

## Description

This invention relates to a method of, and machine for, winding tubes from strip.

Australian Patent No. 530,251 and Patent Application No. 15562/83, both in the name of Rib Loc Hong Kong Ltd. disclose machines for producing tubes of helically wound extruded plastic strip having at its side complementary rib and groove formations which, in successive convolutions of the helix, are caused to interlock by a joining roller.

EP-A-0 025 971 also relates to a machine for the continuous manufacture of plastic tubes by helical winding and discloses a machine for winding tubes from a strip of a resilient material having longitudinal side flanges with integrated interconnecting means. The known machine comprises a cylindrical core, means for rotating the core, an annular sleeve coaxially about the core and forming an annular space between them, an inlet opening in the sleeve to the annular space and means (Fig. 4) for guiding a strip through the inlet opening to the annular space.

The present invention has been devised with the general objects of providing a machine which is particularly efficient in the production of tubes wound from strip, and a method of making such tubes.

Other objects achievable in preferred embodiments of the invention are to provide such a machine which may be quickly and easily modified to produce such tubes of different diameters, which is particularly compact and so well suited for lowering into a manhole for the production of a tube projected as a liner into a sewer, and which, though simple and economical to manufacture, is sturdy and durable in use.

In those above respects we have found that in relation to the machine of EP-A-0 025 971 the objects of this invention at least essentially can be achieved by providing a series of ribbed pressure rollers mounted on said sleeve in a helical path and entering the annular space to press a separate locking strip into locking engagement about the adjacent side flanges of the convolutions.

With the foregoing and other objects in view, the invention resides broadly, in one aspect, in a machine for winding tubes from strip of resilient material having longitudinal side flanges and a series of spaced longitudinal flanges and interlocking the side flanges by a longitudinal recessed locking strip of resilient material, which machine includes a base; a substantially cylindrical core mounted rotatably on the base and defining the internal diameter of a tube to be formed; means for rotating the core; an annular outer sleeve mounted on the base coaxially about the core and forming an annular space between them; an inlet opening in the

sleeve to the annular space; means for guiding a tube forming strip through the inlet opening to the annular space; a series of pressure rollers mounted on the sleeve in a helical path and entering the annular space to urge the strip into frictional engagement with the rotating core and to guide it to form about the core a helix with closely adjacent convolutions; means for guiding a longitudinal recessed locking strip of resilient material as locking means for locking together the said adjacent convolutions through the inlet opening to the adjacent convolutions of the tube forming strip; and a series of spaced circumferential grooves, separated by annular ribs, about the pressure rollers, in which the spaced longitudinal flanges can be engaged and thereby guided; the pressure rollers being arranged to press the locking strip into locking engagement about the adjacent side flanges of the convolutions.

Means are preferably provided for introducing glue to the longitudinal groove or recess of the locking strip before its entry to the inlet opening.

The core and the assembly of the outer sleeve and pressure rollers are preferably interchangeable with others for the production of tubes of different diameters.

Other features of the invention will become apparent from the following description.

In order that a preferred embodiment of the invention may be readily understood and carried into practical effect, reference is now made to the accompanying drawings, wherein:

Figure 1 is a partly broken-away side elevational view of a machine according to the invention;

FIG. 2 is a partly broken-away plan view of the machine;

FIG. 3 is an end elevational view of the machine;

FIG. 4 is a sectional view of the lower part of the machine taken along line 4-4 in FIG. 2;

FIG. 5 is a detail drawing, to enlarged scale, of a pressure roller of the machine and strips interlocked thereby; and

FIG. 6 is a sectional view, to larger scale, along line 6-6 in FIG. 1.

The machine illustrated includes an upright base plate 10 having at its top corners shackles 11 to which are attached cables 12 from a winch or the like (not shown) by means of which the machine may be lifted and lowered, for example, into a man-hole.

The base plate 10 is apertured to accept the housing 13 for the bearings of a main shaft 14, the housing extending forwardly of the base plate 10 and having a peripheral flange 15 bolted to the rear face of the base plate.

A double sprocket 16 is keyed on the rear end of the main shaft 14, and an annular mounting plate 17 is welded or otherwise secured on the front part

of the shaft.

