

Description

The present invention relates generally to the winding of flexible elongate materials, such as slide fastener stringer tapes, slide fastener chains, surface-type fasteners known as hook-and-loop fasteners, belts for garments, and ornamental tapes. More particularly, it relates to a spool for winding thereon a flexible elongate material and also to a method and apparatus for winding a flexible elongate material on such spool.

There are known various winding methods and apparatus which comprise a spool for winding thereon a flexible elongate material, the spool being in the form of a cylindrical rod with or without a flange at either end thereof. The known spools have a smooth material-bearing peripheral surface and some of them include a resilient clip generally constituted by a leaf spring, extending axially of the spool and urged against the peripheral surface to hold a leading end of the flexible elongate material.

Winding a flexible elongate material on such known spool needs a manual operation to hold a leading end of the flexible elongate material either by an adhesive or by the clip before the spool is revolved. This manual operation is tedious and time-consuming, thereby lowering the winding efficiency. Furthermore, such manual holding operation can hardly be effected when a relatively narrow elongate material is to be wound on a spool having opposed annular end flanges of a diameter which is considerably large in relation to the distance between the annular end flanges. With the known spool thus constructed, an automated winding of the flexible elongate material is difficult to achieve.

From GB-A-1 040 764 an anchoring device is known for the releasable anchoring of the end of a flexible strip to a holding member. The anchoring device comprises a resilient generally cylindrical clamping member having a slit in its wall that extends from end to end thereof to define a pair of lips. The holding member has a bore defined by arcuate surfaces of different radii that are connected to form a radially offset axially extending shoulder to receive the clamping member in frictional engagement, and a passage extending transverse to the bore and arcuately offset from the shoulder. Said clamping and holding members are arranged such as to receive one end of a strip fed through the passage and slit. The inserted strip becomes locked between the members upon a relative rotation of the members, and a co-operating stop assembly comprising the shoulder and one of the lips to restrict rotation of the clamping member in the reverse direction.

It is clear that in the case of a spool according to GB-A-1 040 764:

(i) a loose clamping member is needed which must be put manually in a bore.

(ii) the end of the flexible strip must be put through a slot into the bore and then through a

slit into the clamping member; to anchor the end of the flexible strip the clamping member must then be rotated over an angle of at least 180°.

(iii) the bore is excentric, so the reel must at least have two bores: one centrally to receive a drive shaft and to rotate about it and a second one for receiving the clamping member.

The present invention seeks to provide a spool for winding thereon a flexible elongate material, the spool having structural features which enable a leading end of the elongate material to be held on the spool without the necessity of tedious and time-consuming manual operation.

The present invention further seeks to provide a method and apparatus for automatically winding a flexible elongate material on such spool.

According to a first aspect of the present invention, there is provided a spool for winding thereon a flexible elongate material, comprising: a cylindrical body having an axial hole communicating with an opening and adapted for holding a leading end of the flexible elongate material, and a pair of radially outwardly extending annular flanges at opposite ends of the body whereby the spool body comprises a hollow cylindrical body having an annular peripheral wall defining said axial hole in the centre of the spool, the opening is a radial opening defined in said annular peripheral wall and communicating with said axial hole which extends from one end of said spool body, said hole being adapted to receive means cooperating with said radial opening for holding said leading end of the flexible elongate material and said radial opening is adapted to provide a passage for the holding means.

According to a second aspect of the present invention, there is provided a method of winding a flexible elongate material method being characterized by using a spool comprising a cylindrical body having an axial hole communicating with a radial opening and adapted for holding a leading end of the flexible elongate material, and a pair of radially outwardly extending annular flanges at opposite ends of the body whereby the spool body comprises a hollow cylindrical body having an annular peripheral wall defining said axial hole in the centre of the spool, the radial opening defined in said annular peripheral wall and communicating with said axial hole which extends from one end of said spool body, said hole being adapted to receive means cooperating with said radial opening for holding said leading end of the flexible elongate material and said radial opening is adapted to provide a passage for the holding means, and further comprising the steps of: rotatably holding the spool from its opposite ends by and between a pair of oppositely disposed first and second drive shafts said first drive shaft being provided with means adapted for holding a leading edge of said flexible elongate material and cooperating with said radial opening; guiding a leading end of the flexible elongate material to the radial opening of the spool body to thereby

cause the leading end to be adhered by said holding means to the annular peripheral wall of the spool body; and winding the elongate material on the spool by rotating the first and second drive shafts.

According to one embodiment of the method of the invention the holding means is a vacuum pump creating a suction force obtained by having in the first drive shaft an axial suction passage-way communicating with the axial hole in the spool body; producing a negative pressure in the axial hole in the spool body by discharging air from the axial hole through the suction passage-way, thereby creating a suction force acting around the radial opening in the spool body.

According to a second embodiment of the method of the invention the holding means comprises at least one locking needle being supported on a slider which is rotatory within an end of a first drive shaft and said needle being selectively projectable beyond a peripheral surface of the annular wall of the spool body through the radial opening and whereby the leading end of the flexible elongate material is locked on the locking needle when said locking needle projects outwardly beyond the peripheral surface of the annular wall.

According to a third aspect of the present invention, there is provided an apparatus for winding a flexible elongate material, comprising: a spool with a cylindrical body having an axial hole communicating with an opening and adapted for holding a leading end of the flexible elongate material, and a pair of radially outwardly extending annular flanges at opposite ends of the body characterized in that the spool body comprises a hollow cylindrical body having an annular peripheral wall defining said axial hole in the centre of the spool, a radial opening defined in said annular peripheral wall and communicating with said axial hole which extends from one end of said spool body, said hole being adapted to receive means cooperating with said radial opening for holding said leading end of the flexible elongate material and said radial opening is adapted to provide a passage for the holding means for winding thereon the flexible elongate material; a pair of oppositely disposed first and second drive shafts relatively movable toward and away from each other for releasably holding said spool, said first and second drive shafts being rotatable about their own axes to revolve said spool, said first drive shaft having at its one end an annular flange engageable with said one end of said spool body, and an extension projecting from said annular flange and receivable in said axial hole in said spool body; and holding means associated with said first drive shaft and cooperative with said radial opening in said spool body for holding a leading end of the flexible elongate material on said spool body.

Many other advantages and features of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying

sheets of drawings in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example.

Figure 1 is a perspective view, with parts cut away for clarity, of a spool embodying the present invention;

Figure 2 is an enlarged fragmentary axial cross-sectional view of the spool shown in Figure 1;

Figure 3 is a perspective view of the spool with an elongated material wound thereon;

Figure 4 is a view similar to Figure 2, showing a modified spool;

Figure 5 is an enlarged perspective view of another spool suitable for winding thereon a flexible elongate material of a relatively large width;

Figure 6 is a fragmentary perspective view of an apparatus for winding a flexible elongate material according to the present invention, the apparatus employing the spool shown in Figure 1;

Figure 7 is an enlarged fragmentary side elevational view, partly in cross section, of the apparatus shown in Figure 6, the view showing the spool held between a pair of opposed drive shafts;

Figure 8 is a view similar to Figure 6, illustrating the manner in which a leading end of the flexible elongate material is held on the spool;

Figure 9 is an enlarged front elevational view showing a modified guide means for guiding the leading end of a flexible elongate material to the spool;

Figure 10 is a view similar to Figure 6, showing a modified winding apparatus according to the invention, the apparatus employing the spool shown in Figure 1;

Figure 11 is an enlarged fragmentary side elevational view of the apparatus shown in Figure 10, the view illustrating locking needles in retracted position;

Figure 12 is a cross-sectional view taken along line XII—XII of Figure 10;

Figure 13 is a view similar to Figure 11, showing the locking needles in locking position; and

Figures 14 and 15 are enlarged schematic cross-sectional views of a modified winding apparatus illustrating different operating steps of resilient locking needles.

