entry point and the exit point of the thread of the twisting area in a twisting machine and/or thread spinning machine, as well as a twisting machine and/or thread spinning machine that apply such process.

[0002] The object of this invention refers, concretely, on the one hand , to a process the aim of which is, through a series of relative movements between the rocker (exit point PS of thread) and the thread guide (entry point PE of thread) of a twisting and/or spinning machine that operates with two or more balloons, achieving that, at each moment of the working cycle, the distance (LB) between the said points (PE, PS) is the most suitable, in order that the thread twisting working speed is maximum and the thread has the maximum tension evenness necessary to stand the said speed without breaking, achieving thus a significant increase of the productivity , a second feature of the invention being a twisting and/or spinning machine provided with the means to implement such process.

FIELD OF APPLICATION OF THE INVENTION

[0003] The field of application of this invention is within the textile sector, and more concretely within the scope of the industry engaged in manufacturing twisting or thread spinning machines.

BACKGROUND OF THE INVENTION

[0004] In the textile sector, and namely in the sector of spinning and twisting, the use of different types of spinning machines is known: continuous ring spinning machines, ring twister, in fact machines that process the thread through a balloon.

[0005] In this type of machines, the maximum working speed is strictly associated to the maximum tension that the thread can stand without breaking.

[0006] In this sense, the applicant himself is the holder of a patent application, number ES 2 606 069 A1 in which a process is disclosed through which, instead of a unique balloon is generated for the thread at a given height as usual, the twisting occurs by means of multiple areas of balloon that offsets the working tension at the said height, so that the tension produced is lower for a same working speed

[0007] Therefore, it is deducted that for a thread, the predetermined ring diameter, weight of the cursor and angular speed of the spindle, the variation of the tension on the thread during a spinning cycle, in turn, depends on the following:

- The distance (LB) existing between the entry point (PE) and the exit point of the thread (PS), that is the working area, that means the area of the balloon.
- The instant winding diameter of the thread on the bobbin. - The instant winding diameter of the thread on the bobbin.Currently several types of folding format are used upon the client's specifications; spinning bobbin, cylindrical, bottle. In all the folding formats during the filling of the bobbin (collecting means) the thread winding diameter is changing as it is filled.

[0008] Bearing in mind that it is not possible to influence the thread winding diameter on the bobbin or the type of folding format of the thread chosen by the client, it could be deducted that the tension variation during the spinning process is unavoidably present if a distance LB is kept constant.

[0009] Well then, the objective of this invention is to go one step beyond and develop a process to set the optimal distance of the said working area every moment, in order that the variation the thread tension is minimum and therefore the machine can operate at a higher speed, bearing in mind for this all the factors that can vary, as well in the machine, in the thread, as during the twisting process itself, a second objective being to develop a machine that incorporates the means to carry out the said process.

[0010] On the other hand, and with reference to the current state-of-the-art, it shall be stated that, at least the applicant is not aware of the existence of any other process, or any other machine or invention having a similar application, that possesses technical and structural characteristics equal or similar to those that the process and the machine herein claimed.

EXPLANATION OF THE INVENTION

[0011] The process to set the optimal working height between the entry point and the exit point of the thread on a twisting machine and/or a thread spinning machine, and the twisting and/or thread spinning machine that applies the said process, provided by this invention is therefore set up as the suitable solution for the above mentioned objective, the characterizing details making it possible and distinguishing them duly appearing in the final claims attached to this description.

[0012] More concretely, what the invention proposes, as it was stated above, is a process to allow applying maximum twisting speed on a twisting machine, after determining, through a series of tests and/or calculations, and to establish, by means of relative movements of the elements that set the entry points of the thread PE and of exit PS, the distance LB best fit in the area of balloon , that means, between the said entry points of the thread PE and of exit PS, where a trajectory can be drawn up that defines two or more balloons , and has the most possible constant tension to stand the said speed without breaking.

[0013] In a spinning or twisting cycle, the collecting means at the exit point of the thread (PS) are the receiving bobbin that is being filled with thread coming from the cursor located at the point (PS), being guided by a ring that goes up and down (called rocker) jointly in the whole machine for orderly filling, and depending on the type of folding format chosen by the client, the bobbin through alternative up and down movements that climb up little by little until completing the bobbin and ending the cycle.

[0014] Therefore, during the cycle of filling with the thread the said bobbin setting up the receiving means, the winding diameter on it is different or changing depending on the position of the rocker.

[0015] When processing in these machines having multiple balloons, it can be seen that, according to given working parameters, the tension on the thread can decrease or increase, when the distance between PE and PS increases, during the full formation of the bobbin or working cycle.

[0016] At same time, when the thread winding diameter on the bobbin (collecting means) increases the tension on the thread decreases and vice versa.