A cylindrical outer sleeve 18 is fixed on the front face of the base plate 10, coaxially with the main shaft 14, the sleeve having at its rear end an internal flange 19 which is bolted to the base plate. The bottom of the outer sleeve 18 is level with the bottom edge of the base plate 10.

A cylindrical core 20 is rotatably mounted coaxially within the outer sleeve 18 so that an annular space 21 is formed between them. The core is divided by an annular median plate 22, which is engaged on the front end of the main shaft 14 and bolted to its mounting plate 17. A section of the periphery of the core 20 is slightly reduced in diameter to form a seating for a rubber or like girdle 23, formed with a tread which is hereinafter described, and which has an outer diameter slightly greater than that of the remainder of the core 20, the surface of which, in front of the girdle, is of polished steel.

A hydraulic motor 24 is mounted in front of the base plate 10 on an adjustable carrier bracket 25, the motor shaft 26 passing through a slotted hole in the carrier plate to carry, behind the base plate, a double sprocket 27 connected by endless chains 28 to the double sprocket 16 on the main shaft 14. The motor shaft 26 also carries a sprocket 29 connected by a chain 30 to a sprocket 31 on the shaft of a glue pump 32 mounted on a bracket 33 fixed on the front of the base plate 10.

The outer sleeve 18 is formed with a series of openings 34 arranged in a helical path about the sleeve. At both ends of each of these openings, there are provided bearing blocks 35 for the shaft 36 of a pressure roller 37, shown more particularly in FIG. 5. Each of these pressure rollers, which may be of a tough resilient plastics material, is formed with a series of equally spaced circumferential grooves 38 separated by annular ribs 39 of which two succeeding ribs, indicated at 39a, are of somewhat lesser diameter than the others. Each of the rollers 37 extends for some distance through its opening 34 to approach, but not contact, the rotatable core 20. The roller shafts 36 are engaged in the bearing blocks 35 for adjustment, radially with respect to the core 20, by means of adjustment screws 40.

The tube forming strip 41, shown in section in FIG. 5, is an extruded strip with a base 42 with side flanges 43 having hooked extremities, and with a series of T-section flanges 44 between the side flanges 43 in equally spaced arrangement corresponding to the spacing of the pressure roller grooves 38.

A roll (not shown) of the tube forming strip 41 may be carried on a reel (not shown), from which an end of the strip is carried to a strip guide 45 mounted in front of the base plate 10, in laterally

adjustable manner, on a pair of brackets 46. The strip guide 45 directs the tube forming strip downwards and more or less tangentially, with respect to the outer sleeve 18, to pass through the opening 34 of one of the pressure rollers 37 and between that pressure roller and the rotatable core 20. The strip guide 45 is also arranged obliquely, as shown in FIG. 1, to direct the tube forming strip to the helical path along which the pressure rollers 37 are arranged and onto that part of the core 20 encircled by the rubber or like girdle 23. The tread of this girdle is in the form of grooves which are substantially parallel to the axes of the pressure rollers 37.

Rotation of the core 20 causes the tube forming strip 41 to pass around the core in a helical path so that, after the completion of one rotation of the core 20 two parts of the strip lie closely adjacent, as shown in FIG. 5, the adjacent hooked side flanges 43 of the two parts of the strip being located in the groove 38 between the two reduced-diameter annular ribs 39a of a pressure roller 37. The opening 34 through which the tube forming strip 41 is introduced from the strip guide 45 is of increased width, as shown in FIG. 1, to give easy entry; and the far edge of each of the openings 34 is bent outwardly, as shown particularly at 46 in FIG. 3, to ensure that the strip, during its travel, does not become blocked, but is guided between the core 20 and the outer sleeve 18.

When a convolution of the helical path of the tube forming strip 41 has been completed, the two adjacent parts of the strip are locked together by a locking strip 47 which may be fed from a reel (not shown) to a locking strip guide 48 adjacent to the strip guide 45. The locking strip 47, as shown in FIGS. 5 and 6, is of open arrow-head configuration, with oppositely directed base flanges, and is capable of being pressed down onto, and locking together, the two adjacent hooked side flanges 43 of the two parts of the tube forming strip 41. The locking strip is applied by feeding it, from the locking strip guide 48, through the opening 34 of the first of the pressure rollers 37 and between its annular ribs 39a, the reduced diameters of which allow for the thickness of the base flanges of the locking strip superimposed on the base portions 42 of the adjacent tube forming strips 41.

