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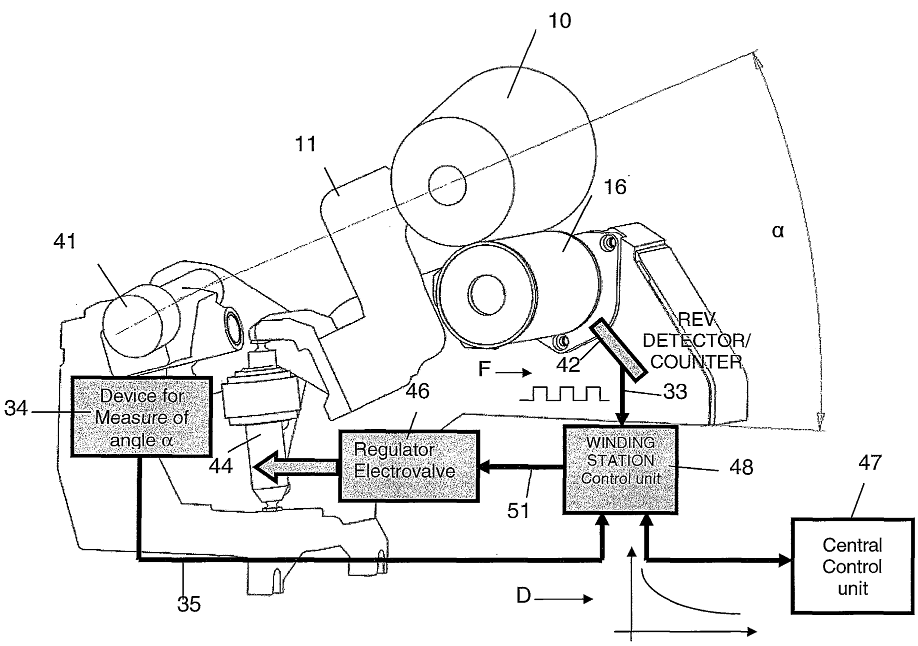
(54) **Device and procedure for the regulation of the contact pressure of a winding bobbin**

(57) Device and process for the regulation of thread winding onto a bobbin (10) by applying a desired contact pressure P_c of the operating bobbin, providing the bobbin-holder arm (11) with a counterweighing counterthrust P_p, on the basis of a pre-established trend of the value of P_c in relation to the advance length of the bobbin (10), indicating the weight of the bobbin (10) in relation to the ratio between the length reached and indicating the rising α angle of the bobbin-holder arm (11), calculating the weight component due to the bobbin (10) and said arm (11) and applying a counterthrust Pp equal to the difference between said component and the pre-established value of the contact pressure P_c referred to the length reached.

Fig. 2



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Description

[0001] The present invention relates to a device and procedure for regulating the winding of thread onto a bobbin to obtain the formation of high-quality bobbins both with respect to form and winding density, in the collection of yarn produced or processed by textile machines for bobbin winding. In industrial practice, the collection technique of yarns is widely prevalent, by activating the rotation of a tube, made idle by the mandrels of a bobbin-holder arm and pulling the yarn coming from a releasing organ to be wound thereon. The bobbin is thus formed by pulling and winding the yarn onto its surface, as it is entrained in rotation with an underlying motorized roll on which the bobbin itself rests. This allows the yarn to be wound at a constant linear rate, regardless of the dimension of the bobbin with the advancing of the winding, and only in relation to the rotation rate of said driving roll. During the formation of the bobbin, the bobbin-holder arm moves away and progressively rises with respect to the motorized driving roll in rotation of the bobbin rotating around its hinging on the structure of the machine. The yarn is thus spirally wound onto the rotating bobbin and distributed with a backward and forward movement on its surface.

[0002] According to the necessities for the subsequent use of the yarn on the bobbin for processing downstream of the bobbin winding, the bobbin must have a conical or cylindrical form, by winding it onto a conical or cylindrical tube. The driving rolls can also be conical or cylindrical. With reference to the scheme of figure 1, which illustrates the technical problem, in general, the distribution of the yarn on the bobbin is effected by the same driving cylinder, which is processed with traversing throats 17 which distribute the thread 18 with an axial backward and forward movement on the surface of the bobbin 10, whereas the driving cylinder 16 in rotation gives it the necessary driving torque for its winding. The number of traversing helixes situated on the bobbin driving cylinder 16, varies according to the titers and densities of the bobbin to be obtained.

[0003] The invention is described herein with reference to automatic bobbin winders in the winding of thread onto a conical tube to form a conical bobbin, moved with a driving roll having a straight cylindrical form, but with the specification that it can also be applied to bobbin winders in which straight cylindrical bobbins are formed, moved in rotation with conical or cylindrical rolls, and also for other textile machines in which the thread processed or produced upstream is collected on bobbins.

[0004] Bobbin winders generally consist of a series of heads or bobbin winding units aligned along the whole front of the machine and equipped with common service equipment for their running; each of them is independent of the others and consequently the bobbins in formation can have different advance degrees in their winding. With reference to the scheme of figure 1, the bobbin 10 is held by the bobbin-holder arm 11 equipped with two counterpoints 12, 13 which are engaged with the conical tube 14 of the base of the bobbin. The conical bobbin in formation 10 rests and presses on the driving roll or cylinder 16, driven by the motor M. The traversing throats 17 distribute the thread 18 with an axial backward and forward movement on the bobbin. The bobbin 10 in formation progressively increases in dimension and weight. The resting pressure of the bobbin on its collection cylinder 16 has a great influence on the density of the bobbin itself.

[0005] The technical problem towards which the present invention is directed is to obtain a good bobbin form, in the sides in the bottom and in the tip, and also in the correct packing of the yarn on its surface, by regulating the parameters which influence it.

[0006] Once a certain type of driving cylinder has been adopted - 1,5-2-2,5-3 helixes for each run - in relation to the titers processed and average densities required, the main winding parameters which influence the packing of the yarn are the bobbin/cylinder pressure and the tension of the winding thread.

