



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**30.07.2003 Bulletin 2003/31**

(51) Int Cl.7: **H01B 13/02**

(21) Application number: **03075183.8**

(22) Date of filing: **20.01.2003**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HU IE IT LI LU MC NL PT SE SI SK TR**  
Designated Extension States:  
**AL LT LV MK RO**

(72) Inventor: **D'Ottavi, Vincenzo  
Castorano, (AP) (IT)**

(74) Representative:  
**Raimondi, Alfredo, Dott. Ing. Prof. et al  
Dott. Ing. Prof. Alfredo Raimondi S.r.l.,  
Piazza le Cadorna 15  
20123 Milano (IT)**

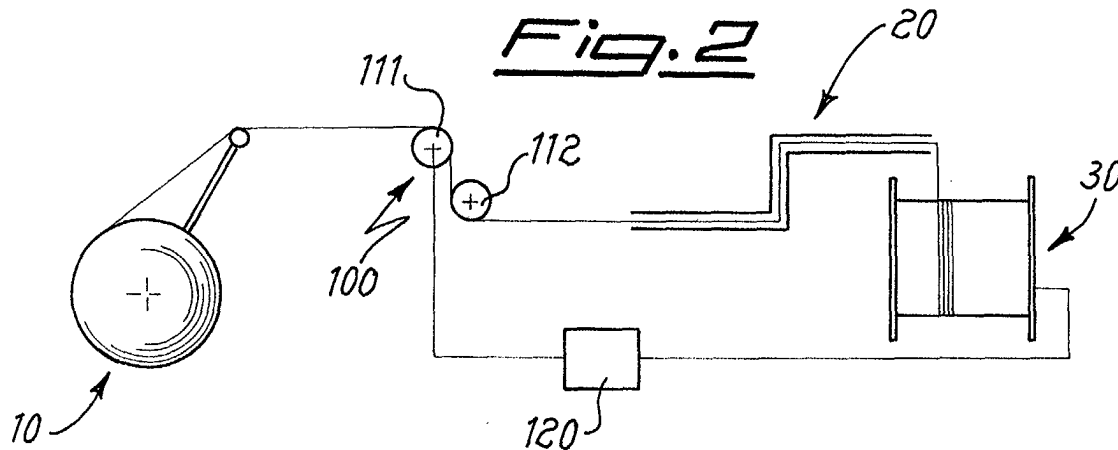
(30) Priority: **24.01.2002 IT MI20020120**

(71) Applicant: **Leoni Felisi S.p.A.  
Milano (IT)**

(54) **Method and associated apparatus for reducing the tension of wires during a strand production process**

(57) Method for reducing the tension of wires during a process for production of a strand using said wires, comprising the steps of unwinding at least one wire (1) from a supply reel, feeding the unwound wire (1) to a stranding machine which pulls the wire, winding it onto

a take-up reel (31) at a predetermined winding speed, said at least one wire being subjected to a pulling/pushing action in the same sense as the direction of feeding thereof, along the section of the travel path between the supply reel and the point of entry into the stranding machine.



**Description**

**[0001]** The present invention relates to a method and an associated apparatus for reducing the tension of wires during a process for production of a strand using said wires.

**[0002]** It is known in the technical sector relating to the production of conductor strands and the like that said strands are made from a wire or a plurality of wires wound onto a supply reel from which the wire(s) is/are unwound so as to be fed to the stranding machine which forms the bundles of wires, imparts one or more twists to them and winds the strand thus formed onto a take-up reel.

**[0003]** It is also known that the movement of the wire is determined by the stranding machine which pulls the wires, unwinding them from the supply reel at a predetermined speed.

**[0004]** Owing to the sliding friction which arises during the various steps of the process, the wire is however subject to slackening and/or tensioning and, in order to compensate for this, the supply reel is equipped with an arm for adjusting the unwinding speed; said arm has a roller onto which the wire is wound and is connected to means for adjusting the speed of rotation of the said reel.

**[0005]** During the winding process the wire is subject to a tension in the longitudinal direction which is permitted and regulated within certain limits, since it tends to equalize the behaviour of different wires wound onto the same reel and wires wound onto different reels.