For better interconnection of the convolutions of the tube forming strip, it is preferred that glue be introduced into the open arrow-head part of the locking strip. This is done by a glue nozzle 49 extending radially into the round-section passage 50 in the locking strip guide 48 through which the locking strip passes. The glue pump 32 draws glue from a reservoir (not shown) by way of a hose 51 and delivers it under pressure to the nozzle through a hose 52.

With continued rotation of the core 20 the helically wound tube forming strip 41, its adjacent convolutions locking and adhesively secured together by the locking strip 47, form, between the rotating core 20 and the outer sleeve 18, a tube of which the internal diameter is determined by the diameter of the core. This tube, as it is formed, is expelled from the open end of the outer sleeve 18, the treaded girdle 23 preventing circumferential slippage on the core but allowing axial slippage of the formed tube over the core's girdle and its polished front part.

The working parts of the machine behind the base plate 10 are shielded by a chain guard 53.

The machine may be used to line a sewer. When the formation of a tube has been commenced, as described, the machine may be lowered by a winch or the like into a manhole, aligned with the sewer, and put into operation to form a lining tube which is impelled forwardly into the sewer. Because of its compact form the machine can be installed for this purpose without deepening or widening the manhole.

If it is required to produce a tube of greater or lesser diameter from the strip, the machine may be quickly and easily modified by the interchanging of the core 20 and outer sleeve 18 (with its associated parts) for others of larger or smaller diameter. The core may be removed by unbolting its median plate 22 from the main shaft flange 17, and the outer sleeve may be removed by unbolting its internal flange 19 from the base plate 10.

Although the operation of the machine has been described and illustrated with reference to the production of tube from the extruded plastic strip 43 and the locking strip 47, it will, with minor modifications, be found very suitable for the production of tube from the well-known plastic strip sold under the trade mark "Rib Loc". Strip of this character is used without a locking strip being required as the rib and groove formations of adjacent convolutions of the helix become interlocked under pressure applied radially with respect to the helix. If the circumferential grooves 38 of the pressure rollers 37 conform to the ribs of the "Rib Loc" strip, it is necessary only that each roller have one, instead of two, of the reduced-diameter annular ribs 39a. If it should be desired that the joint of succeeding convolutions of the helix should be made more secure and gas- and water-tight, the glue nozzle 49 is arranged to inject the glue into the longitudinal groove of the strip.

The invention will be found to be very effective in achieving the objects for which it has been devised, and minor modifications of constructional detail and design which will be readily understood by skilled persons are considered to lie within the scope of the invention hereinafter claimed.

## Claims

1. A machine for winding tubes from strip of resilient material having longitudinal side flanges (43) and a series of spaced longitudinal flanges (44) and interlocking the side flanges (43) by a longitudinal recessed locking strip (47) of resilient material, which machine includes:
  - a base (10);
  - a substantially cylindrical core (20) mounted rotatably on the base (10) and defining the internal diameter of a tube to be formed;
  - means (24) for rotating the core (20);
  - an annular outer sleeve (18) mounted on the base (10) coaxially about the core (20) and forming an annular space (21) between them;
  - an inlet opening (34) in the sleeve (18) to the annular space (21);
  - means (45) for guiding a tube forming strip (41) through the inlet opening (34) to the annular space (21);
  - a series of pressure rollers (37) mounted on the sleeve (18) in a helical path and entering the annular space (21) to urge the tube forming strip (41) into frictional engagement with the rotating core (20) and to guide it to form about the core (20) a helix with closely adjacent convolutions; and
  - means (48) for guiding a longitudinal recessed locking strip (47) of resilient material as locking means for locking together the said adjacent convolutions through the inlet opening (34) to the adjacent convolutions of the tube forming strip (41); and
  - a series of spaced circumferential grooves (38), separated by annular ribs (39), about the pressure rollers (37), in which the spaced longitudinal flanges (43) can be engaged and thereby guided;
  - the pressure rollers (37) being arranged to press the locking strip (47) into locking engagement about the adjacent side flanges (43) of the convolutions.
2. A machine according to claim 1, wherein means (49) are provided for injecting glue into the longitudinal recess of the locking strip (47) prior to its entering the inlet opening (34).
3. A machine according to claim 1 or claim 2, wherein the core (20) is encircled by a girdle (23) of resilient material treaded with ribs substantially perpendicular to the convolutions of the helically-wound tube forming strip (41).
4. A machine according to any one of the preceding claims, wherein each pressure roller (37) is