[0007] As far as the bobbin/cylinder pressure is concerned, each bobbin winding unit which forms the bobbin winder is equipped with its own counterweighing device which regulates the pressure exerted by the bobbin on its driving or collection roll 16. The weight exerted by the bobbin on the cylinder derives from the bobbin-holder arm 11 and from the bobbin 10.

[0008] In general, the bobbin-holder arm 11 is a device which can be raised and lowered rotating around a fulcrum and which has its own invariable and defined weight. The bobbin-holder arm is generally produced with a considerable weight to satisfy the requirements of stability and attenuation of the vibrations. The bobbin 10 also has its own weight, which increases as the winding proceeds and also contributes to the overall resting pressure on the collection cylinder 16. Without counterweighing, the contact pressure of the bobbin on the cylinder would generally be excessive. When the bobbin is significantly deformed in its resting line on the cylinder, the thread is pulled at a lower rate and deposited on the bobbin in its pressed generatrix and according to a much smaller diameter than the effective diameter of the bobbin, thus creating an uncontrolled tension on the wound yarn, which increases on its own. In this case - even if not reaching the point of yarn breakage - excessively hard bobbins would in any case be obtained and, in the case of slippery yarns, due to the low friction between the wound coils, there would be malformations of the sides of the bobbin, whose innermost layers tend to slip due to the pressure towards the ends.

[0009] In the known art, the remedy generally adopted is that of counterweighing by applying a force to the bobbin-holder arm which contrasts the weight of the arm and bobbin, with pneumatic devices or devices with springs anchored on one side to the structure of the machine and on the other side to the bobbin-holder arm. The anchoring points are conceived so that, with the rotation of the bobbin-holder arm being raised or lowered, the counterweighing torque can vary according to a certain law, with a variation in the force applied and/or of its arm: once the application geometry has been determined, the course of the torque applied is established on the basis of the angle of the bobbin-holder arm. Said regulation system, for example that according to patent IT 1.231.742, which regulates the counterweighing force and contact pressure on the basis of the value of the diameter of the growing bobbin, increasing the lifting force of the bobbin in a direct ratio with its diameter. This patent also envisages measuring the diameter on the basis of the ratio between the rotation rates of the bobbin and its driving cylinder. This system is not without drawbacks: for example, the system does not allow the value of the diameter with the bobbin at a standstill to be known; furthermore its indications are misleading during transitory regimes. The diameter to which said prior document refers is the diameter of the deformed bobbin in its resting generatrix on the roll, and not its real diameter.

[0010] The basic criterion of the counterweighing pressure regulation is that the smaller the diameter, the less the bobbin-holder arm has to unload. If the bobbin is too compressed therefore and is deformed more than necessary, the diameter indicated is even more reduced with respect to the correct value and the bobbin-holder arm unloads even less: the error is magnified. The reference to the mere diameter of the bobbin as the only indicative parameter of its weight also leads to a further significant imprecision, as the winding parameters, the yarn titer, the cross angle of the windings, the bobbin-winding tension and so forth, are not taken into consideration: i.e. it neglects the real density of the bobbin, to which the ratio between the real diameter and the weight of the bobbin should refer.

[0011] The present invention is defined in the first claim in its most general meaning of a regulation process of the form and density of the bobbin formed by the winding of yarn. Its variants or preferred embodiments are defined in the dependent claims from 2 to 7.

[0012] The present invention is defined in claim 8 in its meaning of a regulation device of the form and density of the bobbin formed by the winding of yarn. Its variants or preferred embodiments are defined in the dependent claims from 9 to 11.

[0013] Figure 1 illustrates the scheme - in a front view - of a thread collection unit in an automatic bobbin winder and illustrates the technical problem.

[0014] Figure 2 illustrates a scheme of a thread collection unit - in a perspective view and cross-section - of a bobbin-winding station, which indicates the most significant organs which intervene in the process and which form the device according to the present invention for the control and regulation of the bobbin formation.

[0015] Figures 3 to 8 show illustrative diagrams of the weight trends and force exerted as thrusts and counterthrusts exerted on the driving cylinder with the proceeding of the bobbin winding, again calculated with respect to the length.

[0016] The regulation system of the formation according to the present invention, is based on the following logic. During the formation of the bobbin, when the titer of the yarn wound and winding parameters (number of helixes on the driving cylinder and winding tension) are known, the progressive weight of the bobbin P_r is indicated on the basis of the length of thread wound, measured directly with the progressive number of revs of the driving cylinder 16 from the beginning of the bobbin, also possibly taking into account the weight of the empty tube 14. This weight is revealed with much more accuracy than what can be indicated by the deformed diameter of the bobbin. The weight of the bobbin is substantially concentrated on the driving cylinder and has a straight trend with respect to the length indicated, as shown in figure 3.

[0017] According to the scheme of figure 2, again during the formation of the bobbin, the bobbin-holder arm 11 does not change its weight P_b, but, as the winding proceeds, it changes inclination, passing from an initial α_0 for the empty tube to a progressively increasing α value. In the scheme of figure 2, the α angles are indicatively represented as the inclination with respect to the horizontal of the joining of the axis of the fulcrum 41 of the bobbin-holder arm 11 with the axis of the bobbin 10.

[0018] As the bobbin increases, and with it the α angle, the weight distribution of the bobbin-holder arm between its fulcrum 41 and pressure on the driving cylinder 16, varies: the part of weight P_{ba} of the bobbin-holder arm which is resting on the cylinder 16 decreases with an increase in the α, as illustrated in figure 4, which shows the trend of the part of weight P_{ba} resting on the cylinder in relation to the thread length.

[0019] As for the most recently designed bobbin-winders, each bobbin-winding station is equipped with its own control unit which individually governs the winding operation: it is connected with the centralized control unit of the bobbin-winder receiving instructions and exchanging data and information.

