

Method and machine for forming tubes from a strip

Field of the invention

This invention relates to a method and machine for forming tubes from strip and in particular it relates to a machine of the type into which a strip of a selected width is fed and is then curved around in a helical fashion and the edges of the strip are joined together by any suitable means, this operation continuing until the required length of tube has been achieved.

The prior art

It is known to form tubes in this way and reference may be had to US—A—3 199 541 of C. G. Richitelli in which one edge of the strip has a socket formation and the other edge of the strip has a bead formation so that when the strip is fed back on itself in a helical fashion the bead can be pushed into the socket to join the two edges together and thus form a continuous tube.

It is also known to provide machines for effecting the helical winding and as an example of such a machine we refer to US—A—3 606 670 in the name of M. Wienand et al which uses a mandrel onto which the strip is held by means of rollers, the rollers being shaped to align and press together the two complementary edges of a strip when helically wound on such a mandrel.

Another such machine is shown in US—A—3 938 558 in the name of Leroy Anderson, which machine uses a series of rollers which progressively corrugates a strip of metal starting at the centre and gradually corrugating outwards and then winds the corrugated strip to helical form and forms a seam to join the contiguous edges to form a tube, the rollers which form the seam being disposed on both sides of the strip at the point of contact of the strip as it is fed in.

A seam is first formed between contiguous edges of the strip and the strip is then curved to tubular form by further rollers positioned around the circumference of the tube.

A still further patent for forming metal strip into tubes is US—A—3 621 884 in the name of John M. Trihey which again shapes a strip to a required corrugated form and then forms a seam between contiguous edges of the strip by shaping and pressing together the edges to interlock.

In DE—A1—2754 483 a method according to the features of the precharacterising part of claim 1 and a machine according to the features of the precharacterising part of claim 9 are disclosed. From DE—A1—2754 483 it is further known to apply different rotational speeds of the rollers or to apply different or variable diameters of the rollers in order to achieve different size tubes or tubes of constant diameters.

Objects of the invention

It is an object of the invention to provide an improved method of tube formation in which a preformed strip, preferably extruded from a plastic, is helically wound and the convolutions joined together to form a tube, a further object being to provide a close control of the way the strip is bent and the convolutions interlocked to produce either a tube of uniform diameter or a tube of variable diameter along its length.

It is also an object of the present invention to provide certain improvements to machines of that type which form strip into tubular form by helically winding the strip.

It is a still further object to provide means whereby the strip, as the contiguous edges of helical convolutions of the strip are being joined, is given the required shape and curvature.

It is a still further object to provide a machine in which the diameter of the helical tube being formed is variable.

It is a still further object to closely control the diameter of a tube formed in this way and to control this progressively as the tube is being formed so that the dimensions of the tube can be varied progressively in any required manner as the tube is being formed.

Summary of the invention

In the method of forming a tube, a strip having a complementary rib and groove spaced apart on the strip each to extend longitudinally and to be oppositely facing on the strip is guided into a helical configuration to overlap the edges of the strip, with the rib in register with the groove and in which the overlapping parts of the strip are pressed together on a joining roller, and the method is characterised in that the overlapping parts of the strip are pressed together on a joining roller while maintaining a differential feed pressure between that part of the strip being moved to the joining roller and that part of the tube formed by the helically wound strip beyond the joining roller.

A machine for carrying out the method comprises a joining roller rotationally supported on a support frame to engage the strip on one side thereof, the joining roller being positioned to allow the strip passing over it to be curved around into a helical configuration to again engage the joining roller to overlap at least the edge portions of the strip to align the rib with the groove and comprising means to press the overlapping edge portions together and is characterised by pressing the overlapping edge portions together while maintaining a differential forward urging pressure on the two contiguous parts of the strip which are positioned on the joining roller whereby to force the

rib into the groove whilst progressively forming a helical tube from the strip.

Thus the joining of the convolution of the strip to that part of the strip which is fed over the joining roller while under differential pressure has the effect of urging the strip into a helical form to give a strong and accurately formed tube.

Brief description of the drawings

Figure 1 is a plan of a simple form of machine for winding a strip into helical form.

Figure 2 is an end elevation of the machine illustrated in Figure 1.

Figure 3 is a detail of a modification of the illustrated machine.