With continued rotation of the core 20 the helically wound tube forming strip 41, its adjacent convolutions locking and adhesively secured together by the locking strip 47, form, between the rotating core 20 and the outer sleeve 18, a tube of which the internal diameter is determined by the diameter of the core. This tube, as it is formed, is expelled from the open end of the outer sleeve 18, the treaded girdle 23 preventing circumferential slippage on the core but allowing axial slippage of the formed tube over the core's girdle and its polished front part.

The working parts of the machine behind the base plate 10 are shielded by a chain guard 53.

The machine may be used to line a sewer. When the formation of a tube has been commenced, as described, the machine may be lowered by a winch or the like into a manhole, aligned with the sewer, and put into operation to form a lining tube which is impelled forwardly into the sewer. Because of its compact form the machine can be installed for this purpose without deepening or widening the manhole.

If it is required to produce a tube of greater or lesser diameter from the strip, the machine may be quickly and easily modified by the interchanging of the core 20 and outer sleeve 18 (with its associated parts) for others of larger or smaller diameter. The core may be removed by unbolting its median plate 22 from the main shaft flange 17, and the outer sleeve may be removed by unbolting its internal flange 19 from the base plate 10.

Although the operation of the machine has been described and illustrated with reference to the production of tube from the extruded plastic strip 43 and the locking strip 47, it will, with minor modifications, be found very suitable for the production of tube from the well-known plastic strip sold under the trade mark "Rib Loc". Strip of this character is used without a locking strip being required as the rib and groove formations of adjacent convolutions of the helix become interlocked under pressure applied radially with respect to the helix. If the circumferential grooves 38 of the pressure rollers 37 conform to the ribs of the "Rib Loc" strip, it is necessary only that each roller have one, instead of two, of the reduced-diameter annular ribs 39a. If it should be desired that the joint of succeeding convolutions of the helix should be made more secure and gas- and water-tight, the glue nozzle 49 is arranged to inject the glue into the longitudinal groove of the strip.

The invention will be found to be very effective in achieving the objects for which it has been devised, and minor modifications of constructional detail and design which will be readily understood by skilled persons are considered to lie within the scope of the invention hereinafter claimed.

## Claims

1. A machine for winding tubes from strip of resilient material having longitudinal side flanges (43) and a series of spaced longitudinal flanges (44) and interlocking the side flanges (43) by a longitudinal recessed locking strip (47) of resilient material, which machine includes:
  - a base (10);
  - a substantially cylindrical core (20) mounted rotatably on the base (10) and defining the internal diameter of a tube to be formed;
  - means (24) for rotating the core (20);
  - an annular outer sleeve (18) mounted on the base (10) coaxially about the core (20) and forming an annular space (21) between them;
  - an inlet opening (34) in the sleeve (18) to the annular space (21);
  - means (45) for guiding a tube forming strip (41) through the inlet opening (34) to the annular space (21);
  - a series of pressure rollers (37) mounted on the sleeve (18) in a helical path and entering the annular space (21) to urge the tube forming strip (41) into frictional engagement with the rotating core (20) and to guide it to form about the core (20) a helix with closely adjacent convolutions; and
  - means (48) for guiding a longitudinal recessed locking strip (47) of resilient material as locking means for locking together the said adjacent convolutions through the inlet opening (34) to the adjacent convolutions of the tube forming strip (41); and
  - a series of spaced circumferential grooves (38), separated by annular ribs (39), about the pressure rollers (37), in which the spaced longitudinal flanges (43) can be engaged and thereby guided;
  - the pressure rollers (37) being arranged to press the locking strip (47) into locking engagement about the adjacent side flanges (43) of the convolutions.
2. A machine according to claim 1, wherein means (49) are provided for injecting glue into the longitudinal recess of the locking strip (47) prior to its entering the inlet opening (34).
3. A machine according to claim 1 or claim 2, wherein the core (20) is encircled by a girdle (23) of resilient material treaded with ribs substantially perpendicular to the convolutions of the helically-wound tube forming strip (41).
4. A machine according to any one of the preceding claims, wherein each pressure roller (37) is



mounted on the outer sleeve (18) for adjustment in a direction radial to the core (20).

