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

Verfahren und Apparat zum Reduzieren der Zugkraft in Drähte während eines Seilherstellungsverfahrens

Méthode et appareil de réduction de tension dans des fils lors d'un processus de fabrication d'un câble

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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] An exemple of the prior art according to the preamble of claims 1, 8 and 16 is disclosed into EP 0 352 049.

[0008] The technical problem which is posed, therefore, is that of providing a method and 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.

[0009] 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.

[0010] 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, according to the characteristics of claim 1.

[0011] The present invention also relates to an apparatus for reducing the tension of wires during a process for forming a strand according to the characteristics of claim 8.

[0012] 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.

[0013] 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.

[0014] 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.

[0015] 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.

[0016] For the sake of brevity below, the apparatus according to the invention will also be called a tension-reducing apparatus.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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°.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] Said winding angle is normally between 60° and 300° and preferably between 90° and 240°.

[0026] 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.

[0027] 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.

[0028] 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.

[0029] 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

1. Method for reducing the tension of wires (1) during a process for production of a strand (2) using said wires (1) , comprising the steps of:

   - unwinding at least one wire (1) from a supply reel (10);
   - feeding along a feeding direction the unwound wire (1) to a stranding machine (30) which pulls the wire (1),

winding it onto a take-up reel (31) at a predetermined winding speed;

characterized in that said at least one wire (1) 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, by the fact that said pulling/pushing action is applied by an apparatus comprising a first roller (111) and a second roller (112), which are spaced apart along a distance perpendicular to the feeding direction, and at least one (111) of which is motorized (111a), said first (111) and second (112) rollers being movable relative to each other in a direction parallel to the feeding direction, allowing adjustment of a winding angle of the at least one wire (1).

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 (1).

3. Method according to Claim 2, **characterized in that** said sliding friction is determined by the pulling/pushing action of a pair of motorized rollers (111,112) on which the wire (1) is wound at a predefined winding angle.

4. Method according to Claim 3, **characterized in that** said winding angle is between 60° and 300°.

5. Method according to Claim 4, **characterized in that** said winding angle is preferably between 90° and 240°.

6. Method according to Claim 1, **characterized in that** the roller (111) which applies the pulling/pushing action to the wire (1) is rotationally actuated so as to have a speed greater than the speed of driving of the wire by the stranding machine (30).

7. Method according to Claim 6, **characterized in that** the speed of rotation of the motorized roller (111,111a) is greater than the speed of driving of the wire by an amount ranging between 2% and 10% of the latter.

8. Apparatus for reducing the tension of the wires (1) during a process for forming a strand (2) wound onto a reel of a stranding machine (30) using at least one wire (1) fed from a supply reel (10,11), along a feeding direction **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 (1), said pulling/pushing means (100) being located along the section of the travel path between the supply reel (10,11) and the winding reel (30) prior to the stranding machine (30), and
comprising as said means (111,112) 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, **in that** said first (111) and second (112) rollers are parallel to each other and **in that**
said second roller (112) is movable translationwise relative to the first roller (111), to allow adjustment of the winding angle of the wire (1) around the rollers.

9. Apparatus according to Claim 8, **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.

10. Apparatus according to Claim 8, **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.

11. Apparatus according to Claim 10, **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.

12. Apparatus according to Claim 8, **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.

13. Apparatus according to Claim 8, **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.

14. Apparatus according to claim 13, **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).

15. Apparatus according to Claim 8, **characterized in that** the angle of winding of the wire (1) around the motorized roller(s) is between 60° and 300'.

16. 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), according to claim 8.

Patentansprüche

1. Verfahren zur Herabsetzung der Spannung von Drähten (1) bei einem Herstellungsprozess eines Kabels (2) aus den genannten Drähten (1), das folgende Schritte umfasst:

- Abwickeln mindestens eines Drahtes (1) von einer Versorgungsspule (10);
- Zuführen des abgewickelten Drahtes (1), in einer Zuführungsrichtung, zu einer drahtziehenden Kabelwickelmaschine (30), und Aufwickeln desselben auf eine Aufnahmespule (31) bei einer vorbestimmten Wickelgeschwindigkeit ;

dadurch gekennzeichnet, dass der mindestens eine Draht (1) einer Zug-und Schubwirkung in derselben Richtung wie dessen Zuführungsrichtung entlang dem Abschnitt des Bewegungspfades zwischen der Versorgungsspule und dem Eintrittspunkt in die Kabelwickelmaschine unterworfen wird, dadurch, dass die genannte Zug- und Schubwirkung durch einen Apparat aufgebracht wird, der eine erste Rolle (111) und eine zweite Rolle (112) umfasst, die um einen zur Zuführungsrichtung senkrechten Abstand voneinander getrennt sind, und mindestens eine der Rollen (111) motorisiert ist (111 a), wobei die genannte erste (111) und zweite Rolle (112) in einer Richtung parallel zur Zuführungsrichtung einander gegenüber verschiebbar sind und die Regelung eines Wicklungswinkels des mindestens einen Drahtes (1) erlauben.