**[0006]** This tension in the wire, however, gives rise to drawbacks since it increases the tensile load on the wire, deteriorating its functional characteristics and results in the need to increase the driving load of the stranding machine with the consequent need for larger dimensions and an increase in the costs associated with the said machine.

**[0007]** The technical problem which is posed, therefore, is that of providing an apparatus which allows a reduction in the tension produced on the wire during winding thereof onto a reel, for example of a stranding machine.

**[0008]** Within the context of this problem a further requirement is that said apparatus should be simple and inexpensive to realise and also applicable to machines of the traditional type without the need for major modifications.

**[0009]** These technical problems are solved according to the present invention by a method for reducing the tension of wires during a process for production of a strand using said wires, comprising the steps of: unwinding at least one wire from a supply reel, feeding the unwound wire to a stranding machine which pulls the wire, winding it onto a take-up reel at a predetermined winding speed, said at least one wire being subject to a pulling/pushing action in the same sense as the direction of feeding thereof, along the section of the travel path between the supply reel and the point of entry into the stranding machine.

**[0010]** The present invention also relates to an apparatus for reducing the tension of wires during a process for forming a strand wound onto a reel of a stranding machine using at least one wire fed from a supply reel, which apparatus comprises means able to impart to said at least one wire a pulling/pushing force in the same sense as the direction of feeding of the said wire, along the section of the travel path of the wire between the supply reel and the point of entry into the stranding machine.

**[0011]** Further details may be obtained from the following description of a non-limiting example of embodiment of the invention, provided with reference to the accompanying plates of drawings in which:

- Figure 1 shows a functional diagram of a plant of the conventional type for forming a strand;
- Figure 2 shows a diagram similar to that of Fig. 1 with an apparatus for reducing the tension of the wire, according to the present invention;
- Figure 3 shows a view of an example of embodiment of the tension-reducing apparatus according to the present invention; and
- Figures 4a-4c show schematic views of examples of differently adjusted arrangements of a second embodiment of the apparatus according to the invention.

**[0012]** As illustrated in Fig. 1, a conventional plant for forming a strand 2 from at least one wire 1 comprises essentially a reel 10 for supplying the wire(s) 1, a device 20 for guiding the wire(s) entering a stranding machine, schematically shown together with the associated winding reel 30. In the example according to Fig. 1, the guiding device schematically shown is of the type able to impart a single twist to the wire, but, although not illustrated, the stranding machine may comprise means able to impart a double twist to the wires before they are wound onto the reel 30.

**[0013]** The supply reel 10 is connected to an arm 11 for adjusting its speed of rotation, which arm is in turn connected to the wires being unwound.

**[0014]** Fig. 2 shows the plant according to Fig. 1 equipped with an apparatus 100 for reducing the tension of the wires to which the wires 1 are subject during the process for forming and winding a strand 2, which apparatus is arranged in a position between the supply reel 10 and the point of entry into the stranding machine in the direction of feeding of the wires 1.

**[0015]** For the sake of brevity below, the apparatus according to the invention will also be called a tension-reducing

apparatus.

[0016] As illustrated in Fig. 3, the tension-reducing apparatus 100 according to the invention is substantially formed by a first roller 111 which is motorized and by a second drive roller 112 which is idle, the wires 1 being made to pass between said rollers.

[0017] The first motorized roller 111 is rotated by means of an associated controlled motor 111a which imparts a speed of rotation of the roller such as to produce a peripheral speed which is slightly greater than the driving speed of the stranding machine.

[0018] The motor 111a is also connected to a speed control device 120, for example of the type called "encoder", onto which one of the wires 1 fed to the stranding machine is wound; said device is able to detect the speed of the roller and send corresponding signals to actuating means able to vary the speed of rotation of the motor 111a and therefore the corresponding roller 111.

[0019] The second idle roller 112 is mounted on an associated frame 112a which is movable translationwise parallel to the direction of feeding of the wires 1 so as to produce a relative position of the two rollers 111, 112 such as to allow adjustment of the winding angle of the said wires 1 around the first motorized roller as illustrated in Figs. 4a to 4c where a winding angle of 90° is modified to a winding angle of about 180°.

[0020] The greater the winding angle of the wires 1 on the active roller 111, the greater will be the effect of the apparatus and therefore the reduction in the tension exerted on the wires leaving the apparatus; this allows obviously the working conditions of the said apparatus to be adjusted in relation to the different characteristics of the wires 1 to be wound and/or the strands 2 to be formed.