As shown in Figure 1, a spool 20 comprises a hollow cylindrical body 21, having an axial hole 22 extending therethrough, and an elongate radial opening 23 defined in an annular peripheral wall 24 of the spool body 21 and communicating with the axial hole 22. The spool body 21 further has, at its opposite ends, a pair of annular flanges 25, 25 projecting radially outwardly from the annular peripheral wall 24, and a pair of annular hubs 26, 26 fitted in the axial hole 22. As shown Figure 2, the elongate radial opening 23 extends axially in the annular peripheral wall 24 with its opposite ends terminating short of the annular flanges 25. The annular flanges 25 serve as an edge-guide means for guiding opposite longitudinal edges of a flexible elongate material, for example, a slide

fastener stringer tape, while the latter is being wound on the spool 20. The annular flanges 25 further serves to prevent the flexible elongate material held thereon from being displaced off the spool 20 which would otherwise occur when an axial force is exerted on the elongate material.

Figure 4 shows a modified spool 28 which is substantially identical with the spool 20 of Figure 1, with the exception that one end of the hollow cylindrical body 21 is closed by a circular bush 29 fitted in the axial hole 22 in the spool body 21.

Another modified spool 30 shown in Figure 5 is particularly suitable for use in winding an elongate material having a relatively large width. The spool 30 comprises an elongate hollow cylindrical body 31 free of a flange at either end thereof. The spool body 31 has an elongate opening 32 extending axially in an annular peripheral wall 33 of the spool body 31, the opening 32 communicating with an axial hole 34 defined by the annular peripheral wall 33. The axial hole 34 may be a blind hole with its one end closed. The elongate opening 32 has its opposite ends located near the opposite ends of the spool body.

Figure 6 shows an apparatus 35 for winding a flexible elongate material 36, the apparatus 35 employing the spool 20 shown in Figures 1-3.

The winding apparatus 35 includes a pair of first and second drive shafts 37, 38 rotatably supported on a frame (not shown) of the apparatus 35 in axial alignment with each other, the first and second drive shaft 37, 38 being reciprocally movable toward and away from one another in the directions indicated by the arrows A and B.

The first drive shaft 37 includes at its one end an annular flange 39 and a cylindrical extension 40 projecting coaxially from the annular flange 39. The cylindrical extension 40 has an outside diameter which is slightly smaller than the inside diameter of the annular hub 26 of the spool 20 so that, as shown in Figure 7, the extension 40 is receivable in the axial hole 22 of the spool 20 when the latter is held by and between the first and second drive shafts 37, 38. An elastic seal-and-friction ring 41 of soft synthetic rubber is fitted around the cylindrical extension 40 and secured by adhesive bonding to one end face of the annular flange 39. The first drive shaft 37 has an axial suction hole or passageway 42 extending therethrough and having one end or an inlet 42a (Figure 7) adapted to open to the axial hole 22 in the spool 20, the other end of the suction passageway 42 being connected to a suitable vacuum source such as a vacuum pump 43. Although not shown, the other end of the first drive shaft 37 is connected in driven relation to a suitable drive means in such a manner that the first drive shaft 37 effects reciprocating and rotary motions upon operation of the drive means.

The second drive shaft 38 includes an enlarged circular end plate 44 connected at one end thereof, and an elastic seal-and-friction disc 45 of soft synthetic rubber secured by adhesive bonding to an end face of the end plate in confronting

relation to the first drive shaft 37. The second drive shaft 38 is coupled with a suitable drive means (not shown) and driven by the latter to positively rotate in synchronism with the rotation of the first shaft 37 and also to reciprocate toward and away from the first drive shaft 37. Alternatively, the second shaft 38 may be freely rotatably journaled on the frame of the apparatus 35.

The winding apparatus 35 also includes a guide means 46 for guiding the flexible elongate material 36 while the latter is being fed toward the apparatus 35 by means of a suitable feed means (not shown). The guide means 46 comprises a trough-like guide member extending toward the spool body 21 in perpendicular relation to the axis of the same. The trough-like guide member 46 includes a pair of opposed sidewalls 47, 47 extending along the length thereof except its one end portion 48. The one end portion 48 is normally held above the spool body 21 and the other end of the guide member 46 is pivoted on the frame of the apparatus 35. The end portion 48, from which the sidewalls 47, 47 are removed, has a width smaller than the distance between the annular flanges 25 of the spool 20 so that the end portion 48 is receivable between the flanges 25 when the guide member 46 is turned about its pivoted end to move downwardly toward the spool 20.

The winding apparatus 35 thus constructed operates as follow. While the spool 20 is held between the first and second shafts 37, 38 in axially spaced relation thereto, the first and second drive shafts 37, 38 are actuated to move axially in the directions indicated by the arrows A, A in Figure 6. This movement of the shafts 37, 38 causes the spool 20 to be firmly gripped by and between the first and second shafts 37, 38 with the cylindrical extension 40 received in the axial hole 22 in the spool 20. In this instance, the elastic ring 41 and the elastic disc 45 are forced against the mating hubs 26, 26 to provide a pair of fluid-tight seals respectively therebetween. Due to the friction acting between the elastic ring 41 and the hub 26 and between the elastic disc 45 and the hub 26, the spool 20 is rotatable in unison with the first and second drive shafts 37, 38.

Then the vacuum pump 43 is started to exhaust air from the axial hole 22 of the spool 20 through the suction passageway 42, thereby creating a partial vacuum in the axial hole 22. Due to the vacuum thus created, the external atmospheric pressure forces the surrounding air into the axial hole 20 through the radial opening 23 of the spool 20. This airflow also produces a vacuum over an outer surface of the annular peripheral wall 24 in the vicinity of the radial opening 23.

Thereafter, the flexible elongate material 36 is fed longitudinally along the guide member 46 toward the spool 20. At the same time, the guide member 46 is actuated to turn clockwise in the direction indicated by the arrow C in Figure 6 until its end portion 48 is disposed immediately above the annular peripheral wall 24 of the spool body 21. As the elongate material 36 further advances,

its leading end 36a overlies the radial opening 23 whereupon the leading end 36a is sucked toward the radial opening 23 and then adhered to the outer surface of the annular peripheral wall 24, due to the vacuum or negative pressure created in the vicinity of the radial opening 23 and in the axial hole 22 of the spool 20. Then the first and second drive shafts 37, 38 are driven to rotate the spool 20, thereby winding the elongate material 36 on the spool 20. Upon completion of the winding, the first and second drive shafts 37, 38 are stopped and a trailing end 36b (Figure 3) of the elongate material 36 thus wound is locked in position against unwinding by means of an adhesive tape 49. The first and second drive shafts 37, 38 are moved in the directions indicated by the arrows B in Figure 6 to release the spool 20. At the same time the operation of vacuum pump 43 is stopped. Alternatively, the operation of the vacuum pump 43 may be stopped after first several turns of the elongate material 36 have been wound on the spool 20 with the leading end 36 firmly held on the spool 20.

Figure 9 shows a modified guide member 50 having a pneumatic means for guiding the leading end 36a of an elongate material 36 to the spool body 21. The guide means 50 comprises a trough-like guide member 51 extending toward the spool 20 for guiding therealong a flexible elongate material 36, and an air nozzle 52 disposed immediately below a forward end 51a of the guide member 51. The air nozzle 52 produces a stream of air extending forwardly from the forward end 51a of the guide member 51 so that a leading end 36a of the elongate material 36 is supported on the thus produced airstream. The guide member 51 is pivoted at its rear end and pivotably movable between an upper position indicated by the solid lines in Figure 9 and a lower position indicated by the phantom lines in the same figure. While the guide member 51 is held in its lower position, the leading end 36a of the elongate material 36 is guided to the annular peripheral wall 24 of the spool body 21 by means of the airstream ejected from the air nozzle 52. The leading end 36 thus guided is then adhered to the peripheral wall 24 due to a vacuum created in the axial hole 22 of the spool body 21.

