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(54) Spool with steel cord.

(57) The invention relates to a spool (2) filled with an elongate steel element such as steel cord (4) which is wound on the spool (2), said element having two ends called respectively end at empty spool (42) and end at full spool, one of said ends being fixed by means of a hot-melt adhesive (8).

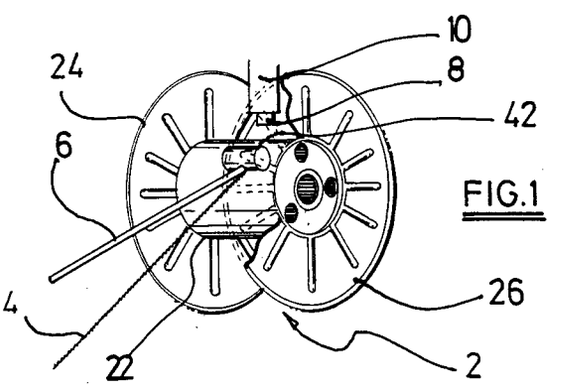

FIG.1

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The invention relates to a spool filled with an elongate steel element such as steel cord which is wound on the spool and to a process of winding steel cord to a spool. In what follows the term "spool" also refers to a bobbin and a reel. Other elongate steel elements are bead wire and hose wire.

Elongate steel elements such as steel cord which is adapted to reinforce elastomers such as tyre plies are conveniently wound on metal spools for storage at the steel cord manufacturers and for transport to the tyre manufacturers.

During the past ten years continuous efforts have been made to automate the process of winding steel cord on a spool, including the steps of fixing both ends of the steel cord, i.e. the cord end at empty spool and the cord end at full spool.

The design of the spool and the process of winding must fulfill a lot of requirements in order to be automated in a proper way.

No damaging on the steel cord may occur.

Furthermore, waste of steel cord is not allowed. This means that after being unwound the steel cord must be used over its entire length, i.e. from the cord end at full spool to the cord end at empty spool.

Moreover, fixing means used to fix both cord ends must not lead to residual products which fall on the floor during the unwinding process and which pollute the working environment.

No time losses must occur during winding and unwinding. This means that fixing means must be used that can be easily handled, applied and removed in an automated way.

The fixing means used to fix the cord end at empty spool must be such that during unwinding no loss of tension must occur in the cord when the cord approaches its end at empty spool.

Still another requirement is that it is preferable that the great mass of existing metal spools now in use, may be used - with or without some necessary adaptations - in the eventually automated process.

It is an object of the present invention to provide for a spool filled with an elongate element such as steel cord which allows automating of the winding and unwinding process. It is a further object of the present invention to provide for a process for winding an elongate steel element such as steel cord on a spool.

According to a first aspect of the invention, there is provided a spool filled with an elongate steel element such as steel cord which is wound on the spool, said element having two ends called respectively end at empty spool and end at full spool, one of said ends being fixed by means of a hot-melt adhesive.

The end at empty spool may be fixed to the core by means of a hot-melt adhesive and/or the end at full spool may be fixed to the rest of the element by means of a hot-melt adhesive.

Hot-melt adhesives are adhesives which do not undergo a curing process but simply cool from the melted state. With respect to the present invention, suitable adhesives are hot-melt adhesives with a rapid setting which may be found between the ethylene and vinyl acetate copolymers (EVA), polyvinyl acetates (PVA), thermoplastic elastomers such as polyurethane, polyether-amide and block terpolymers, polyamides and thermoplastic polyesters. As will become clear hereunder, a great strength is not a point here.

Preferably the spool comprises a core and the end at empty spool is fixed to the core of the spool.

The spool may be made of metal.

The end at full spool may be fixed by means of a hot-melt adhesive but another way to fix the end at full spool is the following : the spool further comprises two flanges and at least one of the flanges comprises at least one hole and at least one clip. The end at full spool is put through one of these holes and is fixed by means of one of these clips.

If the end at full spool is fixed by means of a hot-melt adhesive, the end at empty spool may have been fixed by inserting this end at empty spool into a hole of the core of the spool.

According to a second aspect of the present invention, there is provided a process of winding an elongate steel element such as steel cord to a spool. The element has two ends called respectively end at empty spool and end at full spool. The process comprises the steps of

(i) heating a hot-melt adhesive to above its melting temperature ;

(ii) applying a pressure to the hot-melt adhesive to fix one of said ends ;

(iii) waiting until the hot-melt adhesive has cooled down to a solid state ;

Relating to the fixing of the end at full spool, two ways may be provided.