[0021] As illustrated in Fig. 3 in broken lines it is also possible to envisage that the second roller 112 is in turn motorized by means of a motor 111b which is also regulated by the encoder signal and imparts to the second roller 112 a speed of rotation which is substantially the same as that of the first roller 111 and therefore slightly greater than the speed of feeding of the wire. Since the tension-reducing effect is substantially determined by the winding angle on the first motorized (or active) roller - or by the sum of the winding angles on all the active rollers - it follows that, for the same reduction in tension on the wires 1, the motorization of the second roller 112 results in winding angles of the wires on the two active rollers which are smaller than those required in the case of an idle second roller, also allowing the mechanical design of the apparatus to be simplified.

[0022] According to the present invention, a method for reducing the longitudinal tension of wires 1 forming the components of a strand 2 to be wound onto a reel 30 of a stranding machine is also defined, said method envisaging the following steps:

- unwinding at least one wire 1 from a supply reel;
- feeding the unwound wire 1 to a stranding machine which pulls the wire, winding it onto a take-up reel 31 at a predefined winding speed;

said at least one wire being subjected to a pulling/pushing action in the same sense as the direction of feeding thereof, along the section of the travel path between the supply reel and the point of entry into the stranding machine.

[0023] In a preferred embodiment, said pulling/pushing action is obtained by means of application of a sliding friction to the wire; said sliding friction being determined by the pulling/pushing action of a roller on which the wire is wound at a predefined winding angle depending on the characteristics of the wire and the strand to be formed.

[0024] Said winding angle is normally between 60° and 300° and preferably between 90° and 240°.

[0025] The roller which applies the pulling/pushing force to the wire is rotationally actuated so as to have a speed slightly greater than the speed of driving of the wire by the stranding machine.

[0026] Preferably the peripheral speed of the roller is greater than the speed of driving of the wire by an amount ranging between 2% and 10% of the latter.

[0027] With application of the method for reducing the tension of the wire according to the invention it has been experimentally established that, when manufacturing 84-strand conductors of the smooth bunch type having a wire diameter of 0.40 mm (84x0.40), the cross-section is much more uniform and geometrically regular.

[0028] In addition to the above the winding quality control parameters improve as shown in the following table:

PARAMETER	WITH TENSION-REDUCER	WITHOUT TENSION-REDUCER
Elongation of wires (%)	20.8	13.6
Electrical resistance (ohm/kg)	1.74	1.84