[0017] Based on it, the process of the invention, to set the optimal working height LB between the thread entry point PE and the exit point PS , contemplates at least a step in which the distance LB is increased or decreased by means of dynamically moving the thread entry point PE and/or the thread exit point PS so that the variations of tension of the thread produced by the variation of the thread winding diameter on the bobbin counter each other, achieving a constant tension on the thread during the working cycle of the spinning or twisting process.

[0018] In addition, when the thread exit point PS goes up at a given speed, the thread entry point PE goes up at a higher speed, so that the distance LB increases to counter the decrease of the winding diameter (d) on the bobbin and keep constant the tension of the thread , and when the thread exit point PS goes down at a given speed, the thread entry point PE goes down at a higher speed, so that the distance LB decreases to counter the increase of the winding diameter on the bobbin and keep constant the tension of the thread .

[0019] The proportion between the speed of the thread exit point (PS) and the thread entry point (PE) is ranging from 1/1,01 to 1/300.

[0020] On its part, the twisting and/or thread spinning machine that the invention proposes to apply such process, and that constitutes a second feature of this invention, comprises, in a well-known manner, the thread guiding means that define the thread entry point PE at the upper part of a twisting area (thread guide), and the collecting means of the twisted thread, set up by the above mentioned bobbin associated to a ring or rocker that define the thread exit point PS at the lower part of the said twisting area, the height to be established being the distance LB between such thread entry point PE and such exit point PS, and it is distinguished in that it comprises drive means to provoke the movement in height of guiding means that define the thread entry point PE, regulating the distance LB between the said points depending on the position of the rocker and of the tension of the thread generated during the working cycle.

[0021] In an embodiment of the machine, the said movement means associated of PE and PS are mechanical means, for example, an extendable mechanism that allow the movement in vertical direction of the support on which the thread guiding means are fixed at the entry point and/or of the support on which the thread fastening means are fastened at the exit point. The said mechanical means can be associated to a unique source of movement (a motor) with eventually a multiplicator or reducer to move (PE) and (PS) at different speeds or associated to two sources of independent movement (two motors) one to move (PE) and the other to move (PS).

[0022] And, in another embodiment such means are electrical means.

[0023] Anyway, when the thread winding diameter in the bobbin is from most to least (as the rocker is moving), the distance LB between (PE) and (PS) increases in a proportion (increase of height of PE / increase of height of PS) determined and on the contrary, when the thread winding diameter on the bobbin is from least to most (as the rocker is moving), the distance LB between (PE) and (PS) decreases in a given proportion.

[0024] In addition, the increase or decrease of the said proportion is preferably ranging from 1/1,01 to 1 /5,0. For example when (PE) rises 10 centimeters (PS) it rises from 10,1 to 50 centimeters.

[0025] For example, for a folding format "spinning bobbin" type where the thread winding diameter decreases when the rocker goes up, the distance LB between (PE) and (PS) increases in a given proportion and that as the rocker goes down and therefore its winding diameter increases, the distance LB between (PE) and (PS) decreases in a proportion associated to that of going up.

[0026] The movements of (PE) and (PS) can be synchronously carried out through synchronization means that can also be mechanical or electrical.

[0027] Last, it must be emphasized that, preferably, the optimum distance LB between the said points PS and PE is determined through mathematical calculations that, preferably, are carried out using a specific software or computer program.

[0028] In that case, the above disclosed process, to obtain the distance LB in which the variations of tension counter each other comprises, the following calculation steps are contemplated:

- First, a step of introduction of the variables of the thread and of the machine, that in each case can be different.

  As for the thread, the value of the mass (m) is contemplated in units of Kg/m.

  As for the machine, the variables to bear in mind are:

  - The radius of the ring (a) is the radius that possesses the working area where the thread is twisted, a radius that is determined by the distance existing between the rotation axis of the collecting bobbin and the cursor that constitutes the thread fastening means at the exit point.

  - The radius of the collecting bobbin (b), that means the distance between the vertical axis of the bobbin and the point where it is winding the thread at a given time. This value is twice the winding diameter.

- Second, an introduction step of the following coefficients of:

  - the thread friction with the air (D_n),

  - the thread friction with the cursor (μ_{Y-T}), that is the element that fastens it at the thread exit point as it was said,

  - and of friction of the cursor with the element that guides it (μ_{R-T}), which is the ring.