A first way is :

- heating a hot-melt adhesive to above the melting temperature ;
- applying a pressure to the hot-melt adhesive to fix the end at full spool to the rest of the element.

In a second way, the spool further comprises two flanges. At least one of the flanges comprises at least one hole and at least one clip. The method then further comprises the steps of

- gripping the end at full spool ;
- putting the end at full spool through at least one of said holes ;

- fixing the end at full spool to the spool by means of one of said clips.

The invention will now be explained in more detail with reference to the accompanying drawings wherein

FIGURE 1 is a schematic drawing illustrating how the end at empty spool is fixed to the core of a spool according to the invention ;

FIGURE 2 illustrates how the end at full spool is fixed to the rest of the element by means of a hot-melt adhesive ;

FIGURE 3 shows how the end at full spool may be fixed by means of a hole and a clip.

Referring to FIGURE 1, a metal spool 2 where steel cord 4 is to be wound is shown. The spool 2 comprises a core 22 and two flanges 24 and 26.

If the steel cord 4 is for tyre reinforcement the diameter of the flanges is about 250 mm. The distance between the flanges may be between 150 and 320 mm. The capacity of these types of spools is from 15 up to 40 kg of steel cord.

Metal spools for other kinds of steel elements may have other dimensions and capacities. For steel cord adapted for the reinforcement of belt cord, for example, the diameter of the flanges may be up to 800 mm and the capacity up to 400 kg.

FIGURE 1 shows the situation immediately after a previous spool (not shown) has been filled. The steel cord 4 has been cut thereby creating a cord end at full spool (not shown) for the previous spool and a cord end at empty spool 42 for the current spool 2. The cord end at empty spool 42 has been gripped and brought into contact with the core 22 of spool 2. The cord end at empty spool 42 is held in contact with the core 22 by means of a small roller 6. In the mean time a bar 8 of a suitable hot-melt adhesive is electrically heated in a holder 10 until the bottom side of the hot-melt bar 8 becomes liquid. The electrical heating may be done by means of convenient resistance heating. Generally, hot-melt adhesives must be heated above 79 °C, typical temperatures range from 140 °C to 250 °C, and more particularly from 180 to 230 °C. Once the bottom side of the hot-melt bar 8 has become liquid, the hot-melt bar 8 is pressed against the steel cord 4 and the spool core 22. The holder 10 and the hot-melt bar 8 are then removed from the spool 2. A film of hot-melt adhesive glues the steel cord 4 to the spool core 22 and cools rapidly to a solid state.

The strength of the hot-melt adhesive bond does not need to be very high.

For the winding operation the strength need only be sufficiently high to withstand the tension in the steel cord 4 during the start phase of the winding operation. After the steel cord 4 has made a few turns around the spool core 22 the tension in the steel cord is no longer felt entirely at the cord end at empty spool 42.

For the unwinding operation the strength of the hot-melt adhesive need only be sufficiently high to hold the tension in the unwinding steel cord 4 until the cord end at empty spool 42. The strength must not, on the other hand, be too high, since the cord end at empty spool 42 must be disengageable from the spool core 22 by a small pull.

In this way, the full length of the steel cord 4 may be used without any waste.

Another advantage of the use of the hot-melt adhesive is that if hot-melt adhesive film is left on the spool core 22, it may be easily removed or it may stay on the spool core 22 : once a hot-melt has become solid, it no longer sticks and it does not harm subsequent uses of the spool 2.

FIGURE 2 shows a situation at the end of the winding operation. The spool 2 has been filled and the steel cord 4 has been cut. The cord end at full spool 44 is hold by means of a small roller 6 in contact with the rest of the wound steel cord 4. A bar 8 of a suitable hot-melt adhesive is electrically heated in a holder 10 until the bottom side of the hot-melt bar 8 becomes liquid. Once the bottom side of the hot-melt bar 8 has become liquid, the hot-melt bar 8 is pressed against the cord end at full spool 44 and the rest of the steel cord 4. The holder 10 and the hot-melt bar 8 are then removed from the spool 2.

FIGURE 3 shows another embodiment to fix the cord end at full spool 44 to the spool 2. At least one of the flanges 24, 26 comprises at least one hole 28. This hole 28 is preferably located near the border of the flanges 24 or 26. The flange(s) 24, 26 with the hole also comprise(s) a clip 29 at the exterior side in the neighbourhood of the hole 28. The cord end at full spool 44 is put through the hole 28 and is fixed to the flange by means of the clip 29. The above-mentioned steps are steps which may be automated.

The advantage of both embodiments to fix the cord end at full spool 44 is that no waste of steel cord occurs and that there is no damage to the steel cord.