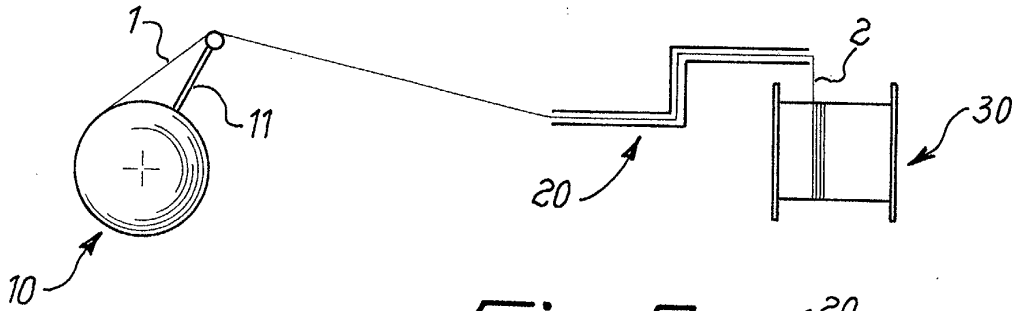
## Claims

- 5
1. Method for reducing the tension of wires during a process for production of a strand using said wires, comprising the steps of:
- unwinding at least one wire (1) from a supply reel;
  - feeding the unwound wire (1) to a stranding machine which pulls the wire, winding it onto a take-up reel (31) at a predetermined winding speed;
- 10 **characterized in that** said at least one wire is subjected to a pulling/pushing action in the same sense as the direction of feeding thereof, along the section of the travel path between the supply reel and the point of entry into the stranding machine.
- 15 2. Method according to Claim 1, **characterized in that** said pulling/pushing action is obtained by means of application of a sliding friction to the wire.
3. Method according to Claim 2, **characterized in that** said sliding friction is determined by the pulling/pushing action of at least one motorized roller on which the wire is wound at a predefined winding angle.
- 20 4. Method according to Claim 2, **characterized in that** said sliding friction is determined by the pulling/pushing action of a pair of motorized rollers on which the wire is wound at a predefined winding angle.
5. Method according to Claim 3, **characterized in that** said winding angle is between 60° and 300°.
- 25 6. Method according to Claim 5, **characterized in that** said winding angle is preferably between 90° and 240°.
7. Method according to Claim 3, **characterized in that** the roller which applies the pulling/pushing action to the wire is rotationally actuated so as to have a speed greater than the speed of driving of the wire by the stranding machine.
- 30 8. Method according to Claim 3, **characterized in that** the speed of rotation of the motorized roller is greater than the speed of driving of the wire by an amount ranging between 2% and 10% of the latter.
- 35 9. Apparatus for reducing the tension of the wires (1) during a process for forming a strand (2) wound onto a reel (30) of a stranding machine using at least one wire (1) fed from a supply reel (10,11), **characterized in that** it comprises means (111,112) able to impart to said at least one wire (1) a pulling/pushing action in the same sense as the direction of feeding of the said wire, along the section of the travel path between the supply reel (10,11) and the winding reel (30).
- 40 10. Apparatus according to Claim 9, **characterized in that** said pulling/pushing means comprise at least one first roller (111) which is motorized and able to impart said pushing/pulling action and a second drive roller (112) which is idle, the wires (1) being wound around said rollers.
- 45 11. Apparatus according to Claim 9, **characterized in that** said pushing means comprise at least one first motorized roller (111) able to impart said pushing/pulling action and at least one second motorized roller (112), around which rollers the wires (1) are wound.
12. Apparatus according to Claim 10 or 11, **characterized in that** said first and second rollers are parallel to each other.
- 50 13. Apparatus according to Claim 10 or 11, **characterized in that** said second roller (112) is movable translationwise relative to the first roller (111).
14. Apparatus according to Claim 10, **characterized in that** said first motorized roller (111) is rotated at a speed of rotation greater than the winding speed of the reel (30) of the stranding machine.
- 55 15. Apparatus according to Claim 14, **characterized in that** the speed of rotation of the motorized roller (111) is greater than the speed of driving of the wire (1) by an amount preferably ranging between 2% and 10% of the latter.
16. Apparatus according to Claim 11, **characterized in that** said first motorized roller (111) is rotated at a speed of

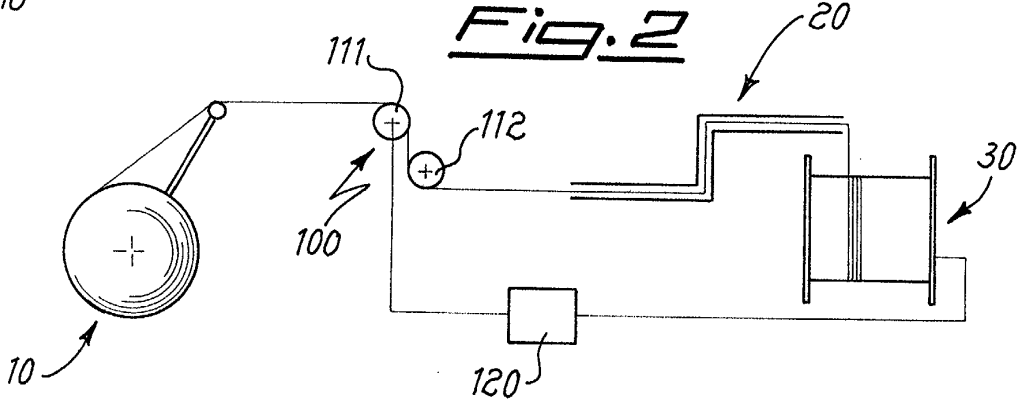
rotation greater than the winding speed of the stranding machine and said second motorized roller (112) is rotated at a speed substantially the same as that of the first roller.