[0020] According to the present invention, the control unit of the single bobbin-winding station is equipped with a rev detector/counter 42 of the driving cylinder; as indicated in figure 1, for example, the rev meter of the driving cylinder 16 is produced with a probe disk which generates impulses in a number proportional to its rotation, indicating the number of impulses progressively received with a receptor 30 and transmitting them, with a line 33, to the control unit of the single bobbin-winding station. A measurer 34 of the rising α angle of the bobbin-holder arm is associated with this.

[0021] Rev-counting devices are known in the art and can be produced with various techniques. A rev-counting device can be produced for example as a disk integral with the rotating part, as shown in figure 1 - for example with a disk 29 fitted on the axis of the driving cylinder 16 in figure 1, or on the bearing of the mandrel of the bobbin-holder arm - having an outer surface with N-S magnetic poles and a Hall effect probe suitably positioned for detecting the passage of said rotating poles. With every passage of a N polar expansion (or also the opposite S) the sensor generates an electric impulse, indicated by a sensor 30 and transmitted to the control unit with the line 33. As the number of poles arranged on the circumference of the magnetic disk is known, it is possible, by counting the number of impulses, to determine the number of revs effected.

[0022] On the basis of the formulations received, when the weight of the bobbin-holder arm and titer of the yarn being processed are known, the control unit of the bobbin-winding unit is capable, with each indication of the α angle and progressive revs effected by the cylinder 16, to calculate the weight component ($P_r + P_{ba}$) which would be totally resting on the driving cylinder 16, without the intervention of the counterweighing device, which corresponds to the sum of the trends of figures 3 and 4 in relation to the length.

[0023] For each type of bobbin and yarn, the desired trend of the part of weight resting on the driving cylinder in relation to the advancing of the bobbin, to obtain the optimum bobbin conformation, is experimentally known. Figure 5, for example, shows desired trends of the resting force exerted on the driving cylinder with the advancing of the bobbin-winding, calculated with respect to the length. In diagram A, relating to normal yarns, the desired value of the desired resting force is constant at 100%, whereas in some cases, for example for elasticized or low-friction yarns, the first winding layers must be much more compact, so that they do not extend beyond the edges under the pressure of the upper layers which are wound over them. The trend of diagram B, specifically illustrates these types of yarns, for which after the winding of the first 20-30% of bobbin length, a percentage decrease in said resting force is required, which passes from the initial 100% to lower values. Depending on the type of yarn and destination of the bobbin, the bobbin-winding parameters are pre-selected for obtaining a certain winding density of the bobbin, experimented during the previous bobbin-winding operations.

[0024] According to the present invention, the desired trend of the contact or resting pressure P_c, specific for the yarn and bobbin being processed, again calculated with respect to the progressive length of the bobbin, is established at the beginning of the processing operation in the central unit of the bobbin-winder and transmitted thereby to the control units of all the bobbin-winding stations or units.

[0025] The Pp, or the counterthrust to be supplied with the piston of the counterweighing device 44, is calculated each time by the control unit of the bobbin-winding unit as the difference

$$P_p = (P_r + P_{ba}) - P_c \qquad \text{(a)}$$

between the total weight component due to the arm 11 and the bobbin 10 which would be resting on the driving cylinder 16, without the intervention of the counterweighing device 44, and the weight or desired resting pressure.

[0026] On the basis of the desired counterthrust value Pp, the control unit 48 of the bobbin-winding unit provides a command to a pressure regulating valve 46 which feeds the pneumatic counterweighing device 44. In the embodiment of figure 2, the pneumatic counterweighing device illustratively consists of a simple-effect piston 44 fed by a proportional regulator electrovalve 46 which determines the pressure of the service fluid to be supplied to said piston 44.

[0027] In the embodiment of the invention described so far, the value of the α angle is directly measured on the bobbin-holder arm 11 each time with the angular sensor 34. According to an alternative embodiment of the present invention, described hereunder, the value of the α angle is calculated instead on the basis of the length measured, thus reducing the measuring to the sole detection of the revs progressively effected by the driving cylinder. When the geometry of the bobbin-holder arm system is known, the α angle value can be easily estimated by calculation on the basis of the length wound which, when the winding density of the bobbin is known, corresponds to the volume of the wound bobbin. This calculation can be effected by the control units of the machine, for example the control unit 48 of the single bobbin-winding unit.

[0028] Illustratively referring, for example, to the cylindrical bobbin wound by the driving of a cylindrical roll, given the following sizes:

α : rising angle of the bobbin-holder arm
α_0 : rising angle of said arm with an empty bobbin
Φ : diameter of the bobbin
Φ_0 : diameter of the tube, i.e. of the empty bobbin
l : useful length of the bobbin-holder arm
L : bobbin length
ρ : density of the bobbin
s: gauge, or axial length, of the bobbin

Tit : yarn titer in m/g

$$\alpha = \mathrm{atan}\ (\ \Phi/2l\ ) - \alpha_0 \qquad \text{(b)}$$

wherein

$$\Phi = \sqrt{\frac{L}{Tit \cdot (\rho \cdot \pi \cdot s)} + \frac{\Phi c}{4}^{2}} \qquad \text{(c)}$$

and therefore

$$\alpha = \mathrm{a\,tan}\left(\frac{\Phi}{2 \cdot l}\right) - \alpha_0 = \mathrm{a\,tan}\left[\frac{\sqrt{\frac{L}{Tit \cdot (\rho \cdot \pi \cdot s)} + \frac{\Phi c}{4}^{2}}}{2 \cdot l}\right] - \alpha_0 \qquad \text{(d)}$$

[0029] Figure 6, on the other hand, illustratively shows the trend of the α angle with respect to the horizontal plane in relation to the length for conical bobbins.

[0030] The detection, calculation and command process for regulating the formation of the bobbin is effected as follows. The central control unit 47 of the machine contains the constructive data - established una tantum - of the bobbin-winding station : for example the weight of the arm P_b, the diameter $Ø_c$ of the driving cylinder, the ratio between the counterweighing thrust Pp and pressure fed with the electrovalve 46.