- Execution of a series of mathematical calculations for solving, at least, the two following sets of equations:

$$\left(\nu^2 - \bar{T}_g + \frac{1}{2}\bar{r}^2\right)\left(\bar{r}'' - \bar{r}\theta'^2\right) - 2\nu\bar{r}\theta' - \bar{r} = \bar{r}\bar{r}'^2 + D_n\bar{r}^3\bar{r}'\theta'\sqrt{\bar{r}'^2 + \bar{z}'^2}$$

$$\left(\nu^2 - \bar{T}_g + \frac{1}{2}\bar{r}^2\right)\left(2\bar{r}'\theta' + \bar{r}\theta''\right) + 2\nu\bar{r}' = \bar{r}^2\bar{r}'\theta' - D_n\bar{r}^2\left(\sqrt{\bar{r}'^2 + \bar{z}'^2}\right)^3$$

$$\left(\nu^2 - \bar{T}_g + \frac{1}{2}\bar{r}^2\right)\bar{z}'' = \bar{r}\bar{r}'\bar{z}' + D_n\bar{r}^3\bar{z}'\theta'\sqrt{\bar{r}'^2 + \bar{z}'^2}$$

$$1 = \bar{r}'^2 + \bar{r}^2\theta'^2 + \bar{z}'^2$$

[0029] Where all the variables used are dimensionless it is detailed below from where each one is coming:

-

  $$\nu = \frac{V_0}{\omega a},$$

  where Vo is the speed of the thread entering through the thread-guide, -- is the ngular speed of the cursor and - is the radius of the ring.

-

  $$\bar{T}_g = \frac{T_g}{m\omega^2 a^2},$$

  where T_g is the tension at the thread guide and m is the mass per unit of length of the thread (Kg per meter).

- $$\bar{r} = \frac{r}{a},$$

  where r is the radial coordinate of the element of the thread involved.

- θ is the angular coordinate (with respect to the rotation axis) of the element of the thread involved.

- $$\bar{z} = \frac{z}{a},$$

  where z is the coordinate that measures the vertical distance traveled by the element of the thread involved of the thread guide.

- $$\bar{D}_n = \frac{D_n}{\omega}$$

  , where D_n is the coefficient of friction of the thread with the air.

- All the variables bearing an apostrophe, such as *r'*, means that they are derivates with respect to the variable

  $$\bar{s} = \frac{s}{a}$$

  , where s is the length of the thread between the thread guide and the element of the thread involved. In turn, a double apostrophe indicates a second derivate. The derivate are measuring the variation of a variable with respect to the other.

$$T_i(\lambda_i)\left(G_i sin(\phi) - \theta_i'(\lambda_i)\right) = \mu_{R-T}\sqrt{\left(T_i(\lambda_i)\left(r_i'(\lambda_i) + G_i cos(\phi)\right) - M\right)^2 + T_i(\lambda_i)^2 z_i'(\lambda_i)^2},$$
$$T_i(\lambda_i) = T_{gi} - \frac{1}{2}, \qquad G_i = e^{\alpha_i \mu_{Y-T}}, \qquad \alpha_i = sin(\phi)\theta_i'(\lambda_i) - cos(\phi) r_i'(\lambda_i),$$
$$i \in \{1, \ldots, n\}$$

[0030] Where all the variables used are dimensionless, it is detailed below from where each one is coming:

- $$T(\lambda) = \frac{T(\lambda)}{m\omega^2 a^2}$$

  , where *T*(λ) is the tension of the thread just when it is passing through the cursor (-- is the length of the thread between the thread guide and the cursor).

- G = $e^{\mu Y\text{-}T\alpha}$, where μ_{Y-T} is the coefficient of friction between the thread and the cursor and *cos*(α) = *sin*(ϕ)θ'(λ) - *cos*(ϕ)$\bar{\bar{r}}'$(λ).

- ϕ is an angle defined by the equation

  $$sin(\phi) = \frac{b}{a}$$

  , where b is the radius of the bobbin and a is the radius of the ring

- μ_{R-T} is the coefficient of friction between the cursor and the ring.

- Same as above r, θ and z are the cylindrical coordinates, in this case of the cursor, that are coincident with those of the thread.

[0031] These two equations allow to draw a graph of the tensions (T(λ)) of the thread depending on the height (LB), identified as (z) in the functions, between thread guide up to the cursor.

- Last, with the data obtained from all the above, the last step is the determination of the optimal height in order that the tension of the thread (T(λ)) is minimum and allows the higher speed (Vo) without breaking or the optimum height in order that the tension has parameters established depending on the quality of the twisted thread to be obtained by the machine.

[0032] In a preferred embodiment, applicable to all the preceding embodiments, the process comprises an additional step of dynamically determining the winding diameter of the collecting bobbin over time in which the thread twisting process is being carried out. The winding diameter of the collecting bobbin varies as the collecting bobbin is being filled with twisted thread, the winding diameter of the said bobbin is increasing over time. The winding diameter also varies depending on the height of the bobbin and of the folding format used.

[0033] The dynamic determination of the radius can be carried out either through a mathematical calculation starting from the predicated working speed or through a sensor provided for such purpose.

[0034] Therefore, as the radius of the collecting bobbin is a variant to bear in mind for the calculation of the equations that provide a graph that allows to determine the optimal working height, if the radius of the collecting bobbin varies, the optimal working height also varies. And as it can be determined how the value of that radius is varying, it can be known how to vary the height of the thread twisting area to keep the maximum working speed with optimum tension of the thread.