5. A machine according to claim 1, including:
  - a normally upright base plate (10);
  - a main shaft (14), its axis perpendicular to the base plate (10), rotatable in bearings (13) on the base plate (10);
  - a cylindrical core (20) mounted on the main shaft (14);
  - a motor (24) on the base plate (10) for driving the main shaft (14);
  - a series of pressure rollers (37), having spaced circumferential grooves (38) separated by annular ribs (39) mounted on the outer sleeve (18) in a helical path to which their axes are perpendicular, each of the pressure rollers (37) entering the annular space (21) through an opening (34) in the sleeve (18), one such opening (34) being an inlet opening (34);
  - a guide (48) on the base plate (10) for guiding a tube forming strip (41), of resilient material through the inlet opening (34) of the annular space (21) for frictional engagement between the core (20) and the pressure rollers (37) which, upon rotation of the core (20), guide the tube forming strip (41) to form about the core (20) a helix with closely adjacent convolutions, longitudinal side flanges (43) and spaced longitudinal flanges (44) on the tube forming strip (41) being engaged and guided by the spaced circumferential grooves (38); and
  - a locking strip guide (48) on the base plate (10) for guiding a longitudinally recessed locking strip (47), of resilient material, through the inlet opening (34) to the annular space (21), the pressure rollers (37) pressing the locking strip (47) into engagement about the adjacent flanges of succeeding convolutions of the tube forming strip.
6. A machine according to claim 5, wherein glue applying means (49) are mounted on the base plate (10) for injecting glue into the longitudinal recess of the locking strip (47) prior to its passage through the inlet opening (34).
7. A machine according to claim 4, claim 5 or claim 6, wherein:
  - the shafts (36) for the pressure rollers (37) are inclined to the axis of the core (20);
  - the pressure rollers (37) are of tough resilient material and have two succeeding annular ribs (39a) of lesser diameter than the remaining annular ribs (39) to engage and press the locking strip (47) into locking engagement with the side flanges of the convolutions.

8. A machine according to claim 5, claim 6 or claim 7, wherein the core (20) is encircled by girdle (23) of resilient material treaded with ribs substantially perpendicular to the convolutions of the helically-wound tube forming strip (41).
9. A machine according to any one of claims 5 to 8, wherein each pressure roller (37) is mounted on the outer sleeve (18) for adjustment in a direction radial to the core (20).
10. A method of winding a tube from strip, including the steps of:
  - introducing a tube forming strip (41) into the annular space (21) between a fixed cylindrical outer sleeve (18) and a cylindrical core (20) rotating coaxially within the outer sleeve (18);
  - guiding the tube forming strip (41) by pressure means on the sleeve and entering the annular space (21), to form about the rotating core (20) a helix with closely adjacent convolutions; and
  - introducing a locking strip (47) into the annular space (21) and into engagement with the adjacent edge portions of the said adjacent convolutions.

#### Patentansprüche

1. Maschine, um Rohre aus einem Streifen aus elastischem Material zu wickeln, der längsseitige Flansche (43) und eine Reihe von beabstandeten Längsflansche (44) aufweist, wobei die Seitenflansche (43) durch einen längs eingelassenen Schließstreifen (47) aus elastischem Material verriegelt sind, wobei die Maschine enthält:
  - einen Grundkörper (10),
  - einen im wesentlichen zylindrischen Kern (20), der rotierbar auf dem Grundkörper (10) angebracht ist und den inneren Durchmesser des zu formenden Rohres definiert,
  - eine Vorrichtung (24), um den Kern (20) zu rotieren,
  - eine ringförmige, äußere Hülse (18), die auf dem Grundkörper (10) coaxial um den Kern (20) angebracht ist und einen ringförmigen Zwischenraum (21) zwischen den beiden bildet,
  - eine Einlaßöffnung (34) in der Hülse (18) zu dem ringförmigen Zwischenraum (21),
  - eine Vorrichtung (45), um einen rohrformenden Streifen (41) durch die Einlaßöffnung (34) zu dem ringförmigen Zwischenraum (21) zu führen,
  - eine Reihe von Druckrollen (37), die auf der Hülse (18) in einem spiralförmigen Weg