Figure 4 is a cross section of a strip and joining roller which joins two edge portions of the strip when the strip is being wound to helical form, the section of the strip on the left being taken at the point of roller contact but the section of the strip on the right which is being fed to form a helix being taken forwardly of the roller before the roller has positioned the strip in its interlocking configuration.

Figure 5 is a view corresponding to Figure 4 but showing the edges of the strip interconnected.

Figure 6 is a section as on line 6—6 of Figure 5.

Figure 7 is a detail of a modified form of joining mechanism comprising a joining roller corresponding to the roller of Figure 6 but utilizing a driving roller to provide a differential drive for the strip and the first convolution of the tube whereby the required curvature of the strip is achieved to form a tube of a selected and variable diameter.

Figure 8 is a sectional view to reduced scale of the mechanism which controls the drive and the mechanism which regulates the dimension of the strip driving roller.

Figure 9 is a view corresponding to Figure 7 but using a divided roller to form a pair of driving rollers which can be operated at differential rotation speeds to achieve the differential drive.

Figure 10 is a sectional view to a smaller scale showing the drive means for the rollers of Figure 9.

Figure 11 is a view showing a helical pipe being formed by the mechanism illustrated in Figures 9 and 10 but showing means whereby the diameter of the tube can be progressively varied as the tube is produced.

Figure 12 is a detail of the adjusting mechanism of Figure 11.

Figure 13 is a plan of the machine shown in Figure 11, but showing the strip and tube in dotted lines.

Figure 14 is an end elevation of the machine shown in Figure 11 again showing the strip and tube in dotted lines.

Figure 15 is a somewhat schematic view of a machine with a similar function to that shown

in part in Figures 7 and 8 but showing how the feed and joining rollers can move circularly to allow the tube being formed to remain stationary.

Description of the preferred embodiment

Referring first to Figures 1 to 6 inclusive, the strip 1 is fed forward by a roller 2 driven from a suitable power source such as a hydraulic or electric motor 3, the strip 1 being kept in contact with the roller 2 by the roller 4, at least one of the rollers being resilient to ensure a firm grip and drive for the strip.

The strip feeds from the rollers 2 and 4 to beneath a guide roller 5 which allows the strip to come into contact with the joining roller 6, from which joining roller 6 the strip passes on in contact with a series of guide rollers 7 positioned around the periphery of the tube which is being formed by the strip, the rollers 5, 6 and 7 being mounted on spindles 8 held to a frame member 9 by nuts 10 on threaded shafts of the spindles, the shafts of the spindles passing through slots 11 in the frame member so that the rollers can be positioned to form tubes of different diameter.

Instead of using the slots 11 in the frame member 9 to vary the position of the spindles 8, each spindle 8, as shown in Figure 3, can be mounted on one end of an arm 14 connected by a pivot pin 15 to the frame member 9 and variable in angle by the other end of the arm 14 being connected by a pin 16 to an adjusting member 17 having right and left hand screw threaded portions 18 and 19, the one portion 19 engaging in the member 20 which engages the pin 16 while the other portion 18 engages in the member 21 which in turn is connected by a pin 22 to the frame member 9.

In this way the position of the rollers 7 can be varied to vary the size of the circle around which they are arranged, either individually or by a single adjustment that can move all rollers.

It will be noted that the strip 1 is fed in at an angle to the axis of the tube being formed, see particularly Figure 1, this being necessary to achieve the required helical formation. To ensure that the strip 1 is correctly positioned helically, the joining roller 6 and the series of rollers 7 each has on it a flange 25, which flanges are preferably movable along the rollers 6 and 7 to allow strips of different width to be used, these flanges 25 engaging one edge of the strip to deflect the strip from the direction in which it is fed to the forming roller 6 to offset the edge so that the required helical formation results, and it will be noted that the series of rollers 7 are themselves angled to correctly position the strip along its helical path. The flange 25 on the joining roller 6 is not always necessary.

Referring now particularly to Figures 4, 5 and 6 it will be noted that the strip 1 has at its one edge portion a socket 26 and at its other edge portion a rib 27 so that when the strip is

helically wound the rib 27 coincides with the socket 26 at the point of contact with the forming roller 6, the strip also having a series of strengthening ribs 28 and a locking rib 29 according to a configuration for which the machine is specifically adapted, but the strip can of course be of other form and need not be limited to the form shown.