2. Verfahren gemäß Anspruch 1, **dadurch gekennzeichnet dass** die genannte Zug- und Schubwirkung durch Anwendung einer Gleitreibung an den Draht (1) erreicht wird.

3. Verfahren gemäß Anspruch 2, **dadurch gekennzeichnet dass** die genannte Gleitreibung durch die Zug- und Schubwirkung eines Paares von motorisierten Rollen (111, 112) erreicht wird, auf die der Draht (1) mit einem vorbestimmten Wicklungswinkel gewickelt wird.

4. Verfahren gemäß Anspruch 3, **dadurch gekennzeichnet dass** der genannte Wicklungswinkel zwischen 60° und 300° beträgt.

5. Verfahren gemäß Anspruch 4, **dadurch gekennzeichnet dass** der genannte Wicklungswinkel vorzugsweise zwischen 90° und 240° beträgt.

6. Verfahren gemäß Anspruch 1, **dadurch gekennzeichnet dass** die Rolle, die die Zug-und Schubwirkung auf den Draht (1) ausübt, drehbar derart betätigt wird, dass ihre Geschwindigkeit größer als die Antriebsgeschwindigkeit des Drahtes seitens der Kabelwickelmaschine (30) ist.

7. Verfahren gemäß Anspruch 6, **dadurch gekennzeichnet dass** die Drehgeschwindigkeit der motorisierten Rolle (111, 111 a) um einen Betrag im Bereich zwischen 2% und 10% größer als die Antriebsgeschwindigkeit des Drahtes ist.

8. Apparat zur Herabsetzung der Spannung der Drähte (1) bei einem Verfahren zur Formung eines auf eine Spule einer Kabelwickelmaschine (30) gewickelten Kabels (2) unter Verwendung von mindestens einem von einer Versorgungsspule (10, 11) entlang einer Zuführungsrichtung gespeisten Draht (1), **dadurch gekennzeichnet, dass** er Mittel (111, 112) umfasst, die imstande sind, dem genannten mindestens einem Draht (1) eine Zug- und Schubwirkung in derselben Richtung wie die der Zuführungsrichtung des genannten Drahtes (1) zu verleihen, wobei die genannten Zug- und Schubvorrichtungen (100) entlang dem Abschnitt des Bewegungspfads zwischen der Zuführungsrolle (10, 11) und der aufwickelnden Rolle (30) vor der Kabelwickelmaschine (30) liegen, die genannten Mittel (111, 112) mindestens eine erste Rolle (111) umfassen, die motorisiert und imstande ist, die genannte Zug- und

Schubwirkung auszuüben, eine zweite Antriebsrolle (112) sich im Leerlauf befindet und die Drähte (1) um die genannten Rollen gewunden werden, und dass die genannten ersten (111) und zweiten (112) Rollen parallel zueinander stehen und dass die genannte zweite Rolle (112) der ersten Rolle (111) gegenüber beweglich verschiebbar ist, um eine Regelung des Wicklungswinkels des Drahtes (1) um die Rollen zu erlauben.

9. Apparat gemäß Anspruch 8, **dadurch gekennzeichnet, dass** die genannten Schubvorrichtungen jeweils mindestens eine erste motorisierten Rolle (111) umfassen, die die genannte Zug- und Schubwirkung auszuüben vermag, und mindestens eine zweite motorisierte Rolle (112) umfassen, und die Drähte (1) um diese Rollen gewunden werden.

10. Apparat gemäß Anspruch 8, **dadurch gekennzeichnet, dass** die genannte erste motorisierte Rolle (111) mit einer Drehgeschwindigkeit rotiert wird, die größer als die Wickelgeschwindigkeit der Spule (30) der Kabelwickelmaschine ist.

11. Apparat gemäß Anspruch 10, **dadurch gekennzeichnet, dass** die Drehgeschwindigkeit der motorisierten Rolle (111) um einen Betrag größer als die Antriebsgeschwindigkeit des Drahtes (1) ist, der vorzugsweise in einem Bereich zwischen 2% und 10% des letzteren liegt.