DESCRIPTION OF THE DRAWINGS

[0035] To complement this description that is being done and in order to assist to best understanding the characteristics of the invention, attached to this specification, as an integral part thereof, are drawings in which, for illustration and no limitation purpose the following has been represented:

The figure number 1.- It shows in an elevation view the schematic representation of the basic elements of a thread twisting machine that intervene in the working or twisting area on which the process object of the invention is applied, showing the arrangement of each of them;

the figure number 2.- It shows a schematic elevation view of an example of the thread twisting machine, according to the invention, and an example thereof provided with means for the movement associated of PE and PS for applying the process object of the invention;

the figure number 3-A, and 3B.- It shows both schematic views of the
working area of the machine to which the process of the invention is applied, represented with the thread entry point PE in raised and lowered position, respectively, to modify the distance LB and counter the variations of the bobbin diameter determined by the movement of the rocker.

PREFERRED EMBODIMENT OF THE INVENTION

[0036] At the sight of the the described and unique figure 1, and according to the numerals adopted in it, the stated and described in details below can be seen.

[0037] Concretely, in the said figure 1, it can be seen how the twisting (1) and/or thread spinning machine (8) to which the process of this invention applies, comprises, untwisted thread feeding means (2), associated to guiding means (3) that define the entry point of the thread (PE) at the upper part of a twisting area (4), and twisted thread colleting means, preferably a bobbin (5), associated to a cursor that slides on an associated ring rocker (6) and that defines the thread exit point (PS) at the lower part of the said twisting area (4), moved by movement means (7), the distance (LB), between the thread entry point (PE) and the thread exit point (PS), being the height of the twisting (4) and working area of the machine (1) where the thread can draw two or more balloons (B).

[0038] The process to set the optimal working height between the thread entry point (PE) and the thread exit point (PS) in a twisting and/or thread spinning machine (1) that operates with two or more balloons (B), comprises a step where the distance (LB) is increased or decreased by dynamically displacing the thread entry point (PE) and/or the thread exit point (PS) so that the variations of tension of the thread (8) produced by the variation of the winding diameter (d) of the thread (8) on the bobbin (5) counter each other, achieving a constant tension on the thread during the working cycle of the spinning or twisting process.

[0039] On its part, in the figure 2 an example of twisting and/or thread spinning machine (1) can be seen, adapted to apply the process of the invention, in which, in addition to the above described, it is contemplated to include an extendable mechanism as an example of movement means (9) associated of the points (PE) and (PS), more concretely of the movement (9) in height of the guiding means (3) that define the point (PE), in this case, mechanical, to automatically modify the distance (LB) between the guiding means (3) of the thread at the entry point (PE) and the fastening means (6) of the thread at the exit point (PS) of the twisting area (4), which allows the movement in vertical direction of the support where the said guiding means (3) are fixed.

[0040] Most preferably, the process comprises a step where the distance LB between (PE) and (PS) increases in a given proportion when the thread winding diameter on the bobbin is from most to least (as the rocker is moving), and a step where the distance LB between (PE) and (PS) decreases in a given proportion when the thread winding diameter on the bobbin is from least to most (as the rocker is moving). And the increase or decrease of the said proportion has a value ranging from 0,1% to 300%.

[0041] A practical example is detailed below with real dimensions of spinning work for a continue ring twisting machine according to the figures 3A and 3B:

The folding format used is that of spinning bobbin. Two states FIG 3A and FIG 3B are illustrated in order to show a different positioning of the points (PE) and (PS) and therefore a different LB. In this concrete example, the rocker and therefore the point (PS) is moving at a speed of 1m/seg. In the state shown in the FIG 3A where the thread winding diameter (d') is of 37 millimeters at a height of 60 millimeters with respect to the base of the bobbin, it is worked at a distance (LB') of 500 millimeters. In the state shown in the FIG 3B where the thread winding diameter (d") is of 25 millimeters at a height of 90 millimeters with respect to the base of the bobbin, it is worked at a distance (LB") of 600 millimeters. Therefore, the proportion that increased LB between the state of the FIG 3A and the FIG 3B is LB"/LB' = 600/500 =1.2.

[0042] In addition, although it was not represented in the figures, the machine (1) comprises mechanical or electrical synchronization means to synchronize the said movements the associated movement means (9) of (PE) and (PS) perform.

[0043] On the other hand, the machine (1) also additionally incorporates a specific software, installed in the automaton (10) that controls the operation thereof and of the said associated movement means (9), for determining the optimal distance (LB) of the twisting area (4) or the distance between the thread exit point (PS) and the thread entry point (PE), according to the above described process, that can also serve as means for synchronizing the said movement.

[0044] In addition, the twisting machine (1) also comprises collecting means (11) of the variation of the working radius and/or of the thread winding diameter (d) of the bobbin (5), determined por example by optical sensors or of other types.

[0045] The nature of this invention being sufficiently disclosed, as well as the way of implementing it, it is not deemed necessary to extend any longer its explanation in order that any person skilled in the art understands its scope and the advantages arising from it.