- 5
17. Apparatus according to Claim 10, **characterized in that** it comprises a device (120) for controlling the speed of rotation of the motorized roller(s) on which one of the wires (1) fed to the stranding machine (30) is wound.
- 10
18. Apparatus according to Claim 17, **characterized in that** said control device (120) is able to detect the speed of the roller and send corresponding signals to actuating means able to vary the speed of rotation of the motor (111a, 111b) for actuating the motorized roller(s).
19. Apparatus according to Claim 1, **characterized in that** the angle of winding of the wire (1) around the motorized roller(s) is between 60° and 300°.
- 15
20. Plant for forming strands (2) from wires (1), in which at least one stranding machine with a winding reel (30) and at least one reel (10,11) for feeding at least one wire (1) are envisaged, **characterized in that** it comprises an apparatus for reducing the tension of said at least one wire (1), which is provided with means (111,112) able to impart to said at least one wire (1) a pulling/pushing action in the same sense as the direction of feeding of the said wire, along the section of the travel path of the wire between the supply reel (10,11) and the winding reel (30).
- 20
21. Plant according to Claim 20, **characterized in that** said pushing/pulling means of the apparatus comprise at least one first roller (111) which is motorized and able to impart said pushing/pulling action and one second drive roller (112) which is idle, the wires (1) being wound around said rollers.
- 25
22. Plant according to Claim 21, **characterized in that** said pushing/pulling means of the apparatus comprise at least one first motorized roller (111) able to impart said pushing/pulling action and at least one second motorized roller (112), around which rollers the wires (1) are wound.
- 30
23. Plant according to Claim 21, **characterized in that** said first motorized roller (111) is rotated at a speed of rotation greater than the winding speed of the stranding machine.
- 35
24. Plant according to Claim 23, **characterized in that** the speed of rotation of the motorized roller (111) is greater than the speed of driving of the wire (1) by an amount ranging between 2% and 10% of the latter.
- 40
25. Plant according to Claim 22, **characterized in that** said first motorized roller (111) is rotated at a speed of rotation greater than the winding speed of the stranding machine and said second motorized roller (112) is rotated at a speed substantially the same as that of the first roller.
- 45
26. Plant according to Claim 21, **characterized in that** it comprises a device (120) for controlling the speed of rotation of the motorized roller(s) on which one of the wires (1) fed to the stranding machine (30) is wound.
- 50
27. Plant according to Claim 26, **characterized in that** said control device (120) is able to detect the speed of the roller(s) and send corresponding signals to actuating means able to vary the speed of rotation of the motor (111a, 112b) actuating the motorized roller(s).
- 55
28. Plant according to Claim 21, **characterized in that** the winding angle of the wire (1) around the motorized roller (s) is between 60° and 300°.

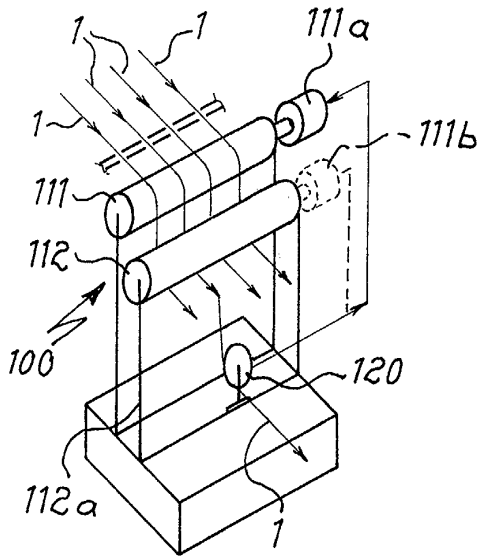
**Fig. 1**



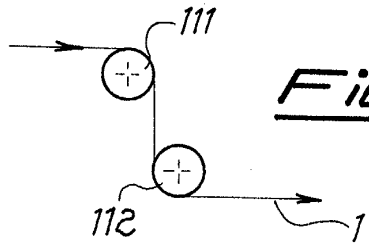
**Fig. 2**



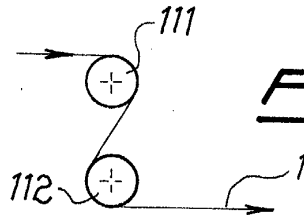
**Fig. 3**



**Fig. 4a**



**Fig. 4b**



**Fig. 4c**