In operation the strip is fed forwardly by being gripped between the driving roller 2 and the pressure roller 4 and contacts the joining roller 6 as it is driven forward, the strip passing over the joining roller 6 to contact the first of the series of rollers 7 and so on until the end of the strip, after one convolution, again reaches the forming roller 6 whereupon, because of the tension existing in the strip due to the bend which is imparted to it as it is helically curved, will cause this strip to be forced down onto the roller 6 but, because it has been helically displaced, it will be forced down to cause the rib 27 to engage the socket 26 and by then continuing to feed the strip forward by means of the rollers 2 and 4 a helical tube is progressively formed.

The strip 1 is being forced forward by the rollers 2 and 4 against the resistance of the strip to be curved by the series of rollers 7 and the effect of this is that there is a differential feed pressure on the strip 1 as it is forced into joining contact with the convoluted strip and this pressure so exerted has the effect of giving to the strip a curvature and lock required to form a successful helical tube.

Because of the urging force of the strip 1 to rotate the tube itself a very effective seal is provided so that the rib 27 is firmly engaged in the socket 26 under substantial pressure, and it will be seen for instance from particularly Figure 4 that the convolution B is forced down onto the joining roller 6 by the force applied as the strip is curved by the series of rollers 7 so that the strip 1 is held very firmly down onto the joining roller 6, and it will be seen also that the part A of the strip which is being fed in onto the roller 6 by the drive roller 2 and pressure roller 4 is pushed by the joining roller into the same plane as that part B of the strip already on the roller.

While in Figures 1 to 6 inclusive a form of the invention is shown in which the strip is forced onto the joining roller 6 by the curved configuration of the strip 1 as the forming takes place, it is possible to have a similar stress induced by the embodiment shown for instance in Figures 7 and 8, in which dual joining rollers 30 are carried on a spindle 31 by bearings 32 but in this case instead of using the roller 2 which is the driving roller at a position remote from the joining roller 6, the driving roller, in this case numbered 33, is positioned to press onto the forming dual rollers 30 the strip 1 as it is being processed into a tube.

As stated earlier there is a differential pressure between that part of the strip 1 fed

into union with the part of the strip which has already been formed into the helix and the latter part of the strip itself, and to achieve this differential pressure the resilient roller 33 is mounted on a hollow shaft 34 which has a flange 35, to which shaft 34 and flange 35 the roller 33 is firmly bonded, the roller however being longitudinally compressible by means of a pressure member 36 on a shaft 37 which is movable in the hollow of a shaft 34 so that by moving the shaft 37 axially in relation to the shaft 34 that part of the roller between the flange 35 and the pressure member 36 can be varied in dimension, the roller being shown in that Figure with the pressure so applied that the part between the flange 35 and the pressure member 36 is of the same diameter as the part on the other side of the flange 35 but by for instance releasing pressure the part between the flange and the pressure member can be reduced in diameter or by increasing pressure it can be increased in diameter in relation to the part on the other side of the flange.

In this way by varying the diameter of that part of the roller 33 which is pressing down on the part B in the illustration, a different forward rate of motion can be given to the Part B of the strip which is already part of a helix this causes the parts A and B to slip relative to each other in the joint between them. It has been found in practice that this forms a very convenient way of selecting the size of the tube which is formed by helically winding the strip.

The method of varying the dimensions of the part of the roller 33 between the flange 35 and the pressure member 36 is shown particularly in Figure 8 and can consist of a thrust bearing 38 engaged by a fork 39 which has on it a threaded stem 40 engaged by a hand wheel 41 which is axially confined between the members 42 of a frame member 43 which as will be seen is connected to a gearbox 44 having in it a worm wheel 45 driven from a worm 46 by a motor 47, the worm wheel 45 being secured to the shaft 34 so that the shaft 34 is both maintained in correct axial position and is driven by the motor 47.

By setting the hand wheel 41 to give the required loading between the flange 35 and the pressure member 36 the required diameter of helical tube is produced.

In this form of the device the righthand portion of the joining roller 30 is shown with its spindle 31 held to the flange 48 by a nut 49 to be adjustable in the slot 50, and the lefthand portion of the roller 30 can be similarly adjustably mounted. However, it will be realised that other forms of adjustment could be used to vary the distance between the roller 33 and the joining roller 30 according to the dimensions of the strip being processed and the diameter of the roller 33.