12. Apparat gemäß Anspruch 8, **dadurch gekennzeichnet, dass** die genannte erste motorisierte Rolle (111) mit einer größeren Drehgeschwindigkeit als die Wickelgeschwindigkeit der Kabelwickelmaschine rotiert wird, und die genannte zweite motorisierte Rolle (112) mit einer Geschwindigkeit rotiert wird, die im Wesentlichen dieselbe wie die der ersten Rolle ist.

13. Apparat gemäß Anspruch 8, **dadurch gekennzeichnet, dass** er mindestens eine Vorrichtung (120) zum Kontrollieren der Drehgeschwindigkeit der motorisierten Rolle(n) umfasst, der (denen) einer der Drähte (1) der Kabelwikkelmaschine (30) zugeführt wird.

14. Apparat gemäß Anspruch 13, **dadurch gekennzeichnet, dass** die genannte Kontrollvorrichtung (120) imstande ist, die Geschwindigkeit der Rolle zu erfassen und entsprechende Signale an Betätigungsvorrichtungen auszusenden, um die Drehgeschwindigkeit des Motors (111a, 111b) zum Betätigen der motorisierten Rolle(n) zu ändern.

15. Apparat gemäß Anspruch 8, **dadurch gekennzeichnet, dass** der Wicklungswinkel des Drahtes (1) um die motorisierte Rolle(n) zwischen 60° und 300° beträgt.

16. Anlage für die Herstellung von Kabeln (2) aus Drähten (1), in der mindestens eine Wickelmaschine mit einer Wicklungsspule (30) und mindestens eine Spule (10, 11) für die Zuführung von mindestens einem Draht (1) vorgesehen werden, **dadurch gekennzeichnet, dass** sie einen Apparat für die Herabsetzung der Spannung des genannten mindestens einen Drahtes (1) gemäß Anspruch 8 umfasst.

Revendications

1. Procédé permettant de réduire la tension dans des fils (1) pendant un processus de fabrication d'un câble (2) utilisant lesdits fils (1), comportant les étapes comprenant de :

- dérouler au moins un fil (1) à partir d'une bobine d'alimentation (10) ;
- fournir suivant une direction d'alimentation le fil déroulé (1) à une machine de formation de câble (30) qui tire le fil (1), l'enrouler sur une bobine de réception (31) à une vitesse d'enroulement prédéterminée ;

caractérisé en ce que ledit, au moins un, fil (1) est soumis à une action consistant à le tirer/pousser dans le même sens que la direction suivant laquelle il est fourni, le long de la section du chemin de circulation entre la bobine d'alimentation et le point d'entrée dans la machine de formation de câble, par le fait que ladite action de tirer/pousser est appliquée par un appareil comprenant un premier rouleau (111) et un second rouleau (112), lesquels sont espacés l'un de l'autre le long d'une distance perpendiculaire à la direction d'alimentation, et dont l'un au moins (111) est motorisé (111a), lesdits premier (111) et second (112) rouleaux pouvant se déplacer l'un par rapport à l'autre dans une direction parallèle à la direction d'alimentation, permettant un réglage de l'angle d'enroulement du, au moins un, fil (1).

2. Procédé selon la revendication 1, **caractérisé en ce que** ladite action de tirer/pousser est obtenue au moyen de l'application d'une friction de glissement au fil (1).

3. Procédé selon la revendication 2, **caractérisé en ce que** ladite friction de glissement est déterminée par l'action de tirer/pousser d'une paire de rouleaux motorisés (111, 112) sur lesquels le fil (1) est enroulé suivant un angle d'enroulement prédéterminé.

4. Procédé selon la revendication 3, **caractérisé en ce que** ledit angle d'enroulement se situe entre 60° et 300°.

5. Procédé selon la revendication 4, **caractérisé en ce que** ledit angle d'enroulement se situe, de préférence, entre 90° et 240°.

6. Procédé selon la revendication 1, **caractérisé en ce que** le rouleau (111) qui applique l'action de tirer/pousser sur le fil (1) est actionné à rotation de façon à avoir une vitesse plus grande que la vitesse d'entraînement du fil par la machine de formation de câble (30).

7. Procédé selon la revendication 6, **caractérisé en ce que** la vitesse de rotation du rouleau motorisé (111, 111a) est supérieure à la vitesse d'entraînement du fil d'une quantité se situant entre 2% et 10% de cette dernière.