Claims

1. Process to set the optimal working height between the thread entry point (PE) and the exit point (PS) on a twisting and/or thread spinning machine (1) that operates with two or more balloons (B), that comprises

    - feeding means (2) of the untwisted thread (8),
    - guiding means (3) that define the thread entry point (PE) at the upper part of a twisting area (4),
    - a cursor that slides on a ring or rocker (6) and that defines the thread exit point (PS) at the lower part of the twisting area (4), the thread exit point (PS) being mobile in height, and
    - collecting means of the twisted thread or bobbin (5) with a winding diameter (d) of the thread on the bobbin (5), the distance (LB) being the height of the twisting area (4) located between the thread entry point (PE) and the thread exit point (PS) where the thread (8),

    characterized in that it comprises a step where the distance (LB) increases or decreases by displacing dynamically the thread entry point (PE) and/or the thread exit point (PS) so that the variations of the tension of the thread (8) produced by the variation of the winding diameter (d) of the thread (8) on la bobbin (5) counter each other, achieving a constant tension on the thread during the working cycle of the spinning or twisting process.

2. Process to set the optimal working height between the thread entry point and the exit point in a twisting and/or thread spinning machine, according to the claim 1, **characterized in that** the distance LB between (PE) and (PS) increases when the thread winding diameter on the bobbin is from most to least, and a step where the distance LB between

(PE) and (PS) decreases when the thread winding diameter on the bobbin is from least to most.

3. Process to set the optimal working height between the thread entry point and the exit point on a twisting and/or thread spinning machine, according to any of the preceding claims, **characterized in that** the proportion between the increase or decrease of the height thread exit point (PS) and the increase or decrease of the height thread entry point (PE) is between 1/1.01 and 1/50.

4. Process to set the optimal working height between the thread entry point and the thread exit point in a twisting and/or thread spinning machine, according to any of the preceding claims, **characterized in that**, in addition, to calculate the said optimal distance (LB) the following steps are carried out:

- introduction of variables of the thread (8); its mass, and the variables of the machine (1); the radius of the ring or rocker (6) and the collection radius of the bobbin (5),
- introduction of the coefficients:

  of friction of the thread (8) with the air,
  of friction of the thread (8) with the fastening means (6),

- execution of the equations:

$$\left(v^2 - T_g + \frac{1}{2}r^2\right)\left(r'' - r\theta'^2\right) - 2vr\theta' - r = rr'^2 + D_n r^3 r'\theta' \sqrt{r'^2 + z'^2}$$
$$\left(v^2 - T_g + \frac{1}{2}r^2\right)\left(2r'\theta' + r\theta''\right) + 2vr' = r^2 r'\theta' - D_n r^2 \left(\sqrt{r'^2 + z'^2}\right)^3$$
$$\left(v^2 - T_g + \frac{1}{2}r^2\right) z'' = rr'z' + D_n r^3 z'\theta' \sqrt{r'^2 + z'^2}$$
$$1 = r'^2 + r^2\theta'^2 + z'^2$$

$$T_i(\lambda_i)\left(G_i sin(\phi) - \theta_i'(\lambda_i)\right) = \mu_{R-T}\sqrt{\left(T_i(\lambda_i)\left(r_i'(\lambda_i) + G_i cos(\phi)\right) - M\right)^2 + T_i(\lambda_i)^2 z_i'(\lambda_i)^2},$$
$$T_i(\lambda_i) = T_{gi} - \frac{1}{2}, \qquad G_i = e^{\alpha_i \mu_{Y-T}}, \qquad \alpha_i = sin(\phi)\theta_i'(\lambda_i) - cos(\phi) r_i'(\lambda_i),$$
$$i \in \{1, \ldots, n\}$$

- generating a graph of the tensions of the thread (8) according to the height between the thread exit point (PS) and the entry point (PE) of the said thread in the twisting area (4),
- automatic determination by the software of the optimal height (LB) from the data obtained in the said graph.

5. Thread twisting and/or spinning machine (1) with one or more balloons (B) that applies a process as disclosed in any of the preceding claims, that comprises:

• feeding means (2) of the untwisted thread (8),
• guiding means (3) that define the thread entry point (PE) at the upper part of a twisting area (4),
• a cursor that slides on a ring or rocker (6) and that defines the thread exit point (PS) at the lower part of the said twisting area (4), the thread exit point (PS) being mobile in height, and
• collecting means of the twisted thread, such as a bobbin (5) with a winding diameter (d) of the thread on the bobbin,
the distance (LB) being the height of the twisting area (4) located between the thread entry point (PE) and the thread exit point (PS)
characterized in that it comprises, movement means (9) in height of guiding means (3) that define the thread entry point (PE).

6. Twisting and/or thread spinning machine, according to the claim 5, **characterized in that** it also comprises collecting means (11) of the diameter (d) of the bobbin (5).