In Figures 9 and 10 is shown a preferred form of device in which instead of using a single

roller 33 with part of it variable in diameter, separate resilient rollers 55 and 56 are used, the roller 55 being the main drive roller to feed the strip 1 into the helix while the roller 56 is the roller which controls the rate of revolution of the helical tube being formed, the roller 55 being mounted on a hollow shaft 57 while the roller 56 is mounted on a separate shaft 58.

In this case the hollow shaft 57 is connected to a worm wheel 60 which in turn engages the worm 61 which is driven by a hydraulic or electrical motor 62, the assembly being positioned in the housing 63 which forms a gearbox to drive the roller 55.

The shaft 58 is similarly connected to a worm wheel 68 engaging a worm 69 driven from a motor 70, the housing 71 being attached to a support member 72 to which the gearbox 63 is also attached, the gearbox 63 again having a bracket 73 which supports the shaft 74 of the two forming rollers 75 and 76, which have bearings 77 engaging the shaft 74. The shaft 74 is again positionable in a slot 78 in the bracket 73 so that by loosening the nut 79 the distance between the rollers 75 and 76 and the corresponding rollers 55 and 56 can be selected. Alternatively rollers 76 and 75 can be individually mounted and spring loaded.

In the case of this embodiment of course the curvature given to the strip as it is formed into a helix is adjusted by varying the speed of the motors 62 and 70 and it will be realised for instance that the roller 56 can be driven at a different speed to the roller 55 by varying the speeds of the motors, and this then has the effect of varying the pressure on the part A of the strip 1 as it is fed forward between the rollers 55 and 75 in relation to the speed of that part B of the strip 1 between the rollers 56 and 76, this differential pressure ensuring that while the two overlapping edges of the strip are forced together to engage the rib 27 in the socket 26 one of these parts of the strip is held back relative to the other part of the strip by the differential speed of the rollers 55 and 56 to cause the joined strip to be given a curvature due to the differential pressures existing in the two contiguous parts of the strip 1 being joined.

This again allows the diameter of the helical tube being formed to be varied simply by varying the differential speed of the motors 62 and 70 but the form of the invention now to be described with reference to Figures 11, 12, 13 and 14 adds a convenient form of control to the operation of the motors 62 and 70 and allows by a simple adjustment of a hand wheel a variation of the diameters of the tube being formed.

Referring now to Figures 11, 12, 13 and 14 it will be seen that again the rollers 55 and 56 are used, driven by the motors 62 and 70 through the gearboxes 63 and 71, but the differential speed can be achieved by varying the speed of one of the motors 62 or 70 by means of a sensing roller 85 which is mounted in a fork 86 on a stem 87 which in turn is

movable in an arm 88 to actuate a transducer 89 according to the pressure being exerted on the roller 85 by the strip 1, the roller 85 moving outwardly if the diameter of the tube increases and inwardly if the diameter of the tube decreases. To allow this sensing to take place for different diameter tubes, or variable diameter tubes, the arm 88 is mounted on a slider 90 on a frame member 91 which supports a threaded shaft 92 confined axially by bearings 93 and 94, the threaded shaft 92 having on it a bevel wheel 95 which meshes with a bevel wheel 96 which in turn is fixed to a shaft 97 having left and right hand threads on it again axially confined in bearings 98 and 99 and having on it a hand wheel 100 so that by rotating the shaft 97 by means of a hand wheel 100 the slider 90 can be moved up and down to fix the position required to produce a tube of a certain diameter, but to avoid distortion of the tube as it is formed the shaft 97 actuates a pair of sliders 102 operating on lateral extensions 103 of the frame member 91 and carrying rollers 104 on brackets 105 so that rotation of the shaft 97 through the bevel wheels 95 and 96 simultaneously moves the rollers 104 either inwards or outwards according to the required diameter, but the sensing roller 85 is moved up and down at a proportional rate to effect the required sensing.

By coupling the transducer 89 to control the speed of one of the motors 62 or 70 it is thus then possible to vary the differential speed to maintain the diameter of the spiral being formed through the sensing roller 85 which changed the speed of the motor according to the position of the roller 85 in relation to the arm 88 which in turn actuates the transducer 89 to either increase or decrease the speed of the relevant motor to maintain the correct curvature of the strip 1.

The strip 1 actually is fed in by means of a guide 107 which is shaped to feed the strip correctly to the roller 55 and this guide has on it rollers or pins 108 which confine the strip correctly within the guide 107 but allowed to be drawn forward by the roller 55 at the correct speed to be forced into contact with the rollers 55 and 75.