angeordnet sind und in den ringförmigen Zwischenraum (21) vordringen, um den rohrformenden Streifen (41) in einen Reibschluß mit dem rotierenden Kern (29) zu zwingen und ihn zu führen, eine Spirale mit eng benachbarten Windungen um den Kern (20) zu bilden,

Mittel (48) zur Führung eines in Längsrichtung eingelassenen Streifens (47) aus elastischem Material als Schließmittel zum Verschließen benachbarter Windungen durch die Einlaßöffnung (34) zu den benachbarten Windungen des rohrformenden Streifens (41), und

eine Reihe von beabstandeten Umfangsrillen (38), die durch ringförmige Rippen (39) voneinander getrennt sind, an den Druckrollen (37), in die die beabstandeten Längsflansche (43) eingreifen und dadurch geführt werden können,

wobei die Druckrollen (37) so ausgebildet sind, daß sie den Schließstreifen (47) in einen Schließeingriff über den benachbarten Seitenflansch (43) der Windungen drücken.

2. Maschine nach Anspruch 1, bei dem eine Vorrichtung (49) vorgesehen ist, um Klebstoff in den Längseinlaß des Schließstreifens (47) einzuspritzen, bevor er die Einlaßöffnung (34) erreicht.

3. Maschine nach Anspruch 1 oder 2, bei der der Kern (20) von einem Gürtel (23) aus elastischem Material umgeben ist, der mit stehenden Rippen profiliert ist, die im wesentlichen senkrecht zu den Windungen des spiralförmig gewundenen rohrformenden Streifens (41) stehen.

4. Maschine nach einem oder mehreren der vorhergehenden Ansprüche, bei der jede Druckrolle (37) zur Einstellung in eine Richtung radial zum Kern (20) auf der äußeren Hülse (18) angebracht ist.

5. Maschine nach Anspruch 1, mit:

einer normalerweise aufrechten Grundplatte (10),

einer Hauptwelle (14), deren Achse senkrecht zu der Grundplatte (10) steht und die rotierbar in Lagern (13) auf der Grundplatte (10) ist,

einen zylindrischen Kern (20), der an der Hauptwelle befestigt ist,

einen Motor (24), um den Hauptschaft (14) anzutreiben,

einer Reihe von Druckrollen (37), die beabstandete Umfangsrillen (38) aufweisen, die durch ringförmige Rippen (39) getrennt sind, die auf der äußeren Hülse (18) auf einem spi-

ralförmigen Weg angeordnet sind, zu dem ihre Achsen senkrecht stehen, wobei jede der Druckrollen (37) in den ringförmigen Zwischenraum (21) durch eine Öffnung (34) in der Hülse (18) eintritt, wobei eine solche Öffnung (34) als Einlaßöffnung (34) ausgebildet ist,

einer Führung (48) auf der Grundplatte (10), um einen rohrformenden Streifen (41) aus elastischem Material durch die Einlaßöffnung (34) des ringförmigen Zwischenraums (21) in einen Reibschluß zwischen dem Kern (20) und den Druckrollen (37) zu führen, die, wenn der Kern (20) rotiert, den rohrformenden Streifen (41) so führt, daß er um den Kern (20) eine Spirale mit eng benachbarten Windungen, Längsseitenflanschen (43) und beabstandeten Längsflanschen (44) auf den rohrformenden Streifen (41) bildet, der von den Umfangsrillen (38) eingebunden und geführt wird; und

einer Schließstreifenführung (48) auf der Grundplatte (10), um einen längs eingelassenen Schließstreifen (47) aus elastischem Material durch die Einlaßöffnung (34) in den ringförmigen Zwischenraum (21) zu führen, wobei die Druckrollen (37) den Schließstreifen (47) in Verschuß über die benachbarten Flanschen von aufeinander folgenden Windungen des rohrformenden Streifens drücken.