A modified winding apparatus 55 shown in Figure 10 is substantially identical with the apparatus 35 shown in Figure 6 with the exception that in place of the pneumatic holding means of the apparatus 35, the apparatus 55 includes a mechanical holding means for holding the leading end of a flexible elongate material, the mechanical holding means being associated with a first drive shaft 56. Other structural components are identical with those of the apparatus 35 so that they are indicated by the same reference numerals as those of the apparatus 35.

The first drive shaft 56 is rotatably mounted on a frame (not shown) of the apparatus 55 and coupled with a suitable drive means for rotary and reciprocating motions. The first shaft 56 includes at its one end an annular flange 57 and a

cylindrical extension 58 projecting coaxially from the flange 57. The cylindrical extension 58 has an outside diameter slightly smaller than the inside diameter of the hub 26 of the spool 20 so that the extension 58 is receivable in the axial hole 22 of the spool body 21 as the first and second drive shafts 56, 38 are moved toward each other to grip the spool 20 therebetween. The first drive shaft 56 also includes an elastic friction ring 59 of soft synthetic rubber fitted around the cylindrical extension 58 and adhered to one end face of the annular flange 57.

As shown in Figure 11, the cylindrical extension 58 has a radial recess 60 extending diametrically therethrough and communicating with a central axial hole 61 defined in the first drive shaft 56. An auxiliary drive shaft 62 is rotatably received in the axial hole 61 and coupled at its one end with a suitable drive means (not shown) to rotate about its own axis. The other end of the auxiliary drive shaft 62 has an integral eccentric pin 63 projecting into the radial recess 60. A slider 64 is slidably received in the radial recess 60 and includes an oblong hole 65 in which the eccentric pin 63 of the auxiliary drive shaft 62 is movably received, the oblong hole 65, as shown in Figure 12, extending perpendicularly to the axis of the radial recess 60. With this construction, the slider 64 is reciprocally movable in response to the rotation of the auxiliary drive shaft 62.

The slider 64 also includes a plurality of locking needles 66 projecting from one of the opposite end faces of the slider 64 and disposed along the axis of the cylindrical extension 58. The end faces of the slider 64 are arcuate and have the same radius of curvature as a peripheral surface of the cylindrical extension 58. The slider 64 has a height (the distance between tip ends of the locking needles 66 and the vertex of the other arcuate end face of the slider 64) which is substantially the same as or slightly smaller than the distance of the cylindrical extension 58. The eccentricity of the eccentric pin 63, i.e. the distance between the center of the eccentric pin 63 and the axis of the auxiliary drive shaft 62 is so set as to enable the slider 64 to move reciprocate between a retracted position shown in Figures 11 and 12 in which the slider 64 including its locking needles 66 is fully received in the radial recess 60 with the lower arcuate end face extending in flush with the peripheral surface of the cylindrical extension 58, and a locking position shown in Figure 13 in which the locking needles 66 project outwardly from an upper end 63 of the radial recess 60 with the upper arcuate end face of the slider 64 extending in flush with the peripheral surface of the cylindrical extension 58. In the locking position shown in Figure 13, the locking needles 66 also project through the radial opening 23 outwardly beyond the peripheral surface of the annular wall 24 of the spool body 21.

The winding apparatus 55 also includes a presser pad 68 disposed in registry with the locking needles 66 and reciprocally movable toward and away from the latter to force the

leading end 36a of the flexible elongate material 36 into interlocking engagement with the locking needles 66 while the latter is held in the locking position of Figure 13.

The winding apparatus 55 operates as follows. The spool 20 is disposed between the first and second drive shafts 56, 38 with its radial opening 23 held in axial alignment with the locking needles 66 on the first shaft 56. In this instance, the locking needles 66 are fully retracted in the radial recess 60 in the cylindrical extension 58 of the first drive shaft 56. Then the first and second drive shafts 56, 38 are moved toward each other to firmly grip the spool 20 therebetween, as shown in Figure 11 in which the locking needles 66 are disposed in registry with the radial opening 23 in the spool body 21. The auxiliary drive shaft 62 is turned through an angle of 180° to move the slider 64 in its upper locking position where the locking needles 66 project outwardly from the radial opening 23 of the spool 20.

Subsequently, an elongate material 36 is fed along the guide member 47 (Figure 10) toward the spool 20. In synchronism therewith, the guide member 47 is actuated to turn in the direction indicated by the arrow C so that a leading end 36a of the elongate material 36 is guided by the end portion 48 of the guide member 46 to extend over the radial opening 23 of the spool 20. Then the pressure pad 68 is actuated to move downwardly toward the locking needles 66, thereby locking the leading end 36a of the elongate material 36 on the locking needles 66. The first and second drive shafts 56, 38 are driven to rotate the spool 20, thereby winding the elongate material 36 on the spool 20. After the elongate material 36 has fully been wound on the spool 20, the auxiliary drive shaft 62 is turned through an angle of 180° to retract the locking needles 66 into the radial recess 60 in the cylindrical extension 58. Then the first and second drive shafts 56, 38 are moved away from each other to release the spool 20. It is possible to move the locking needles 66 to its retracted position after first several turns of the elongate material 36 have been wound on the spool 20.

Figures 14 and 15 shows a modified locking mechanism for releasably locking the leading end 36a of a flexible elongate material 36. The locking mechanism comprises a hollow cylindrical main drive shaft 70 having an end portion receivable in the axial hole of the spool 20, and an auxiliary drive shaft 71 rotatably received in the hollow cylindrical main drive shaft 70 in concentric relation therewith. The auxiliary drive shaft 71 supports thereon an eccentric disc 72 carrying, on its peripheral surface, a row of resilient locking needles 73 (only one shown). In response to the rotary motion of the auxiliary drive shaft 71 and hence of the eccentric disc 72, the resilient locking needles 73 move between the locking position of Figure 14 in which the needles 73 project outwardly beyond the outer periphery of the annular wall 24 of the spool body 21, through an elongate radial recess 74 in the main drive shaft 70 and

through the radial opening 23 in the annular wall 24, and the retracted position of Figure 15 in which the locking needles 73 are resiliently deformed along an inner peripheral surface of the hollow main drive shaft 70.

Claims

1. A spool (20) for winding thereon a flexible elongate material (36) comprising a cylindrical body (21) having an axial hole (22) communicating with an opening (23) and adapted for holding a leading end (36a) of the flexible elongate material, and a pair of radially outwardly extending annular flanges (25) at opposite ends of the body, characterized in that the spool body comprises a hollow cylindrical body (21) having an annular peripheral wall (24) defining said axial hole (22) in the centre of the spool, the opening is a radial opening (23) defined in said annular peripheral wall (24) and communicating with said axial hole (22) which extends from one end of said spool body (21), said hole (22) being adapted to receive means cooperating with said radial opening (23) for holding said leading end (36a) of the flexible elongate material (36) and said radial opening (23) is adapted to provide a passage for the holding means.

2. A spool according to claim 1, said radial opening (23) extending axially in said annular peripheral wall (24) and having opposite ends terminating short of said annular flanges (25).