8. Appareil permettant de réduire la tension sur des fils (1) pendant un processus de fabrication d'un câble (2) enroulé sur une bobine d'une machine de formation de câble (30) utilisant au moins un fil (1) fourni à partir d'une bobine d'alimentation (10, 11) suivant une direction d'alimentation, **caractérisé en ce qu'**il comporte des moyens (111, 112) capables de communiquer au dit au moins un fil (1) une action consistant à le tirer/pousser dans le même sens que la direction de fourniture dudit fil (1), lesdits moyens pour tirer/pousser (100) étant placés le long de la section du parcours de circulation entre la bobine d'alimentation (10, 11) et la bobine d'enroulement (30) avant la machine de formation de câble (30), et comprenant en tant que dits moyens (111, 112) au moins un premier rouleau (111) qui est motorisé et qui est capable de communiquer ladite action consistant à tirer/pousser et un second rouleau d'entraînement (112) qui est libre, les fils (1) étant enroulés autour desdits rouleaux, **en ce que** lesdits premier (111) et second (112) rouleaux sont parallèles l'un à l'autre et **en ce que** ledit second rouleau (112) peut se déplacer en translation par rapport au premier rouleau (111) afin de permettre un réglage de l'angle d'enroulement du fil (1) autour des rouleaux.

9. Appareil selon la revendication 8, **caractérisé en ce que** lesdits moyens de pousser comportent au moins un premier rouleau motorisé (111) capable de communiquer ladite action de pousser/tirer et au moins un second cylindre motorisé (112), rouleaux autour desquels les fils (1) sont enroulés.

10. Appareil selon la revendication 8, **caractérisé en ce que** ledit premier rouleau motorisé (111) tourne à une vitesse de rotation supérieure à la vitesse d'enroulement de la bobine (30) de la machine de formation de câble.

11. Appareil selon la revendication 10, **caractérisé en ce que** la vitesse de rotation du rouleau motorisé (111) est supérieure à la vitesse d'entraînement du fil (1) d'une quantité se situant de préférence entre 2% et 10% de cette dernière.

12. Appareil selon la revendication 8, **caractérisé en ce que** ledit premier rouleau motorisé (111) tourne à une vitesse de rotation supérieure à la vitesse d'enroulement de la machine de formation de câble et **en ce que** ledit second rouleau motorisé (112) tourne a une vitesse essentiellement identique à celle du premier rouleau.

13. Appareil selon la revendication 8, **caractérisé en ce qu'**il comporte un dispositif (120) pour commander la vitesse de rotation du rouleau (des rouleaux) motorisé(s) sur lequel (lesquels) l'un des fils (1) fourni à la machine de formation de câble (30) est enroulé.

14. Appareil selon la revendication 13, **caractérisé en ce que** ledit dispositif de commande (120) est capable de détecter la vitesse du rouleau et d'envoyer des signaux correspondants aux moyens d'actionnement capables de modifier la vitesse de rotation du moteur (111a, 111b) permettant d' actionner le (les) rouleau(x) motorisé(s).

15. Appareil selon la revendication 8, **caractérisé en ce que** l'angle d'enroulement du fil (1) autour du (des) rouleau (x) motorisé(s) se situe entre 60° et 300°.

16. Usine de fabrication de câbles (2) à partir de fils (1), dans laquelle au moins une machine de formation de câble pourvue d'une bobine d'enroulement (30) et d'au moins une bobine (10, 11) servant à fournir au moins un fil (1) sont envisagées, **caractérisée en ce qu'**elle comprend un appareil permettant de réduire la tension dudit au moins un fil (1) selon la revendication 8.