[0031] Again on the control unit 47 of the bobbin-winder - at the beginning of an operating cycle - the values of the bobbin-winding parameters are established for obtaining the desired density p, the yarn titer, and also the final weight of the bobbin P_f i.e. of the final bobbin length. The control unit of the bobbin-winder 47 - again at the beginning of an operating cycle - sends the established values so far described to the single control units 48, generally consisting of electronic cards, with which the bobbin-winding units forming the machine are equipped.

[0032] As already specified above, the desired trend D of the contact or resting pressure P_c - necessary for obtaining a bobbin having the desired characteristics, specific for the yarn and bobbin being processed, and as always calculated with respect to its progressive length - is established at the beginning of the processing operation in the central unit of the bobbin-winder and transmitted thereby to the control units of all the stations or bobbin-winding units.

[0033] During the processing, each single bobbin-winding unit operates autonomously and has a bobbin with its own advance degree, which can differ from one to another, as also its control unit 48 controls its bobbin in relation to its advancement. Said unit 48 receives impulses F corresponding to the revs effected by the driving cylinder, for example generated by a probe disk, measures the metres of thread wound on the basis of the impulses received and calculates the bobbin weight P_r.

[0034] According to the two alternative embodiments described above, the control unit of the bobbin-winding unit proceeds with the direct detection, or calculation on the basis of the length indicated, of the rising α angle of the bobbin-holder arm.

[0035] From these two measurements, length wound and rising angle of the bobbin-holder arm, it then calculates the thrust on the driving cylinder due to the weight P_r of the bobbin and the thrust P_{ba} on the cylinder due to the weight P_b of the bobbin-holder arm, whose incidence varies with the lifting of the arm itself.

[0036] The control unit 48 of the bobbin-winding unit also knows the counterthrust value Pp underway with the counterweighing piston on the basis of the command signal provided in the previous regulation step of the electrovalve 46; it is therefore capable of calculating the P_c resulting from the detections effected on the basis of the expression (a) and compares it with the value of P_c which is required as a base for the present length parameter on the basis of the trend of the diagram established at the beginning of the bobbin-winding operation.

[0037] When the value of P_c previously provided significantly differs from the P_c value required on the basis of the new indication, the control unit 48 of the bobbin-winding unit calculates the pressure to be supplied to the piston and sends the signal of the new pressure value to be fed to the counterweighing device 44, to the electrovalve 46.

[0038] Figure 7 illustratively shows the trend of the counterweighing force Pp in relation to the length, wherein the curve A refers to normal yarns and the curve B refers to elasticized yarns. Analogously, figure 8 illustratively shows the trend of the pressure in bar to be fed with the electrovalve 44.

[0039] According to another embodiment variant of the present invention, the α angle value can either be directly detected and also calculated on the basis of the length reached, comparing them with each other. When the two values differ considerably, the density of the bobbin being processed differs from the desired density: if the α angle value detected directly significantly exceeds the calculated value, the bobbin is too soft and must increase its density and vice versa. The cause of this diversity can be sought locally for the single unit - for example an non-calibrated thread-tensioner - or for the whole bobbin-winder - for example variations in the pressure of the service fluid distributed to the thread-tensioner and/or counterweighing devices.

[0040] Once the hypothesis of an irregular parameter on the whole bobbin-winder has been discarded, a possible remedy can consist in the local correction of the tension supplied to the thread: on the basis of the difference in the α values, the control unit 48 of the bobbin-winding unit increases or reduces the thread tension to increase or decrease the density of the bobbin ρ_r to the desired value, processing and sending the relative command signal to the thread-tensioner not indicated in the figure for the sake of simplicity.

[0041] According to a perfected embodiment of the process for regulating the formation of the bobbin according to the present invention, in the restarting phase of the bobbin, the value of P_c is increased to allow a better entrainment of the bobbin, reducing the slippages between the bobbin 10 and the driving cylinder 16, consequently reducing the counterthrust Pp of the counterweighing device 44, with respect to that of the regime regulation for the length reached. The reduction value of the thrust value (or counterthrust) Pp is within the range of 20% - 60%, and preferably from 25% to 35%.

[0042] Apart from the structural winding elements of the bobbin already illustrated above, the scheme of figure 1 indicates, for illustrative but non-limiting purposes, the further components of the device according to the invention for effecting the regulation process of the bobbin formation, the following components are shown in figure 2

- pneumatic counterweighing device 44 connected to the bobbin-holder arm 21, to be fed with a service fluid deriving from its line,
- electrovalve 46 for the feeding of the counterweighing device,
- rev-counter sensor 42 of the revs effected by the driving cylinder 30,
- and angular sensor or detector 34 of the rising α angle of the bobbin-holder arm,
- electronic card 48, which forms the control unit of the bobbin-winder station, connected to the control unit 47 of the bobbin-winder, with the line 50, from which it receives the established processing data, subsequently autonomously effecting the phases of the regulation process described above during the advancing of the bobbin,
- connection line 33 of the impulse generator of the driving cylinder with the electronic card 48 for counting the revs effected by the driving roll 16,
- connection line 35 of the detector 34 with the electronic card 48 for counting the rising angle α of the bobbin-holder arm 11,
- connection line 51 of the electronic card 48 with the electrovalve 46.

[0043] On comparing the regulation systems available in the known art, the process and device for regulating the bobbin formation according to the present invention offer considerable advantages. The weight of the bobbin is measured with great accuracy on the basis of the length effectively wound and the yarn titer with a much higher precision than that allowed by the systems of the known art. The weight with which the bobbin-holder arm rests on the driving cylinder is distributed on the basis of the effective lifting of the arm itself during the processing of the bobbin, detected and/or calculated on the basis of the length.