3. A spool according to claim 1, said axial hole (22) extending through said spool body (21).

4. A spool according to claim 1, said axial hole (22) terminating short of the other end of said spool body (21).

5. A method of winding a flexible elongate material (36) on a spool the method being characterized by using a spool comprising a cylindrical body (21) having an axial hole (22) communicating with a radial opening (23) and adapted for holding a leading end (36a) of the flexible elongate material, and a pair of radially outwardly extending annular flanges (25) at opposite ends of the body whereby the spool body comprises a hollow cylindrical body (21) having an annular peripheral wall (24) defining said axial hole (22) in the centre of the spool, the radial opening (23) defined in said annular peripheral wall (24) and communicating with said axial hole (22) which extends from one end of said spool body (21), said hole (22) being adapted to receive means cooperating with said radial opening (23) for holding said leading end (36a) of the flexible elongate material (36) and said radial opening (23) is adapted to provide a passage for the holding means, and further comprising the steps of: rotatably holding the spool (20) from its opposite ends by and between a pair of oppositely disposed first and second drive shafts (37, 38) said first drive shaft being provided with means adapted for holding a leading edge (36a) of said flexible elongate material and cooperating with said radial opening (23); guiding a leading

leading end 36a of the flexible elongate material 36 into interlocking engagement with the locking needles 36 while the latter is held in the locking position of Figure 13.

The winding apparatus 55 operates as follows. The spool 20 is disposed between the first and second drive shafts 56, 38 with its radial opening 23 held in axial alignment with the locking needles 66 on the first shaft 56. In this instance, the locking needles 66 are fully retracted in the radial recess 60 in the cylindrical extension 58 of the first drive shaft 56. Then the first and second drive shafts 56, 38 are moved toward each other to firmly grip the spool 20 therebetween, as shown in Figure 11 in which the locking needles 66 are disposed in registry with the radial opening 23 in the spool body 21. The auxiliary drive shaft 62 is turned through an angle of 180° to move the slider 64 in its upper locking position where the locking needles 66 project outwardly from the radial opening 23 of the spool 20.

Subsequently, an elongate material 36 is fed along the guide member 47 (Figure 10) toward the spool 20. In synchronism therewith, the guide member 47 is actuated to turn in the direction indicated by the arrow C so that a leading end 36a of the elongate material 36 is guided by the end portion 48 of the guide member 46 to extend over the radial opening 23 of the spool 20. Then the pressure pad 68 is actuated to move downwardly toward the locking needles 66, thereby locking the leading end 36a of the elongate material 36 on the locking needles 66. The first and second drive shafts 56, 38 are driven to rotate the spool 20, thereby winding the elongate material 36 on the spool 20. After the elongate material 36 has fully been wound on the spool 20, the auxiliary drive shaft 62 is turned through an angle of 180° to retract the locking needles 66 into the radial recess 60 in the cylindrical extension 58. Then the first and second drive shafts 56, 38 are moved away from each other to release the spool 20. It is possible to move the locking needles 66 to its retracted position after first several turns of the elongate material 36 have been wound on the spool 20.

Figures 14 and 15 shows a modified locking mechanism for releasably locking the leading end 36a of a flexible elongate material 36. The locking mechanism comprises a hollow cylindrical main drive shaft 70 having an end portion receivable in the axial hole of the spool 20, and an auxiliary drive shaft 71 rotatably received in the hollow cylindrical main drive shaft 70 in concentric relation therewith. The auxiliary drive shaft 71 supports thereon an eccentric disc 72 carrying, on its peripheral surface, a row of resilient locking needles 73 (only one shown). In response to the rotary motion of the auxiliary drive shaft 71 and hence of the eccentric disc 72, the resilient locking needles 73 move between the locking position of Figure 14 in which the needles 73 project outwardly beyond the outer periphery of the annular wall 24 of the spool body 21, through an elongate radial recess 74 in the main drive shaft 70 and

through the radial opening 23 in the annular wall 24, and the retracted position of Figure 15 in which the locking needles 73 are resiliently deformed along an inner peripheral surface of the hollow main drive shaft 70.

Claims

1. A spool (20) for winding thereon a flexible elongate material (36) comprising a cylindrical body (21) having an axial hole (22) communicating with an opening (23) and adapted for holding a leading end (36a) of the flexible elongate material, and a pair of radially outwardly extending annular flanges (25) at opposite ends of the body, characterized in that the spool body comprises a hollow cylindrical body (21) having an annular peripheral wall (24) defining said axial hole (22) in the centre of the spool, the opening is a radial opening (23) defined in said annular peripheral wall (24) and communicating with said axial hole (22) which extends from one end of said spool body (21), said hole (22) being adapted to receive means cooperating with said radial opening (23) for holding said leading end (36a) of the flexible elongate material (36) and said radial opening (23) is adapted to provide a passage for the holding means.

2. A spool according to claim 1, said radial opening (23) extending axially in said annular peripheral wall (24) and having opposite ends terminating short of said annular flanges (25).

3. A spool according to claim 1, said axial hole (22) extending through said spool body (21).

4. A spool according to claim 1, said axial hole (22) terminating short of the other end of said spool body (21).

5. A method of winding a flexible elongate material (36) on a spool the method being characterized by using a spool comprising a cylindrical body (21) having an axial hole (22) communicating with a radial opening (23) and adapted for holding a leading end (36a) of the flexible elongate material, and a pair of radially outwardly extending annular flanges (25) at opposite ends of the body whereby the spool body comprises a hollow cylindrical body (21) having an annular peripheral wall (24) defining said axial hole (22) in the centre of the spool, the radial opening (23) defined in said annular peripheral wall (24) and communicating with said axial hole (22) which extends from one end of said spool body (21), said hole (22) being adapted to receive means cooperating with said radial opening (23) for holding said leading end (36a) of the flexible elongate material (36) and said radial opening (23) is adapted to provide a passage for the holding means, and further comprising the steps of: rotatably holding the spool (20) from its opposite ends by and between a pair of oppositely disposed first and second drive shafts (37, 38) said first drive shaft being provided with means adapted for holding a leading edge (36a) of said flexible elongate material and cooperating with said radial opening (23); guiding a leading



end (36a) of the flexible elongate material (36) to the radial opening (23) of the spool body (21) to thereby cause the leading end (36a) to be adhered by said holding means to the annular peripheral wall (24) of the spool body (21); and winding the elongate material (36) on the spool (20) by rotating the first and second drive shafts (37, 38; 56; 70).

6. A method according to claim 5 wherein the holding means is a vacuum pump (43) creating a suction force obtained by having in the first drive shaft (37) an axial suction passageway (42) communicating with the axial hole (22) in the spool body (21); producing a negative pressure in the axial hole (22) in the spool body (21) by discharging air from the axial hole (22) through the suction passageway (42), thereby creating a suction force acting around the radial opening (23) in the spool body (21).

7. A method according to claim 6, said negative-pressure producing step terminating after first several turns of the elongated material (36) have been wound on the spool (20).

8. A method according to claim 5 wherein the holding means comprises at least one locking needle (66; 73) being supported on a slider (64) which is rotatory within an end (58) of a first drive shaft (56, 70) and said needle being selectively projectable beyond a peripheral surface of the annular wall (24) of the spool body (21) through the radial opening (23) and whereby the leading end (36a) of the flexible elongate material (36) is locked on the locking needle (66; 73) when said locking needle projects outwardly beyond the peripheral surface of the annular wall (24).

9. A method according to claim 8, said locking step terminating after first several turns of the elongate material (36) have been wound on the spool (20).