6. Maschine nach Anspruch 5, dadurch gekennzeichnet, daß eine Vorrichtung (49) zum Aufbringen von Klebstoff auf der Grundplatte (10) angebracht ist, um Klebstoff in den Längseinlaß des Schließstreifens (47) einzuspritzen, bevor er die Einlaßöffnung (34) passiert.

7. Maschine nach Anspruch 4, 5 oder 6, bei der die Wellen (36) für die Druckrollen (37) zu der Achse des Kerns (20) geneigt sind,

wobei die Druckrollen (37) aus festem, elastischem Material sind und zwei aufeinander folgende ringförmige Rippen (39a) einen geringeren Durchmesser als die übrigen ringförmigen Rippen (39) aufweisen, um den Schließstreifen (47) in Kraftschluß mit den Seitenflanschen der Windungen zu bringen und zu drücken.

8. Maschine nach Anspruch 5, 6 oder 7, bei der der Kern (20) von einem Gürtel (23) aus elastischem Material umgeben ist, der mit im wesentlichen senkrecht zu den Windungen des spiralförmig gewundenen rohrformenden Streifens (41) stehenden Rippen profiliert ist.

9. Maschine nach einem oder mehreren der Ansprüche 5 - 8, bei der jede Druckrolle (37) auf der äußeren Hülse (18) zur Einstellung in eine



Richtung radial zum Kern (20) angebracht ist.

10. Verfahren, um ein Rohr von einem Streifen zu wickeln, das die folgenden Schritte enthält:

Einführen eines rohrformenden Streifens (41) in den ringförmigen Zwischenraum (21) zwischen einer festen, zylindrischen äußeren Hülse (18) und einem zylindrischen Kern (20), der koaxial in der äußeren Hülse (18) rotiert;

Führung des rohrformenden Streifens (41) durch eine Druckvorrichtung an der Hülse und Einführen in den ringförmigen Zwischenraum (21), um eine Spirale mit eng benachbarten Windungen um den rotierenden Kern (20) zu bilden; und

Einführung eines Schließstreifens (47) in den ringförmigen Zwischenraum (21) und Eingreifen mit dem benachbarten Kantenbereiche der benachbarten Windungen.

#### Revendications

1. Machine pour enrouler des tubes à partir d'une bande de matériau élastique comportant des rebords latéraux longitudinaux (43) et une série de rebords longitudinaux espacés (44) et verrouiller mutuellement les rebords latéraux (43) par une bande de verrouillage évidée longitudinale (47) de matériau élastique, laquelle machine comprend :

une base (10);

un coeur sensiblement cylindrique (20) monté à rotation sur la base (10) et formant le diamètre interne d'un tube à réaliser;

un moyen (24) pour faire tourner le coeur (20);

un manchon externe annulaire (18) monté sur la base (10) coaxialement au coeur (20) et formant un espace annulaire (21) entre eux;

une ouverture d'entrée (34) dans le manchon (18) jusqu'à l'espace annulaire (21);

un moyen (45) pour guider une bande (41) de formation de tube dans l'ouverture d'entrée (34) jusqu'à l'espace annulaire (21);

une série de rouleaux de pression (37) montés sur le manchon (18) en une hélice et entrant dans l'espace annulaire (21) pour solliciter la bande (41) de formation de tube en engagement par friction avec le coeur rotatif (20) et la guider pour former autour du coeur (20) une hélice à spires adjacentes rapprochées; et

un moyen (48) pour guider une bande de verrouillage longitudinale évidée (47) de matériau élastique en tant que moyen de verrouillage pour verrouiller lesdites spires adjacentes dans l'ouverture d'entrée (34) aux spires adjacentes de la bande (41) de formation de tube;

et

une série de gorges espacées circonférentiellement (38), séparées par des nervures annulaires (39), sur les rouleaux de pression (37), dans lesquelles les rebords longitudinaux espacés (43) peuvent être engagés et donc guidés;

les rouleaux de pression (37) étant agencés de manière à presser la bande de verrouillage (47) en engagement de verrouillage sur les rebords latéraux adjacents (43) des spires.

2. Machine selon la revendication 1, dans laquelle un moyen (49) est prévu pour injecter de la colle dans l'évidement longitudinal de la bande de verrouillage (47) avant qu'elle pénètre dans l'ouverture d'entrée (34).