[0044] The determination of the advance degree of the bobbin and resting pressures or weights of the bobbin-holder arm and bobbin in formation, as also the determination of their distribution on the driving cylinder, are not influenced by defects in the winding density. These operations can be effected with the bobbin at a standstill or in movement.

Claims

1. A process for the regulation of the winding of the thread onto a bobbin to obtain bobbins having the desired form and density, by the application of a desired contact pressure P_c of the bobbin (10) being processed, by applying a counterthrust Pp to the bobbin-holder arm (11) provided by the counterweighing device (44), on the basis of a pre-established trend of the value of P_c in relation to the advance degree of the bobbin, **characterized in that** said pre-established trend of the contact pressure value P_c is calculated with respect to the advance length of the bobbin

and that during the formation of the bobbin, the device indicates the weight of the bobbin in formation P_r on the basis of the measurement of its length reached, it measures the rising angle (α) of the bobbin-holder arm and, for each indication of the angle (α) and length reached of the bobbin in formation, it calculates the total weight component ($P_r + P_{ba}$) which is resting on the driving cylinder (16), applying a counterthrust Pp each time, calculated as the difference between said weight component and the pre-established contact pressure value, according to the formula $Pp = (P_r + P_{ba}) - P_c$ referring to the length reached.

2. The process for regulating the winding of the thread onto a bobbin according to claim 1, **characterized in that** the length reached by the bobbin in formation is detected on the basis of the number of progressive revs effected by the driving cylinder (16) starting from the beginning of the bobbin (10).

3. The process for regulating the winding of the thread onto a bobbin according to claim 1, **characterized in that** the value of the rising angle (α) of the bobbin-holder arm (11) is measured directly on said arm each time.

4. The process for regulating the winding of the thread onto a bobbin according to claim 1, **characterized in that** the value of the rising angle (α) of the bobbin-holder arm (11) is calculated on the basis of the length measured and corresponding to the volume of the bobbin reached, the geometry of the system and the winding density of the bobbin being known.

5. The process for regulating the winding of the thread onto a bobbin according to claim 1, **characterized in that** the value of the rising angle (α) of the bobbin-holder arm (11) is both detected directly on said arm and calculated on the basis of the length reached, each time, subsequently comparing the two values and **in that**, when said values differ significantly, the control unit (48) of the winding unit increases or reduces the thread tension to increase or decrease the density of the bobbin p to the desired value, processing and sending the relative command signal to the thread-tensioner.

6. The process for regulating the winding of the thread onto a bobbin according to claim 1, **characterized in that** in the restarting phase of the bobbin, the value of P_c is increased, reducing the counterthrust Pp of the counterweighing device (44), with respect to the regime regulation value for the length reached.

7. The process for regulating the winding of the thread onto a bobbin according to claim 6, **characterized in that** the reduction value of the counterthrust value Pp is within the range of 20% - 60%, and preferably from 25% to 35%.

8. A device for regulating the thread winding onto a bobbin to obtain bobbins having the desired form and density, by the application of a desired contact pressure P_c of the bobbin (10) being processed, comprising a counterweighing device (44) applied to the bobbin-holder arm (11) to provide a counterthrust Pp, on the basis of a pre-established trend of the value of P_c in relation to the advance degree of the bobbin, **characterized in that** said pre-established contact pressure value P_c is calculated with respect to the advance length of the bobbin and **in that** the device comprises measuring means (42) of the length reached for determining the weight of the bobbin in formation P_r, means (34) for determining the rising angle (α) of the bobbin-holder arm (11) and means, at each detection of the α angle and length reached by the bobbin in formation, for calculating the total weight component ($P_r + P_{ba}$) which is resting on the driving cylinder (16) without counterthrusts, each time applying a counterthrust Pp with a counterweighing device (44) calculated as the difference between said weight component and the pre-established value of the contact pressure, with the formula $Pp = (P_r + P_{ba}) - P_c$ referring to the length reached.

9. The device for the regulation of the thread winding according to claim 8, **characterized in that** the measuring means of the length reached consist of a rev-counter devices of the progressive number of revs of the driving cylinder (16) from the beginning of the bobbin.

10. The device for the regulation of the thread winding according to claim 8, **characterized in that** the counterweighing device consists of a simple-effect piston 44) fed by an electrovalve (46) which determines the pressure of the service fluid to be supplied to the piston (44).

11. The device for the regulation of the thread winding according to claim 8, **characterized in that** the determination of the rising angle (α) of the bobbin-holder arm (11) is effected by the control unit (48) of the bobbin-winding station by calculation on the basis of the length measured.