10. An apparatus for winding a flexible elongate material, comprising: a spool (20) with a cylindrical body (21) having an axial hole (22) communicating with an opening (23) and adapted for holding a leading end (36a) of the flexible elongate material, and a pair of radially outwardly extending annular flanges at opposite ends of the body (25) characterized in that the spool body comprises a hollow cylindrical body (21) having an annular peripheral wall (24) defining said axial hole (22) in the centre of the spool, a radial opening (23) defined in said annular peripheral wall (24) and communicating with said axial hole (22) which extends from one end of said spool body (21), said hole (22) being adapted to receive means cooperating with said radial opening (23) for holding said leading end (36a) of the flexible elongate material (36) and said radial opening (23) is adapted to provide a passage for the holding means for winding thereon the flexible elongate material (36); a pair of oppositely disposed first and second drive shafts (37, 38; 56, 38; 70, 38) relatively movable toward and away from each other for releasably holding said spool (20), said first and second drive shafts (37, 38; 56, 38; 70, 38) being rotatable about their own axes to

revolve said spool (20), said first drive shaft (37; 56; 70) having at its one end an annular flange (39; 59) engageable with said one end of said spool body (21), and an extension (40; 58) projecting from said annular flange (39; 59) and receivable in said axial hole (22) in said spool body (21); and holding means (43; 62—66; 71—73) associated with said first drive shaft (37; 56; 70) and cooperative with said radial opening (23) in said spool body (21) for holding a leading end (36a) of the flexible elongate material (36) on said spool body (21).

11. An apparatus according to claim 10, said first drive shaft (37) including an axial suction passageway (42) having one end (42a) communicative with said axial hole (22) in said spool body (21), said holding means comprising a vacuum source (43) connected to the other end of said suction passageway (42) for producing a negative pressure in said axial hole (22), thereby creating a suction force acting around said radial opening (23).

12. An apparatus according to claim 11, said first drive shaft (37) further including an elastic seal-and-friction ring (41) disposed around said extension (40) and sealingly frictionally engageable with said one end of said spool body (21).

13. An apparatus according to claim 10, said extension (58) of said first drive shaft (56; 70) having a radial recess (60; 74) disposed in registry with said radial opening (23) in said spool body (21), said first drive shaft (56; 70) further including an axial hole (61) communicating at its one end with said radial recess (60; 74), said holding means comprising an auxiliary drive shaft (62; 71) rotatably received in said axial hole (61) in said first drive shaft (56; 70), at least one locking needle (66, 73) operatively connected with said auxiliary drive shaft (56; 70) and selectively projectable beyond an outer peripheral surface of said annular peripheral wall (24), through said radial recess (60; 74) in said extension (58) and through said radial opening (23) in said spool body (21), and a presser pad (68) disposed in registry with said radial opening (23) in said spool body (21) and reciprocally movable toward said spool body (21) to force the leading end (36a) of the elongate material (36) into locking engagement with said locking needle (66; 73) when the latter projects beyond said outer peripheral surface of said annular wall (22).

14. An apparatus according to claim 13, said radial recess (60) extending diametrically through said extension (58), said holding means further including a slider (64) slidably received in said radial recess (60), said slider having opposite end faces facing to the opposite ends of said radial recess (60), and an oblong hole (65) extending perpendicular to the axis of said radial recess (60), said locking needle (66) being disposed on one of said end faces of said slider (64), said auxiliary drive shaft (56) having an eccentric pin (63) movably received in said oblong hole (65).

15. An apparatus according to claim 14, said



first drive shaft (56) further including an elastic friction ring (59) disposed around said extension (58) and frictionally engageable with said one end of said spool body (21).

16. An apparatus according to claim 14, said extension (58) having a cylindrical shape, said end faces of said slider (64) being arcuate and having the said radius of curvature as a peripheral surface of said cylindrical extension (58).

17. An apparatus according to claim 13, said auxiliary drive shaft (71) including an eccentric disc (72) movably disposed in said axial hole in said first drive shaft (70), said locking needle (73) being resilient and disposed on a peripheral surface of said eccentric disc (72).

18. An apparatus according to claim 10, further including means (46; 50) for guiding the elongate material (36) to said annular wall (24) of said spool body (21).

19. An apparatus according to claim 18, said guide means comprising a pivotable trough-like guide member (46, 51) having a forward end portion (48) movable toward and away from said annular wall (24) of said spool body (21), in response to the angular movement of said guide member (51).

20. An apparatus according to claim 18, said guide means (50) comprising a pivotable trough-like guide member (51) having a forward end portion (51a) movable toward and away from said annular wall (24) of said spool body (21), in response to the angular movement of said guide member (51), and an air nozzle (52) disposed immediately below said end portion (51a) of said guide member (51) for producing a stream of air extending forwardly from said forward end portion (51a) of said guide member (51).

Patentansprüche

1. Spule (20) zum Aufwickeln von langgestrecktem biegsamen Material (36), umfassend einen zylindrischen Körper (21) mit einer axialen Bohrung (22), die mit einer Öffnung (23) in Verbindung steht und geeignet ist, ein vorderes Ende (36a) des langgestreckten biegsamen Materials festzuhalten, und zwei an gegenüberliegenden Enden des Körpers angeordnete, sich radial nach außen erstreckende ringförmige Flansche (25), dadurch gekennzeichnet, daß der Spulenkörper einen hohlen zylindrischen Körper (21) umfaßt, der eine ringförmige Umfangswand (24) hat, die im Zentrum der Spule die besagte axiale Bohrung (22) begrenzt, wobei die Öffnung eine radiale Öffnung (23) ist, die in der ringförmigen Umfangswand (24) ausgebildet ist und mit der axialen Bohrung (22) in Verbindung steht, die sich von einem Ende des Spulenkörpers (21) erstreckt, wobei diese Bohrung (22) geeignet ist, Mittel aufzunehmen, die mit der radialen Öffnung (23) zusammenwirken, um das vordere Ende (36a) des langgestreckten biegsamen Materials (36) festzuhalten, und wobei die radiale Öffnung (23) geeignet ist, einen Kanal für die Haltemittel zu bilden.

2. Spule nach Anspruch 1, wobei sich die

radiale Öffnung (23) in der ringförmigen Umfangswand (24) axial erstreckt und gegenüberliegenden Enden hat, die kurz vor den ringförmigen Flanschen (25) enden.

3. Spule nach Anspruch 1, wobei sich die axiale Bohrung (22) durch den Spulenkörper (21) erstreckt.

4. Spule nach Anspruch 1, wobei die axiale Bohrung (22) kurz vor dem anderen Ende des Spulenkörpers (21) endet.

5. Verfahren zum Aufwickeln von langgestrecktem biegsamen Material (36) auf eine Spule, gekennzeichnet durch die Verwendung einer Spule mit einem zylindrischen Körper (21), der eine mit einer radialen Öffnung (23) in Verbindung stehende und zum Festhalten eines vorderen Endes (36a) des langgestreckten biegsamen Materials geeignete axiale Bohrung (22) aufweist, und mit zwei ringförmigen Flanschen (25), die sich an gegenüberliegenden Enden des Körpers radial nach außen erstrecken, wobei der Spulenkörper einen hohlen zylindrischen Körper (21) umfaßt, der eine die besagte axiale Bohrung (22) im Zentrum der Spule begrenzende ringförmige Umfangswand (24) aufweist, wobei die in dieser ringförmigen Umfangswand (24) ausgebildete radiale Öffnung (23) mit der axialen Bohrung (22) in Verbindung steht, die sich von einem Ende des Spulenkörpers (21) erstreckt, wobei diese Bohrung (22) zur Aufnahme von Mitteln geeignet ist, die mit der radialen Öffnung (23) zusammenwirken, um das vordere Ende (36a) des langgestreckten biegsamen Materials (36) festzuhalten und wobei die radiale Öffnung (23) geeignet ist, einen Kanal für die Haltemittel zu bilden, und ferner umfassend die Schritte: drehbares Halten der Spule (20) an ihren gegenüberliegenden Enden mit und zwischen zwei gegenüberliegend angeordneten ersten und zweiten Antriebswellen (37, 38), wobei die erste Antriebswelle mit Mitteln versehen ist, die geeignet sind, ein vorderes Ende (36a) des langgestreckten biegsamen Materials festzuhalten und die mit der radialen Öffnung (23) zusammenwirken; Zuführen eines vorderen Endes (36a) des langgestreckten biegsamen Materials (36) zu der radialen Öffnung (23) des Spulenkörpers (21), damit das vordere Ende (36a) von den Haltemitteln an der ringförmigen Umfangswand (24) des Spulenkörpers (21) gehalten wird; und Aufwickeln des langgestreckten Materials (36) auf die Spule (20) durch Verdrehen der ersten und zweiten Antriebswelle (37, 38; 56; 70).