7. Twisting and/or thread spinning machine, according to the claim 5, **characterized in that** the movement means (9) in height of guiding means (3) that define the thread entry point (PE) are an extendable mechanism that allows the movement in vertical direction of the support at which the guiding means (3) of the thread are fixed at the entry point (PE).

8. Twisting and/or thread spinning machine, according to the claim 8 or 9, **characterized in that** in addition it comprises mechanical or electrical synchronization means to synchronize the movements of the thread entry point (PE) and of the thread exit point (PS).

9. Twisting and/or thread spinning machine, according to any of the claims 5 to 8, **characterized in that** it comprises a specific software installed in an automaton (10) that the movement means (9) and therefore the distance (LB) depend on the winding diameter (d).

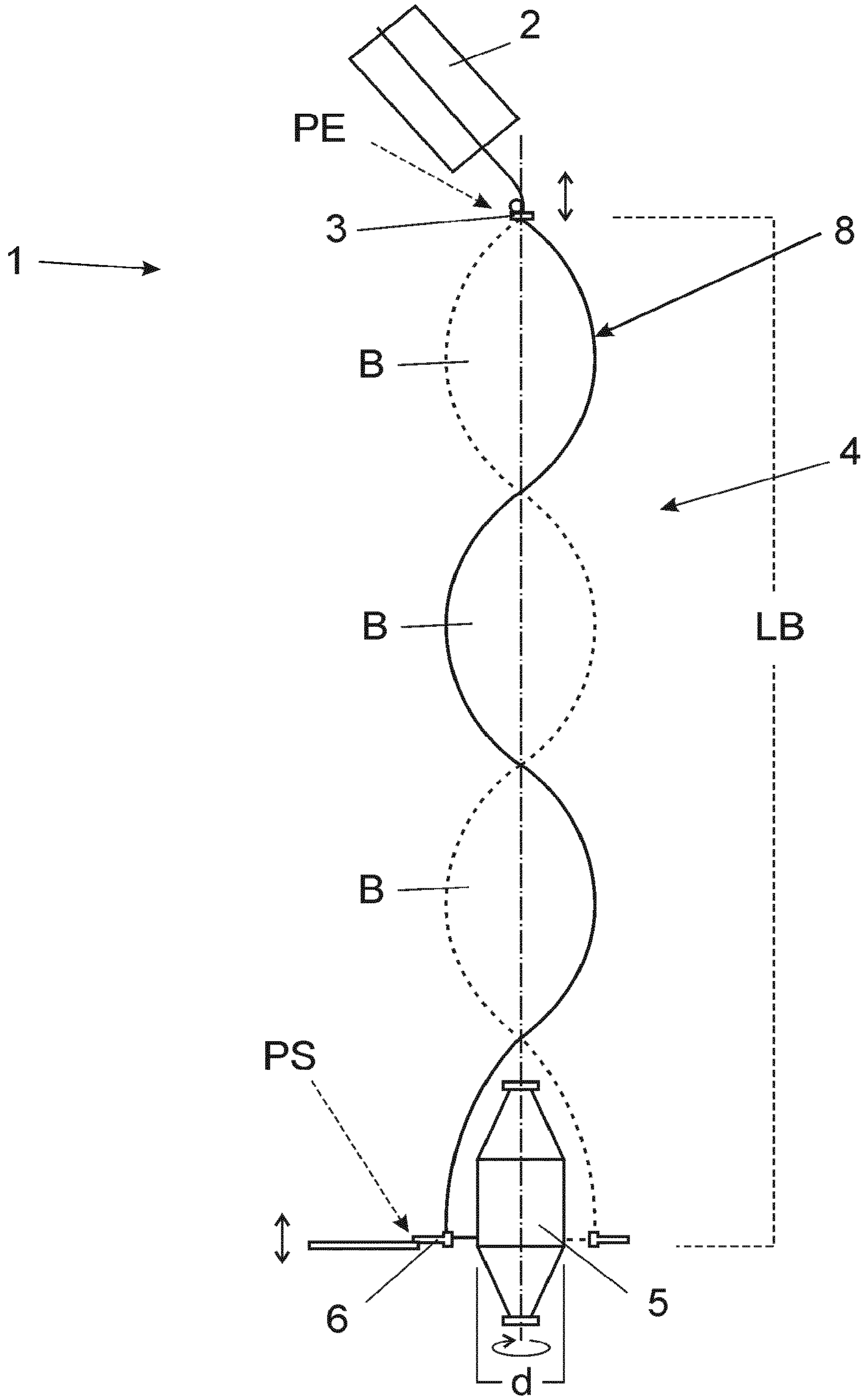

FIG. 1

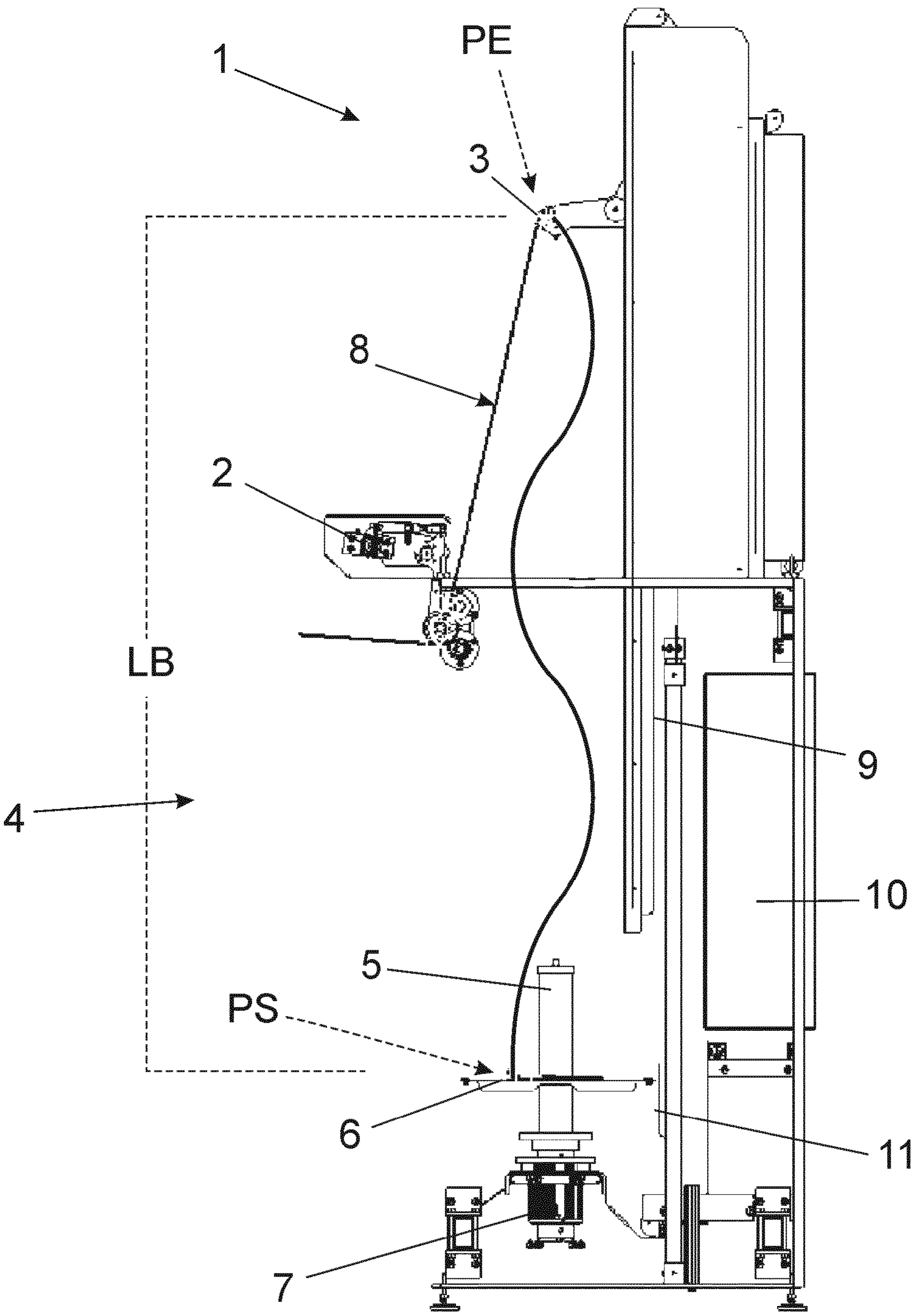

FIG. 2

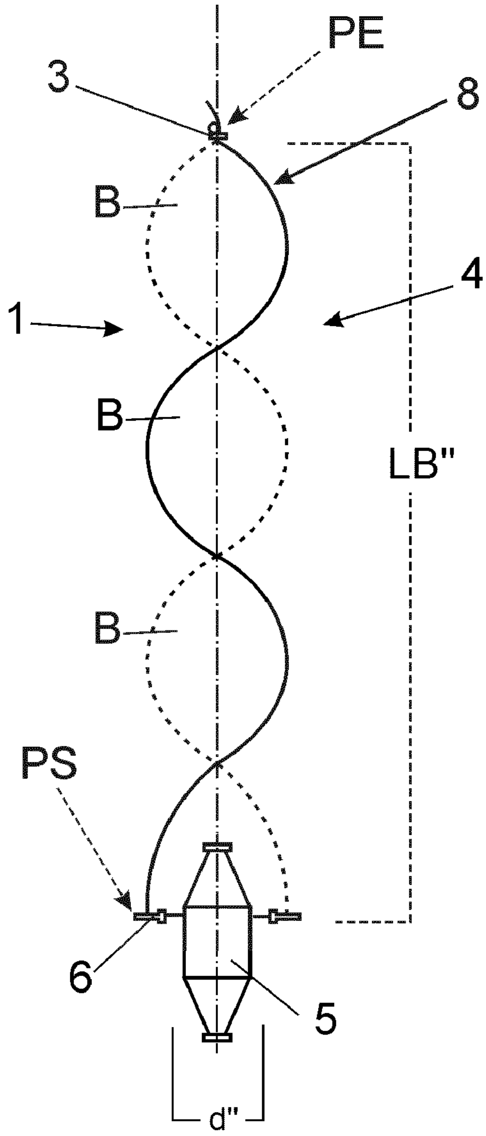

FIG. 3-A

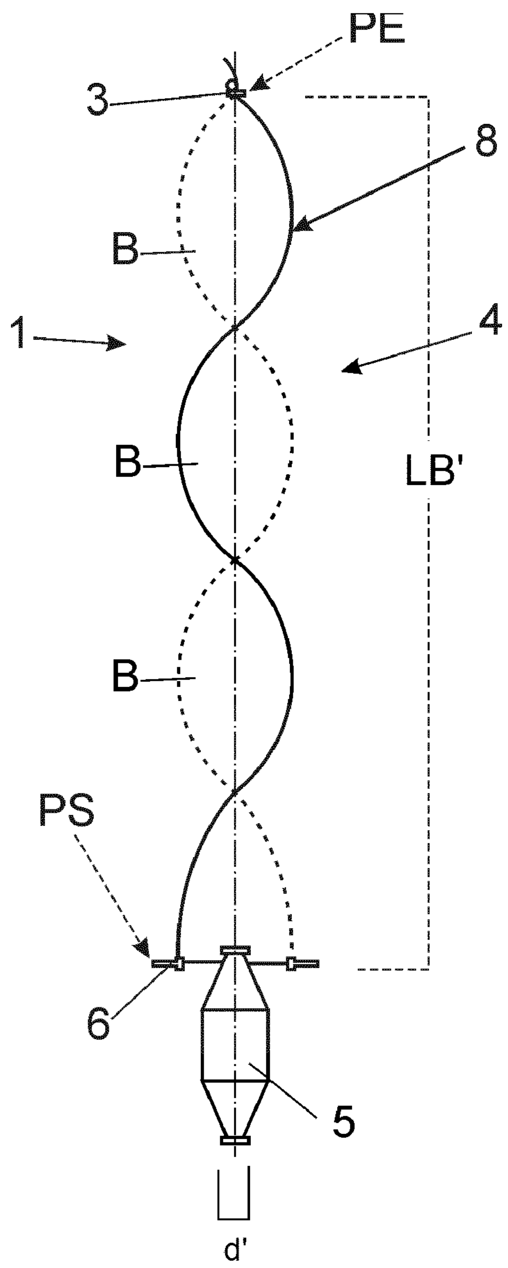

FIG. 3-B

INTERNATIONAL SEARCH REPORT

International application No
PCT/ES2020/070403

A. CLASSIFICATION OF SUBJECT MATTER
INV. D01H1/02 D01H1/36 D01H13/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	WO 2018/122625 A1 (TWISTPERFECT S L [ES]; CASUMCONI S L [ES]) 5 July 2018 (2018-07-05) paragraph [0046] - paragraph [0052]; figures 1-2 paragraph [0056] - paragraph [0058] -----	1,3,5-9 2,4
Y	DE 612 109 C (BBC BROWN BOVERI & CIE) 23 April 1935 (1935-04-23) page 1, line 1 - page 1, line 10 page 1, line 58 - page 2, line 86; figures 1-4 -----	1,3,5-9
Y	FR 2 789 409 A1 (ICBT YARN [FR]) 11 August 2000 (2000-08-11) page 3, line 5 - page 4, line 8 page 5, line 27 - page 7, line 2; figure 2 -----	1,3,5-9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 September 2020	08/10/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Todarello, Giovanni

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/ES2020/070403

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2018122625 A1	05-07-2018	AU 2017385976 A1	25-07-2019
		BR 112019013524 A2	23-06-2020
		CA 3048433 A1	05-07-2018
		CL 2019001780 A1	08-11-2019
		CN 109072493 A	21-12-2018
		CO 2019007640 A2	20-08-2019
		CU 20190065 A7	04-02-2020
		EC SP19054387 A	30-08-2019
		EP 3540102 A1	18-09-2019
		JP 2020514563 A	21-05-2020
		KR 20190100213 A	28-08-2019
		PE 20191252 A1	18-09-2019
		WO 2018122625 A1	05-07-2018
		ZA 201904912 B	26-02-2020
DE 612109 C	23-04-1935	DE 612109 C	23-04-1935
		FR 738650 A	28-12-1932
FR 2789409 A1	11-08-2000	NONE	

Form PCT/ISA/210 (patent family annex) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- ES 2606069 A1 **[0006]**