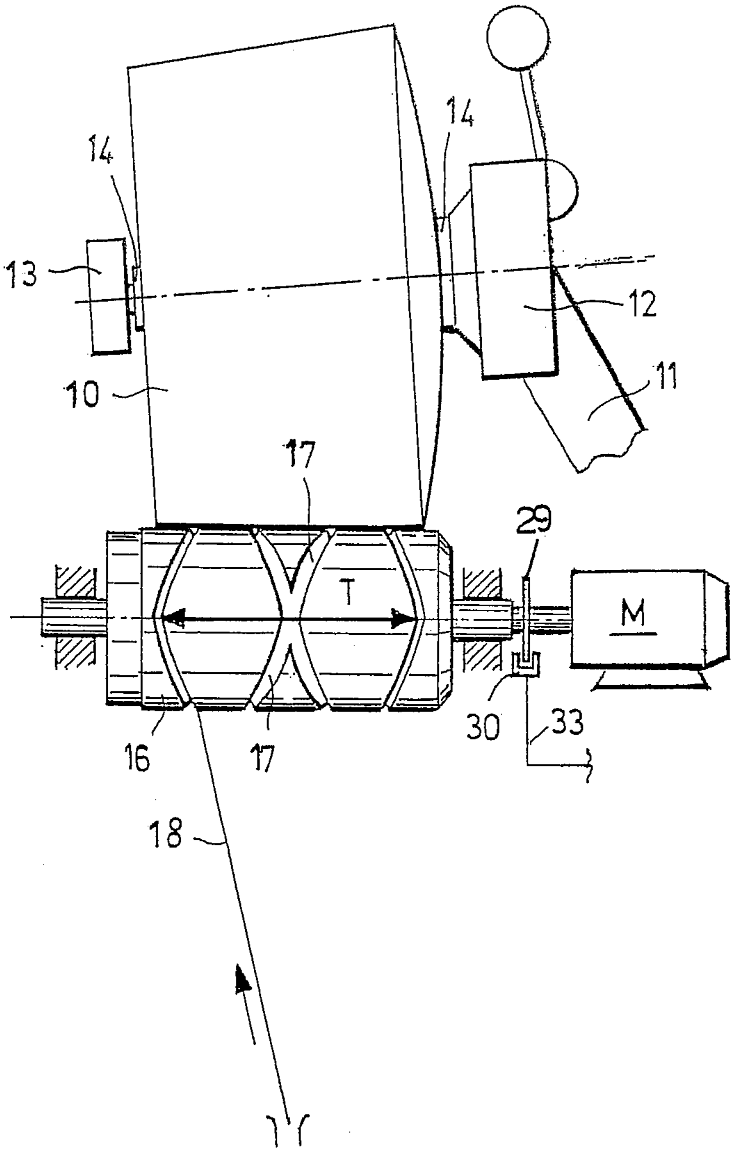

Fig.1

Fig. 2

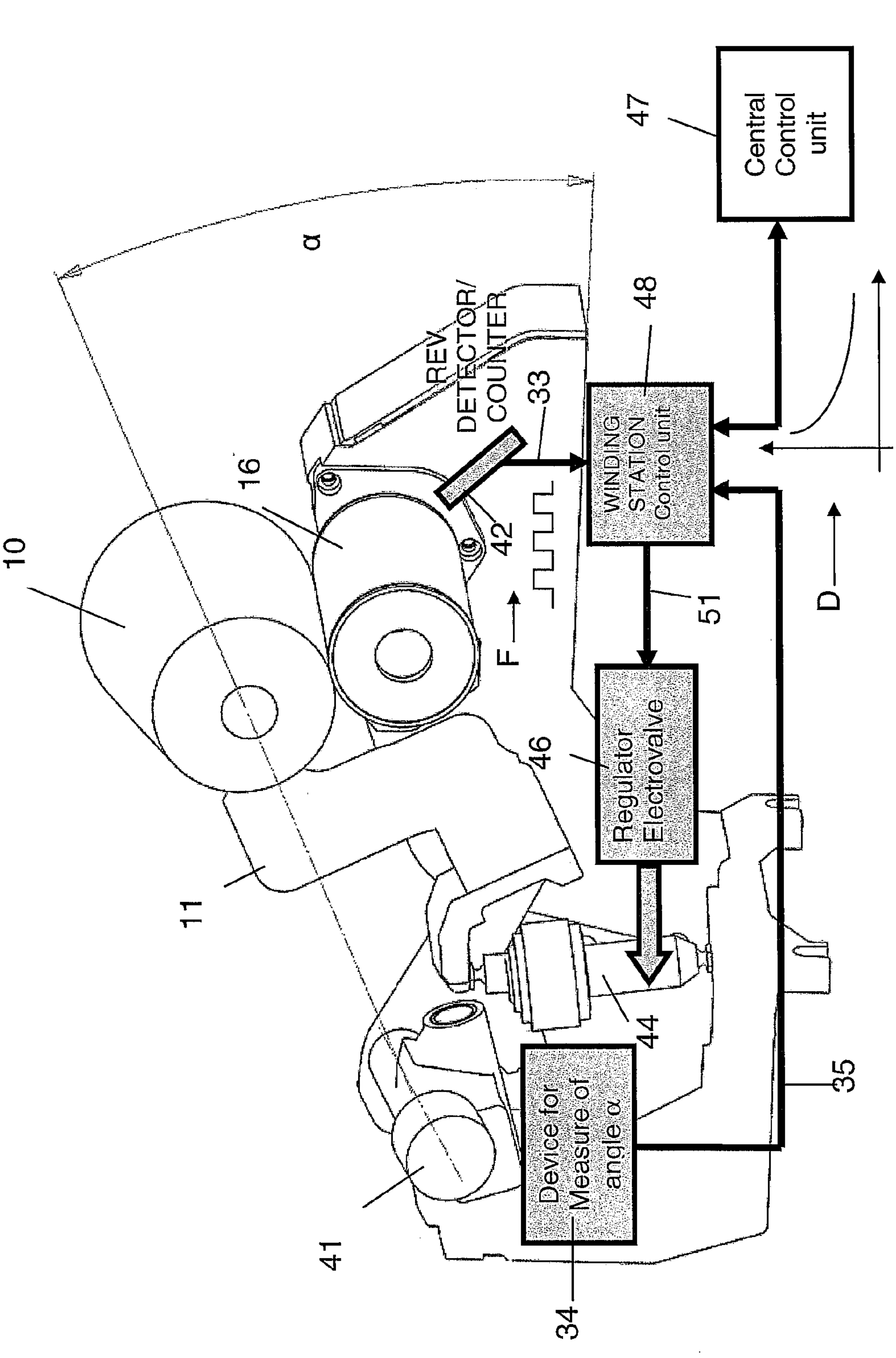
α
REV
DETECTOR/
COUNTER
33
16
10
42
F
48
WINDING
STATION
Control unit
51
47
Central
Control
unit
D
46
Regulator
Electrovalve
11
44
35
Device for
Measure of
angle α
41
34