6. Verfahren nach Anspruch 5, wobei die Haltemittel aus einer Saugpumpe (43) bestehen, die eine Saugwirkung ausübt, indem die ersten Antriebswelle (37) eine mit der axialen Bohrung (22) des Spulenkörpers (21) in Verbindung stehenden Saugkanal (42) hat; Erzeugen eines Unterdruckes in der axialen Bohrung (22) des Spulenkörpers (21) durch Ableiten von Luft aus der axialen Bohrung (22) durch den Saugkanal (42), wodurch im Bereich der radialen Öffnung (23) des Spulenkörpers (21) eine Saugkraft geschaffen wird.



* C L M S *

7. Verfahren nach Anspruch 6, wobei die Erzeugung eines Unterdruckes beendet wird, nachdem einige Windungen des langgestreckten Materials (36) auf die Spule (20) aufgewickelt wurden.

8. Verfahren nach Anspruch 5, wobei die Haltemittel mindestens eine Sperrnadel (66; 73) umfassen, die auf einem in einem Ende (58) einer ersten Antriebswelle (56; 70) drehbaren Schlitten (64) abgestützt ist, wobei diese Nadel wahlweise durch die radiale Öffnung (23) über eine Umfangsfläche der ringförmigen Wand (24) des Spulenkörpers (21) hinausragen kann, wodurch das vordere Ende (36a) des langgestreckten biegsamen Materials (36) auf der Sperrnadel (66; 73) festgelegt wird, wenn diese Sperrnadel über die äußere Umfangsfläche der ringförmigen Wand (24) nach außen hinausragt.

9. Verfahren nach Anspruch 8, wobei dieser Festlegungsschritt beendet wird, nachdem einige Windungen des langgestreckten Materials (36) auf die Spule (20) aufgewickelt wurden.

10. Vorrichtung zum Aufwickeln eines langgestreckten biegsamen Materials, umfassend eine Spule (20) mit einem zylindrischen Körper (21), der eine mit einer Öffnung (23) in Verbindung stehende und zum Festhalten eines vorderen Endes (36a) des langgestreckten biegsamen Materials geeignete axiale Bohrung (22) und an gegenüberliegenden Enden des Körpers radial nach außen ragende ringförmige Flansche (25) aufweist, dadurch gekennzeichnet, daß der Spulenkörper einen hohlen zylindrischen Körper (21) umfaßt, der eine die axiale Bohrung (22) im Zentrum der Spule begrenzende ringförmige Umfangswand (24), eine in der ringförmigen Umfangswand (24) ausgebildete und mit der axialen Bohrung (22), die sich von einem Ende des Spulenkörpers (21) erstreckt, in Verbindung stehende radiale Öffnung (23) aufweist, wobei diese Bohrung (22) zur Aufnahme von Mitteln geeignet ist, die mit der radialen Öffnung (23) zusammenwirken, um das vordere Ende (36a) des langgestreckten biegsamen Materials (36) festzuhalten und wobei die radiale Öffnung (23) geeignet ist, einen Kanal für die Haltemittel zu bilden, um darauf das langgestreckte biegsame Material (36) aufzuwickeln; daß zwei einander gegenüberliegende erste und zweite Antriebswellen (37, 38; 56, 38; 70, 38) abstandsveränderlich angeordnet sind, um die Spule (20) lösbar festzuhalten, wobei die erste und zweite Antriebswelle (37, 38; 56, 38; 70, 38) zum Verdrehen der Spule (20) um ihre Eigenachse verdrehbar sind, wobei die erste Antriebswelle (37; 56; 70) an ihrem einen Ende einen Ringflansch (39; 59) hat, der mit dem besagten einen Ende des Spulenkörpers (21) in Eingriff bringbar ist, und eine Verlängerung (40; 58) hat, die von dem Ringflansch (39; 59) vorsteht und in die axiale Bohrung (22) des Spulenkörpers (21) einführbar ist; und daß der ersten Antriebswelle (37; 56; 70) Haltemittel (43; 62—66; 71—73) zugeordnet sind, die mit der radialen Öffnung (23) des Spulenkörpers (21) zusammenwirken, um ein vorderes Ende (36a) des langgestreckten biegsamen Materials (36) auf dem Spulenkörper (21) festzuhalten.

11. Vorrichtung nach Anspruch 10, wobei die erste Antriebswelle (37) einen axialen Saugkanal (42) enthält, dessen eines Ende (42a) mit der axialen Bohrung (22) des Spulenkörpers (21) verbindbar ist, wobei die Haltemittel eine Unterdruckquelle (43) umfassen, die mit dem anderen Ende des Saugkanals (42) verbunden ist, um in der axialen Bohrung (22) einen Unterdruck zu erzeugen und dadurch eine im Bereich der radialen Öffnung (23) wirksame Saugkraft zu schaffen.

12. Vorrichtung nach Anspruch 11, wobei die erste Antriebswelle (37) ferner einen biegsamen Dichtungs- und Reibring (41) aufweist, der die Verlängerung (40) umgibt und mit dem besagten einen Ende des Spulenkörpers (21) dicht und reibschlüssig in Eingriff bringbar ist.

13. Vorrichtung nach Anspruch 10, wobei die Verlängerung (58) der ersten Antriebswelle (56; 70) eine radiale Ausnehmung (60; 74) hat, die mit der radialen Öffnung (23) des Spulenkörpers (21) fluchtet, wobei die erste Antriebswelle (56; 70) ferner eine axiale Bohrung (61) hat, die an ihrem einen Ende mit der radialen Ausnehmung (60; 74) in Verbindung steht, wobei die Haltemittel eine Hilfsantriebswelle (62; 71) umfassen, die in der axialen Bohrung (61) der ersten Antriebswelle (56; 70) drehbar gelagert ist, wobei mindestens eine Sperrnadel (66; 73) mit dieser Hilfsantriebswelle (56; 70) gekuppelt und wahlweise durch die radiale Ausnehmung (60; 74) der Verlängerung (58) und durch die radiale Öffnung (23) des Spulenkörpers (21) hindurch über die äußere Umfangsfläche der ringförmigen Umfangswand (24) hinausragen kann, und ein Andrückpolster (68) umfassen, das mit der radialen Öffnung (23) des Spulenkörpers (21) fluchtet und gegenüber dem Spulenkörper (21) hin- und herbeweglich ist, um das vordere Ende (36a) des langgestreckten Materials (36) mit der Sperrnadel (66; 73) in Sperreingriff zu bringen, wenn diese über die äußere Umfangsfläche der ringförmigen Wand (24) hinausragt.