Claims

1. A spool filled with an elongate steel element such as steel cord which is wound on the spool,
said element having two ends called respectively end at empty spool and end at full spool,
one of said ends being fixed by means of a hot-melt adhesive.

2. A spool according to claim 1
the end at empty spool being fixed to the spool by means of a hot-melt adhesive.

3. A spool according to claim 2
said spool comprising a core,
the end at empty spool being fixed to the core.

4. A spool according to any of claims 2 or 3,
the end at full spool being fixed to the rest of the element by means of a hot-melt adhesive.

5. A spool according to any of claims 2 or 3,
the spool further comprising two flanges,
at least one of the flanges comprising at least one hole, the end at full spool being put through one of said holes.

6. A spool according to claim 5,
the flanges further comprising at least one clip,
the end at full spool being fixed by means of one of said clips.

7. A spool according to claim 1
the end at full spool being fixed by means of an hot-melt adhesive.

8. A spool according to claim 7
the spool comprising a core,
the core comprising at least one hole,
the end at empty spool being fixed in one of said holes.

9. A spool according to any one of claims 1 to 8,
the spool being made of metal.

10. A process of winding an elongate steel element such as steel cord to a spool,
said element having two ends called respectively end at empty spool and end at full spool,
the process comprising the steps of
(i) heating a hot-melt adhesive to above its melting temperature ;
(ii) applying a pressure to the hot-melt adhesive to fix one of said ends ;
(iii) waiting until the hot-melt adhesive has cooled down to a solid state.

11. A process according to claim 10
the end at empty spool being fixed to the spool.

12. A process according to claim 11,
the process further comprising the step of
(iv) winding the steel cord on the spool.

13. A process according to claim 12,
the process further comprising the steps of
(v) heating a hot-melt adhesive to above the melting temperature ;
(vi) applying a pressure to the hot-melt adhesive to fix the end at full spool to the rest of the element.

14. A process according to claim 12,
the spool further comprising two flanges,
at least one of the flanges comprising at least one hole,
the process further comprising the steps of
(v) gripping the end at full spool ;
(vi) putting the end at full spool through at least one of said holes.

15. A process according to claim 14,
the flanges further comprising at least one clip,
the process further comprising the step of
(vii) fixing the end at full spool to the spool by means of one of said clips.