Fig.3

Bobbin weight

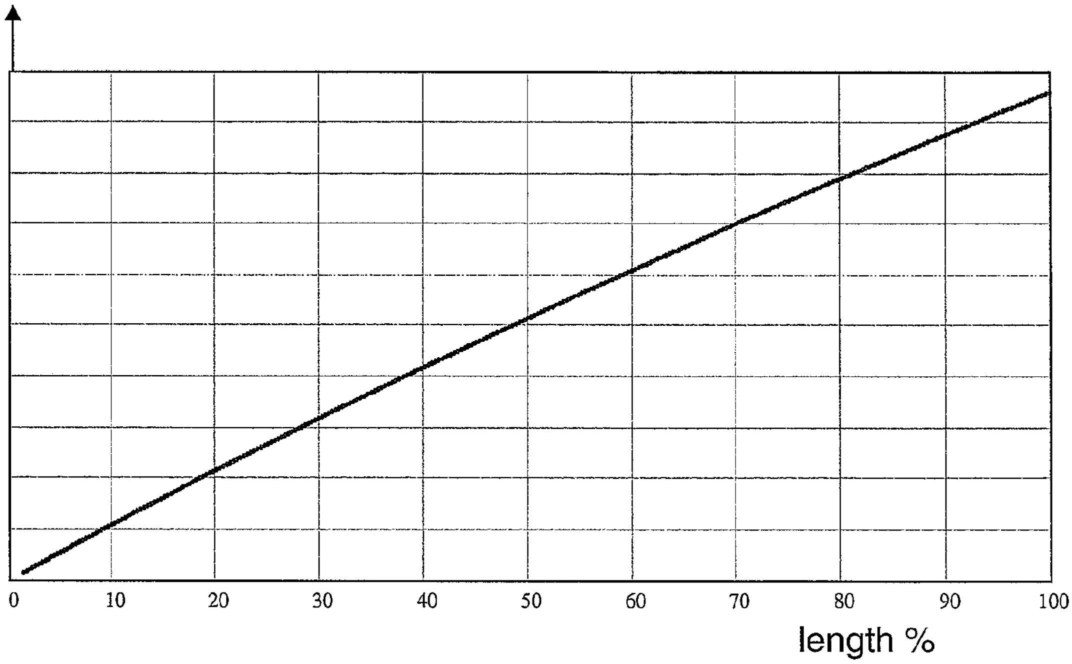

Fig.4

Weight of bobbin-holder arm

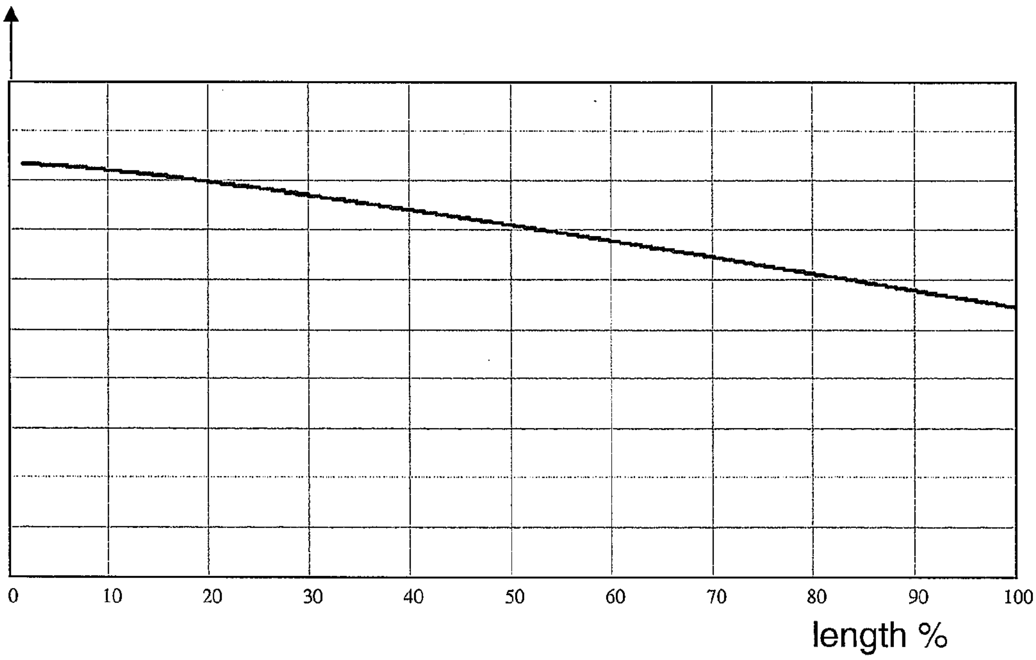

Fig.5

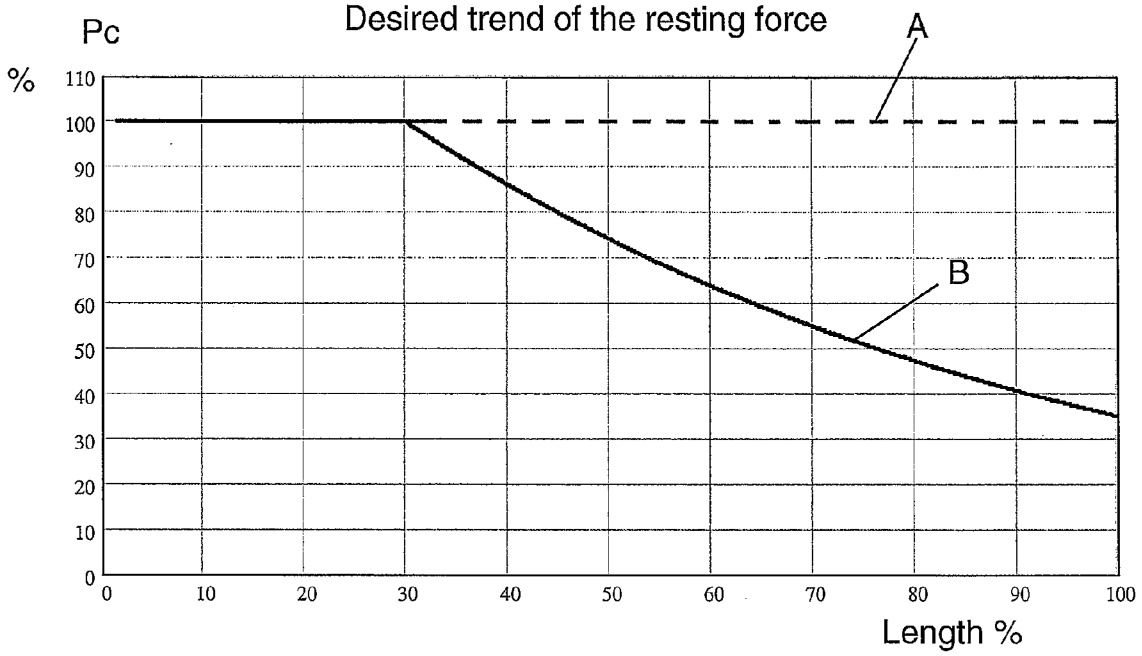