14. Vorrichtung nach Anspruch 13, wobei sich die radiale Ausnehmung (60) diametral durch die Verlängerung (58) erstreckt, wobei die Haltemittel ferner einen Schlitten (64) umfassen, der in diese radiale Ausnehmung (60) verschiebbar eingreift, wobei der Schlitten gegenüberliegende Endflächen hat, die den gegenüberliegenden Enden der radialen Ausnehmung (60) zugekehrt sind, und ein Langloch (65) hat, das sich rechtwinklig zur Achse der radialen Ausnehmung (60) erstreckt, wobei die Sperrnadel (66) an einer der Endflächen des Schlittens (64) angeordnet ist und die Hilfsantriebswelle (56) einen in das Langloch (65) beweglich eingreifenden Exzenterzapfen (63) hat.

15. Vorrichtung nach Anspruch 14, wobei die erste Antriebswelle (56) ferner einen biegsamen Reibring (59) aufweist, der auf der Verlängerung (58) angeordnet und mit dem besagten einen Ende des Spulenkörpers (21) reibschlüssig in Eingriff bringbar ist.

16. Vorrichtung nach Anspruch 14, wobei die Verlängerung (58) zylindrisch ist und wobei die Endflächen des Schlittens (64) bogenförmig sind und den gleichen Krümmungsradius wie die



Umfangsfläche der zylindrischen Verlängerung (58) haben.

17. Vorrichtung nach Anspruch 13, wobei die Hilfsantriebswelle (71) eine Exzentrerscheibe (72) aufweist, die in der Axialbohrung der ersten Antriebswelle (70) beweglich angeordnet ist, wobei die Sperrnadel (73) biegsam und auf einer Umfangsfläche der Exzentrerscheibe (72) angeordnet ist.

18. Vorrichtung nach Anspruch 10, ferner umfassend Mittel (46; 50) zum Zuführen des langgestreckten Materials (36) zu der ringförmigen Wand (24) des Spulenkörpers (21).

19. Vorrichtung nach Anspruch 18, wobei die Führungsmittel ein schwenkbares rinnenartiges Führungsteil (46, 51) umfassen, dessen vorderer Endbereich (48) entsprechend der Schwenkbewegung des Führungsteils (51) zu der ringförmigen Wand (24) des Spulenkörpers (21) hin und von dieser weg bewegbar ist.

20. Vorrichtung nach Anspruch 18, wobei die Führungsmittel (50) ein schwenkbares rinnenartiges Führungsteil (51) umfassen, dessen vorderer Endbereich (51a) entsprechend der Schwenkbewegung des Führungsteils (51) zu der ringförmigen Wand (24) des Spulenkörpers (21) hin und von dieser weg bewegbar ist, und der eine Luftdüse (52) aufweist, die unmittelbar unter dem Endbereich (51a) des Führungsteils (51) angeordnet ist, um einen Luftstrom zu erzeugen, der von diesem vorderen Endbereich (51a) des Führungsteils (51) nach vorne gerichtet ist.

Revendications

1. Bobine (20) pour enrouler sur celle-ci un matériau allongé flexible (36) comportant un corps cylindrique (21) ayant un trou axial (22) communiquant avec une ouverture (23) et adapté pour maintenir une extrémité avant (36a) du matériau allongé flexible, et une paire de flasques (25) annulaires s'étendant radialement vers l'extérieur aux extrémités opposées du corps, caractérisée en ce que le corps de bobine comporte un corps (21) cylindrique creux ayant une paroi (24) périphérique annulaire définissant ledit trou axiale (22) au centre de la bobine, en ce que l'ouverture est une ouverture radiale (23) définie dans ladite paroi (24) périphérique annulaire et communiquant avec ledit trou axial (22) qui s'étend depuis une extrémité dudit corps de bobine (21), ledit trou (22) étant adapté pour recevoir les moyens coopérant avec ladite ouverture radiale (23) afin de maintenir ladite extrémité avant (36a) du matériau allongé flexible (36) et en ce que ladite ouverture radiale (23) est adaptée pour procurer un passage pour les moyens de maintien.

2. Bobine selon la revendication 1, ladite ouverture radiale (23) s'étendant axialement dans ladite paroi périphérique annulaire (24) et ayant des extrémités opposées se terminant à faible distance desdits flasques annulaires (25).

3. Bobine selon la revendication 1, ledit trou axial (22) s'étendant à travers ledit corps de bobine (21).

4. Bobine selon la revendication 1, ledit trou axial (22) se terminant à faible distance de l'autre extrémité dudit corps de bobine (21).

5. Procédé pour enrouler un matériau allongé flexible (36) sur une bobine, le procédé étant caractérisé par l'utilisation d'une bobine comportant un corps cylindrique (21) ayant un trou axial (22) communiquant avec une ouverture radiale (23) et adapté pour maintenir une extrémité avant (36a) du matériau allongé flexible, et une paire de flasques (25) annulaires s'étendant radialement vers l'extérieur aux extrémités opposées du corps, dans lequel le corps de bobine comporte un corps (21) cylindrique creux ayant une paroi (24) périphérique annulaire définissant ledit trou axial (22) au centre de la bobine, l'ouverture radiale (23) définie dans ladite paroi (24) périphérique annulaire et communiquant avec ledit trou axial (22) qui s'étend depuis une extrémité dudit corps de bobine (21), ledit trou (22) étant adapté pour recevoir des moyens coopérant avec ladite ouverture radiale (23) pour maintenir ladite extrémité avant (36a) du matériau allongé flexible (36) et en ce que ladite ouverture radiale (23) est adaptée pour procurer un passage pour les moyens de maintien, et comportant de plus les étapes suivantes: maintien de façon à ce qu'elle puisse tourner de la bobine (20) par ses extrémités opposées au moyen d'une paire de premier et deuxième arbres d'entraînement (37, 38) disposés de façon opposée et entre ceux-ci, ledit premier arbre d'entraînement étant muni de moyens adaptés pour maintenir un bord avant (36a) dudit matériau allongé flexible et coopérant avec ladite ouverture radiale (23); guidage d'une extrémité avant (36a) du matériau allongé flexible (36) vers l'ouverture radiale (23) du corps de bobine (21) afin de provoquer par conséquent l'adhérence de l'extrémité avant (36a) au moyen desdits moyens de maintien sur la paroi (24) périphérique annulaire du corps de bobine (21); et l'enroulement du matériau allongé (36) sur la bobine (20) en faisant tourner les premier et deuxième arbres d'entraînement (37, 38; 56; 70).

6. Procédé selon la revendication 5 dans lequel les moyens de maintien sont une pompe à vide (43) créant une force de succion obtenue par le fait qu'on a dans le premier arbre d'entraînement (37) un passage de succion axial (42) communiquant avec le trou axial (22) dans le corps de bobine (21); que l'on produit une pression négative dans le trou axial (22) dans le corps de bobine (21) en déchargeant de l'air depuis le trou axial (22) à travers le passage de succion (42), ce qui crée par conséquent une force de succion agissant autour de l'ouverture radiale (23) dans le corps de bobine (21).

7. Procédé selon la revendication 6, ladite étape de production de pression négative se finissant après que les premiers tours du matériau allongé (36) aient été enroulés sur la bobine (20).

8. Procédé selon la revendication 5, dans lequel les moyens de maintien comportent au moins une aiguille de verrouillage (66; 73) supportée sur une glissière (64) qui peut tourner à l'intérieur d'une

extrémité (58) d'un premier arbre d'entraînement (56; 70) et ladite aiguille pouvant faire saillie de façon sélective au-delà d'une surface périphérique de la paroi annulaire (24) du corps de bobine (21) à travers l'ouverture radiale (23), et dans lequel l'extrémité avant (36a) du matériau allongé flexible (36) est accrochée sur l'aiguille de verrouillage (66; 73) lorsque ladite aiguille de verrouillage s'étend vers l'extérieur au-delà de la surface périphérique de la paroi annulaire (24).