3. Machine selon la revendication 1 ou 2, dans laquelle le coeur (20) est entouré par une ceinture (23) de matériau élastique, sculptée de nervures sensiblement perpendiculaires aux spires de la bande (41) de formation de tube en hélice.

4. Machine selon l'une quelconque des revendications précédentes, dans laquelle chaque rouleau de pression (37) est monté sur le manchon externe (18) pour ajustement dans une direction radiale relativement au coeur (20).

5. Machine selon la revendication 1, comprenant :  
une plaque d'assise généralement verticale (10);

un arbre principal (14), dont l'axe est perpendiculaire à la plaque d'assise (10), tournant dans des paliers (13) sur la plaque d'assise (10);

un coeur cylindrique (20) monté sur l'arbre principal (14);

un moteur (24) sur la plaque d'assise (10) pour entraîner l'arbre principal (14);

une série de rouleaux de pression (37), comportant des gorges (38) espacées circonférentiellement, séparées par des nervures annulaires (39) montées sur le manchon externe (18) en une hélice par rapport à laquelle leur axe est perpendiculaire, chacun des rouleaux de pression (37) pénétrant dans l'espace annulaire (21) par une ouverture (34) dans le manchon (18), ladite ouverture (34) étant une ouverture d'entrée (34);

un guide (48) sur la plaque d'assise (10) pour guider une bande (41) de formation de tube, en matériau élastique, dans l'ouverture d'entrée (34) de l'espace annulaire (21) pour engagement par friction entre le coeur (20) et les rouleaux de pression (37) qui, lors de la



rotation du coeur (20), guident la bande (41) de formation de tube pour former autour du coeur (20) une hélice à spires adjacentes rapprochées, les rebords latéraux longitudinaux (43) et les rebords longitudinaux espacés (44) sur la bande (41) de formation de tube étant engagés et guidés par les gorges (38) espacées circonférentiellement; et

un guide de bande de verrouillage (48) sur la plaque d'assise (10) pour guider une bande de verrouillage évidée longitudinalement (47), de matériau élastique, dans l'ouverture d'entrée (34) jusqu'à l'espace annulaire (21), les rouleaux de pression (37) pressant la bande de verrouillage (47) en engagement sur les rebords adjacents des spires successives de la bande de formation de tube.

Machine selon la revendication 5, dans laquelle, le moyen (49) d'application de colle est monté sur la plaque d'assise (10) pour injecter de la colle dans l'évidement longitudinal de la bande de verrouillage (47) avant qu'elle pénètre dans l'ouverture d'entrée (34).

7. Machine selon la revendication 4, 5 ou 6, dans laquelle :

les arbres (36) pour les rouleaux de pression (37) sont inclinés par rapport à l'axe du coeur (20);

les rouleaux de pression (37) sont en matériau élastique dur et comportent deux nervures annulaires successives (39a) d'un plus petit diamètre que les nervures annulaires restantes (39) pour engager et presser la bande de verrouillage (47) en engagement de verrouillage avec les rebords latéraux des spires.

8. Machine selon la revendication 5, 6 ou 7, dans laquelle le coeur (20) est entouré par une ceinture (23) de matériau élastique, sculptée de nervures sensiblement perpendiculaires aux spires de la bande (41) de formation de tube en hélice.

9. Machine selon l'une quelconque des revendications 5 à 8, dans laquelle chaque rouleau de pression (37) est monté sur le manchon externe (18) pour ajustement dans une direction radiale relativement au coeur (20).

10. Procédé pour enrouler un tube à partir d'une bande, comprenant les opérations consistant à :

introduire une bande (41) de formation de tube dans l'espace annulaire (21) entre un manchon externe cylindrique fixe (18) et un coeur cylindrique (20) tournant coaxialement

au sein du manchon externe (18);

guider la bande (41) de formation de tube par un moyen de pression sur le manchon et la faire pénétrer dans l'espace annulaire (21), pour former autour du coeur (20) tournant une hélice à spires adjacentes rapprochées; et

introduire une bande de verrouillage (47) dans l'espace annulaire (21) et en engagement avec les portions de bord adjacentes desdites spires adjacentes.