Fig.6

ALFA Angle

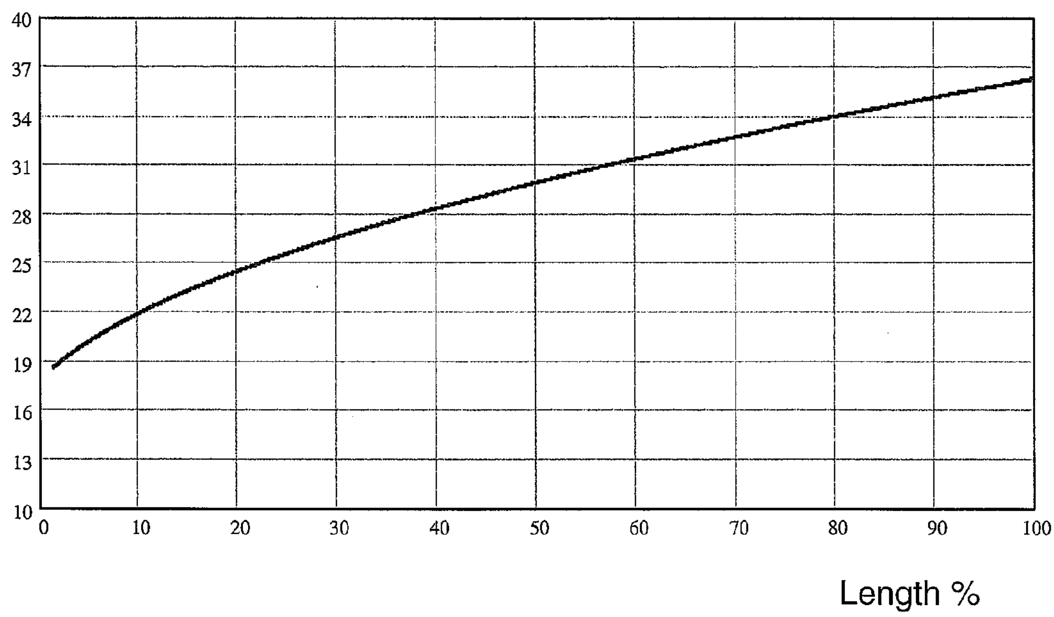

Fig. 7

Trend of the counterweighing Force

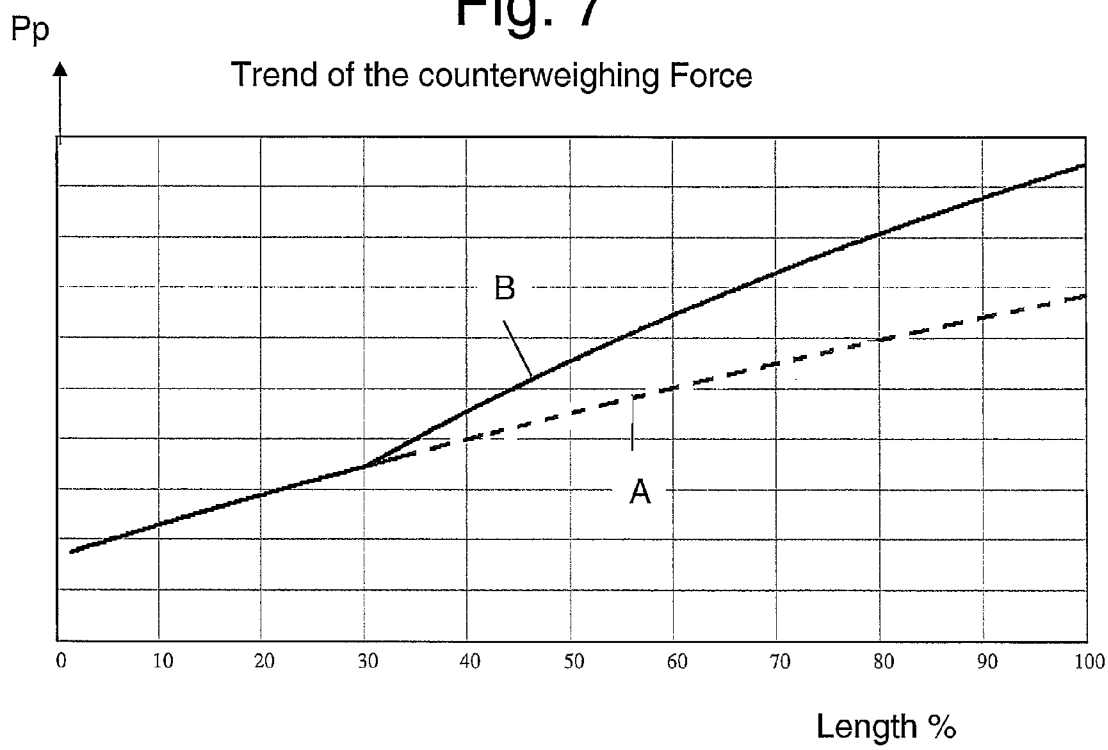

Fig. 8

Trend of pressure fed to electrovalve