9. Procédé selon la revendication 1, ladite étape d'accrochage se terminant après que les premiers tours du matériau allongé (36) aient été enroulés sur la bobine (20).

10. Appareil pour enrouler un matériau allongé flexible, comportant; une bobine (20) avec un corps cylindrique (21) ayant un trou axial (22) communiquant avec une ouverture (23) et adapté pour tenir une extrémité avant (36a) du matériau allongé flexible, et une paire de flasques annulaires s'étendant radialement vers l'extérieur, aux extrémités opposées du corps (25), caractérisé en ce que: le corps de bobine comporte un corps (21) cylindrique creux ayant une paroi (24) périphérique annulaire définissant ledit trou axiale (22) au centre de la bobine, une ouverture radiale (23) définie dans ladite paroi (24) périphérique annulaire et communiquant avec ledit trou axial (22) qui s'étend depuis une extrémité dudit corps de bobine (21), ledit trou (22) étant adapté pour recevoir des moyens coopérant avec ladite ouverture radiale (23) afin de maintenir ladite extrémité avant (36a) du matériau allongé flexible (36) et en ce que ladite ouverture radiale (23) est adaptée pour procurer un passage pour les moyens de maintien afin d'enrouler sur ceux-ci le matériau allongé flexible (36); une paire de premier et deuxième arbres d'entraînement (37, 38; 56, 38; 70, 38) disposés de façon opposée l'un à l'autre et pouvant se rapprocher et s'éloigner l'un de l'autre de façon à maintenir de façon libérable ladite bobine (20), lesdits premier et deuxième arbres d'entraînement (37, 38; 56, 38; 70, 38) pouvant tourner autour de leurs propres axes afin de faire tourner ladite bobine (20), ledit premier arbre d'entraînement (37; 56; 70) ayant à sa première extrémité un flasque annulaire (39, 59) pouvant s'engrener avec ladite première extrémité dudit corps de bobine (21), et une saillie (40, 58) s'étendant depuis ledit flasque annulaire (39, 59) et pouvant être reçue dans ledit trou axial (22) dans ledit corps de bobine (21); et des moyens de maintien (43; 62 à 66; 71 à 73) associés avec ledit premier arbre d'entraînement (37; 56; 70) et coopérant avec ladite ouverture radiale (23) dans ledit corps de bobine (21) pour maintenir une extrémité avant (36a) du matériau allongé flexible (36) sur ledit corps de bobine (21).

11. Appareil selon la revendication 10, ledit premier arbre d'entraînement (37) comportant un passage de succion axial (42) ayant une extrémité (42a) communiquant avec ledit trou axial (22) dans ledit corps de bobine (21), lesdits moyens de maintien comportant une source de vide (43) connectée à l'autre extrémité dudit passage de

succion (42) pour produire une pression négative dans ledit trou axial (22), afin de créer par conséquent une force de succion agissant autour de ladite ouverture radiale (23).

12. Appareil selon la revendication 11, ledit premier arbre d'entraînement (37) comportant de plus un anneau (41) élastique de frottement et d'étanchéité disposé autour de ladite saillie (40) et pouvant être engrené par frottement de façon étanche avec ladite première extrémité dudit corps de bobine (21).

13. Appareil selon la revendication 10, ladite saillie (58) dudit premier arbre d'entraînement (56; 70) ayant une cavité radiale (60; 74) disposée au même niveau que ladite ouverture radiale (23) dans ledit corps de bobine (21), ledit premier arbre d'entraînement (56; 70) comportant de plus un trou axial (61) communiquant à sa première extrémité avec ladite cavité radiale (60; 74), lesdits moyens de maintien comportant un arbre d'entraînement auxiliaire (62; 71) pouvant être reçu de façon à tourner dans ledit trou axial (61) dans ledit premier arbre d'entraînement (56; 70), au moins une aiguille de verrouillage (66; 73) connectée de façon opérationnelle avec ledit arbre d'entraînement auxiliaire (56; 70) et pouvant faire saillie de façon sélective au-delà d'une surface périphérique extérieure de ladite paroi (24) périphérique annulaire, à travers ladite cavité radiale (60; 74) dans ladite saillie (58) et à travers ladite ouverture radiale (23) dans ledit corps de bobine (21), et un tampon presseur (68) disposé au même niveau que ladite ouverture radiale (23) dans ledit corps de bobine (21) et pouvant effectuer un mouvement de va-et-vient afin de se rapprocher dudit corps de bobine (21) de façon à forcer l'extrémité avant (36a) du matériau allongé (36) à venir en engrenement d'accrochage avec ladite aiguille de verrouillage (66; 73) lorsque cette dernière s'étend au-delà de ladite surface périphérique extérieure de ladite paroi annulaire (22).

14. Appareil selon la revendication 13, ladite paroi radiale (60) s'étendant diamétralement à travers ladite saillie (58), lesdits moyens de maintien comportant de plus une glissière (64) reçue de façon à pouvoir glisser dans ladite cavité radiale (60), ladite glissière ayant des faces d'extrémités opposées faisant face aux extrémités opposées de ladite cavité radiale (60), et un trou oblong (65) s'étendant perpendiculairement à l'axe de ladite cavité radiale (60), ladite aiguille de verrouillage (66) étant disposée sur l'une desdites faces d'extrémités de ladite glissière (64), ledit arbre d'entraînement auxiliaire (56) ayant une broche excentrique (63) reçue de façon à pouvoir se déplacer dans ledit trou oblong (65).

15. Appareil selon la revendication 14, ledit premier arbre d'entraînement (56) comportant de plus un anneau (59) de frottement élastique disposé autour de ladite saillie (58) et pouvant être engrené par frottement avec ladite première extrémité dudit corps de bobine (21).

16. Appareil selon la revendication 14, ladite saillie (58) ayant une forme cylindrique, lesdites



faces d'extrémités de ladite glissière (64) ayant une forme d'arc et ayant le même rayon de courbure qu'une surface périphérique de ladite saillie cylindrique (58).

17. Appareil selon la revendication 13, ledit arbre d'entraînement auxiliaire (71) comportant un disque excentrique (72) disposé de façon à pouvoir se déplacer dans ledit trou axial dans ledit premier arbre d'entraînement (70), ladite aiguille de verrouillage (73) étant élastique et étant disposée sur une surface périphérique dudit disque excentrique (72).

18. Appareil selon la revendication 10, comportant de plus des moyens (46; 50) pour guider le matériau allongé (36) vers ladite paroi annulaire (24) dudit corps de bobine (21).

19. Appareil selon la revendication 18, lesdits moyens de guidage comportant un élément (46, 51) de guidage en forme d'auge pouvant pivoter

ayant une partie d'extrémité avant (48) pouvant se rapprocher et s'éloigner de ladite paroi annulaire (24) dudit corps de bobine (21), en réponse au déplacement angulaire dudit élément de guidage (51).

20. Appareil selon la revendication 18, lesdits moyens de guidage (50) comportant un élément de guidage (51) en forme d'auge pouvant pivoter ayant une partie d'extrémité avant (51a) pouvant se rapprocher et s'éloigner de ladite paroi annulaire (24) dudit corps de bobine (21), en réponse au déplacement angulaire dudit élément de guidage (51), et une buse d'air (52) disposée immédiatement en dessous de ladite partie d'extrémité (51a) dudit élément de guidage (51) afin de produire un courant d'air s'étendant vers l'avant par rapport à ladite paroi d'extrémité avant (51a) dudit élément de guidage (51).

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