Fig.1

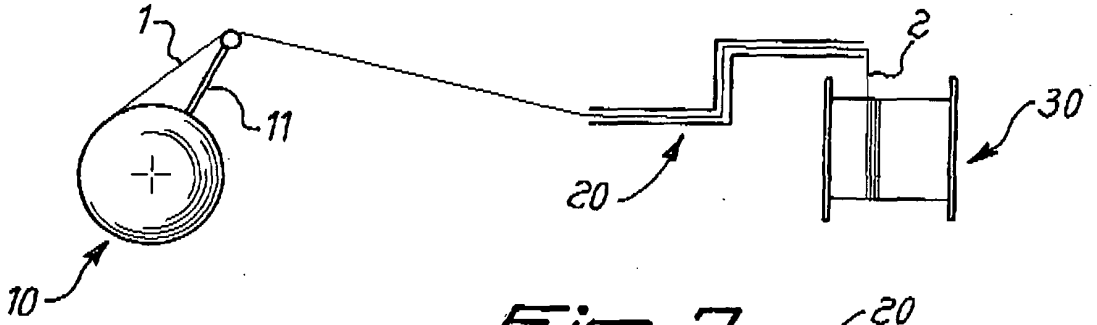


Fig.2

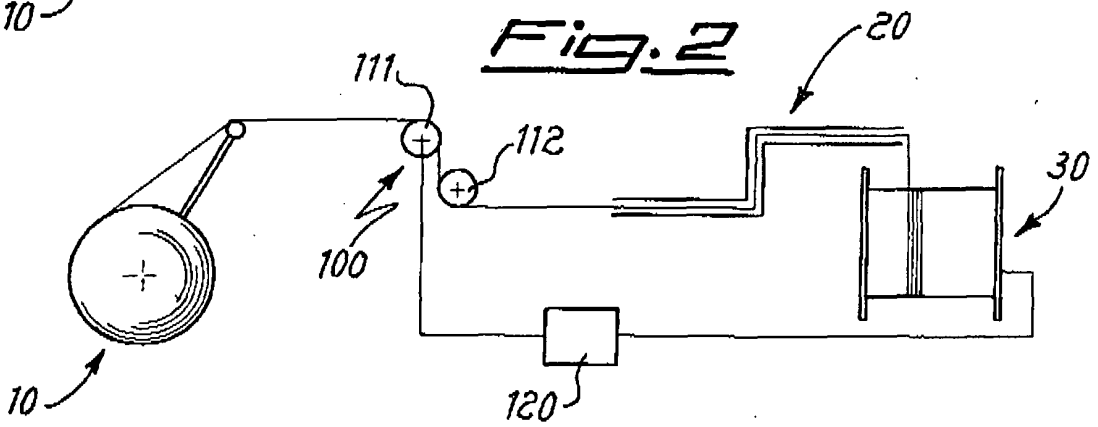
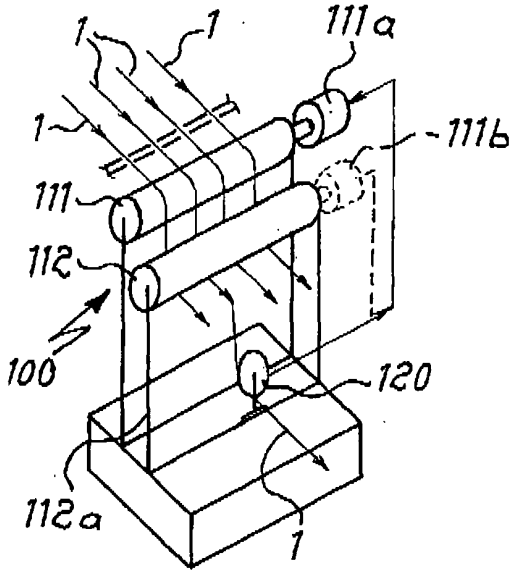


Fig.3



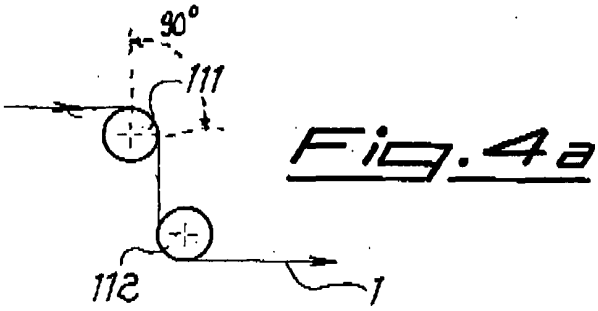


Fig.4a

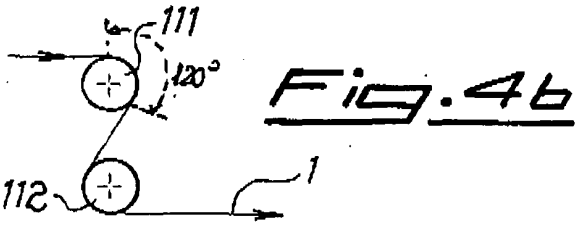


Fig.4b

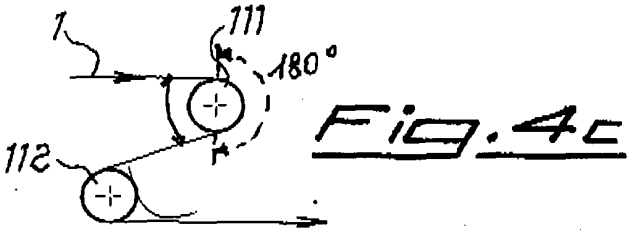


Fig.4c

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0352049 A **[0007]**