16. A process according to claim 10
the end at full spool being fixed to the rest of the element.

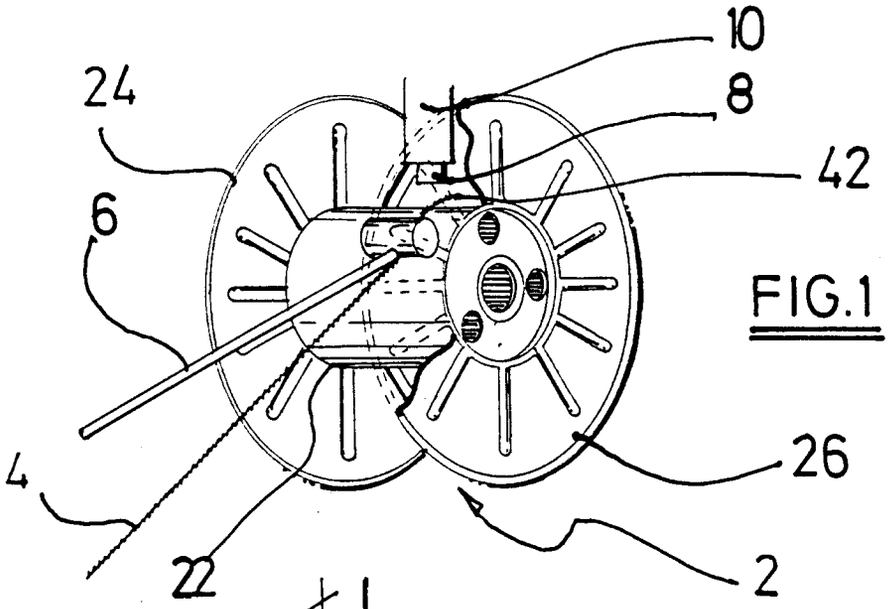

FIG.1

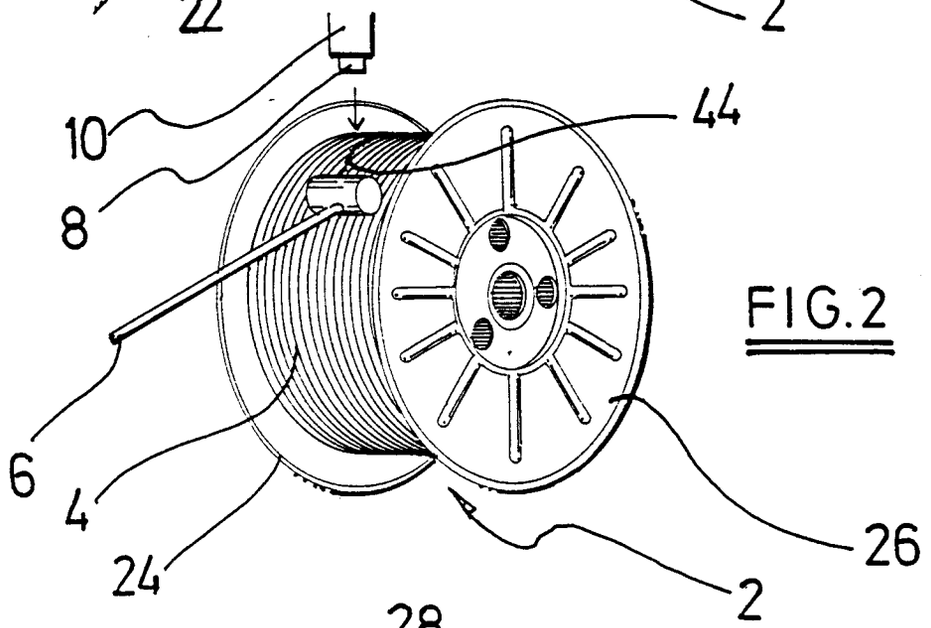

FIG.2

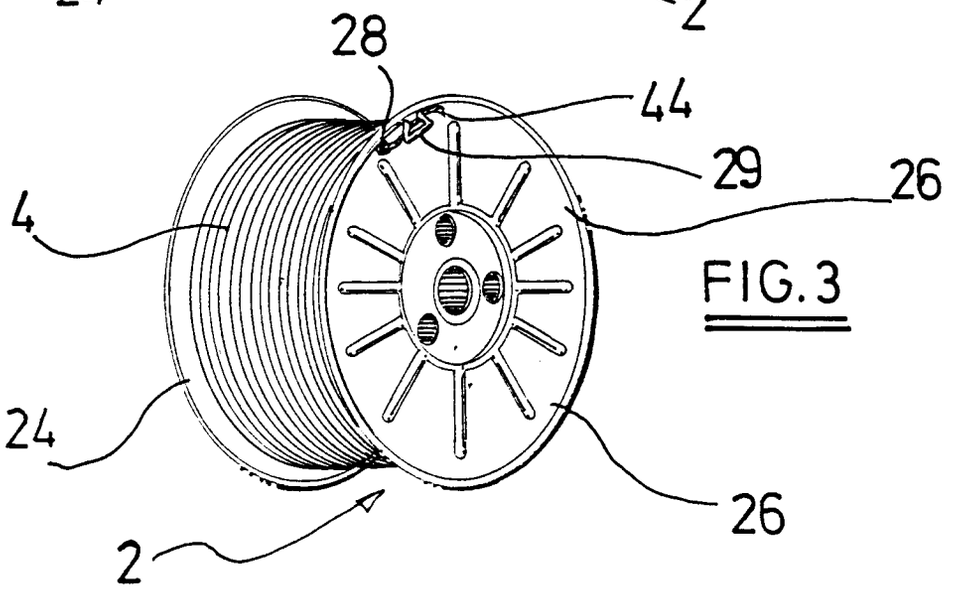

FIG.3

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EUROPEAN SEARCH REPORT

Application Number
EP 92 20 0776

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	GB-A-2 027 076 (W.NIEHOFF) * page 2, line 91 - line 105 *	1,7,10, 16	B65H65/00 B65H75/28
A		4,13	
A	PATENT ABSTRACTS OF JAPAN vol. 8, no. 189 (M-321)30 August 1984 & JP-A-59 078 758 (DAIA SHINKUU GIKEN K.K.) 7 May 1984 * abstract *	1-3, 10-12	
A	US-A-2 583 933 (R.W.ELDER) * column 2, line 35 - column 3, line 57 *	5,6,9, 14,15	
A	PATENT ABSTRACTS OF JAPAN vol. 8, no. 216 (M-329)3 October 1984 & JP-A-59 101 278 (NITSUTETSU YOUSETSU KOGYO K.K.) 11 June 1984 * abstract *	5,8,14	
A	GB-A-2 025 897 (A. AHLSTRÖM OSAKEYHTIÖ)		TECHNICAL FIELDS SEARCHED (Int. Cl.5) B65H D07B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	06 NOVEMBER 1992	GOODALL C.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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