In this way if for instance the diameter of the tube is to be increased the hand wheel 100 is simply rotated to move the arm 88 outwards and simultaneously to move the arms 105 outward but at half the rate of movement of the arm 88 and the changed pressure on the roller 85 will automatically compensate either the motor 62 or 70 to achieve this varied diameter of the helical tube. This assembly therefore makes it possible to produce a progressively tapered tube, or a tube varying substantially in diameter along its length according to a required program.

In normal operation, in the production of constant diameter tubing, both the drive rollers 55 and 56 turn at approximately the same

speed and preferably with the main drive roller 55 turning at a constant speed. The roller 56 may be varied in speed under the control of the size sensing roller 85 to correct any change in diameter of the helical convolution being produced.

Any increase in the helical diameter causes the size sensing roller to rise from its normal position, which through electronic control means varies the speed of the motor 70 driving the roller 56, with the roller 56 then increasing in speed. This increase in speed of the roller 56 in relation to the roller 55 reduces the diameter of the helix being produced until the size-sensing roller 85 has returned to its normal position.

If the size-sensing roller drops below its normal position, the roller 56 will reduce in speed until the helix has caused the sensing roller to return to its normal position.

To change the diameter of the helical tube, the horizontal sensing rollers 104 are moved into position relative to the axial centre line of the helical tube. This change may be made at any time either before or during the time that the helix is being produced.

As the rollers 104 are connected to move with the roller 85 but through half the distance when the hand wheel 100 is rotated the sensing roller 85 will be positioned to vary the speed of the roller 56 and the diameter of the helical convolution which is being produced will change, thus permitting the diameter of a tube to be progressively varied as it is produced either to produce a tube having a constant taper along its length or a tube of varying dimension along its length.

As the tube being formed rotates in any of the foregoing embodiments support means are provided such as the frame bars 106 having on them anti-friction roller 109 which frame bars in turn may be carried by means of a "Y" shaped assembly mounted on a common base which in turn may be mounted on a mono-rail (not shown).

In the form shown in Figure 15 the joining roller 110, which corresponds to the roller 30 of Figure 7, and the feed roller 111, which corresponds to the compound feed roller 33 of Figure 7 are carried on a frame 112 which can rotate in a ring 113 on a chassis 114 provided with transport wheels 115, the frame 112 also carrying a motor 116 which drives the feed roller 111 through a chain 117. In this embodiment a strip 1 is fed between the rollers 110 and 111 and when a first convolution has been formed it is held against rotating in any suitable manner and if drive continues the rollers 110 and 111 force the frame 112 around in the ring, and the chassis 114 is moved forward as the helical tube is formed.

To allow the rotation the frame 112 has on its circumference a track 120 engaged by rollers 121 rotatably carried in the ring 113 fixed to the chassis 114.

As in operation the frame 112 rotates as the drive roller 111 drives the frame around by reaction of the helical tube which is prevented from rotating. The strip 1 must be fed to between the rollers 110 and 111 and this can be achieved by mounting a spool 122 with a coil of strip 123 on it (shown in dotted lines) on a support shaft 124 on the frame 112 the strip can be unwound and by following generally the path of the arrow 125 will feed to between the rollers 110 and 111.

The drive roller 111 is of similar construction to that shown in Figure 7, for the roller 33, that is it has a resilient portion X and a resilient but expandable portion Y which is tensioned by the nut 127 to determine the required differential drive to produce the required diameter of the helically formed tube.

This form of device is particularly suitable for large tubes which, for instance, must be embedded in the ground, and can be formed by allowing the chassis 114 to move forward as the tube is manufactured.

This principle can, of course, be applied in various ways but the machine must be shaped to allow free feed to the rollers 110 and 111.

The electrical feed to the motor 116 can be taken to it in any suitable manner.

The machine described in this Figure may be changed for hand operation by simply mounting and spindles of the rollers 110 and 111 on an arm secured to a spindle on a support frame at the axis of the tube to be formed and rotating the roller 111 by a hand crank whereupon the rollers will drive the arm around the helical convolution of the tube.

Obviously the roller 111 can be replaced by the two-roller assembly shown particularly in Figure 9 rather than the embodiments shown which uses a single variable-diameter roller.

So far as the sealing of the helical joint in the tube is concerned, this can be achieved by engaging the rib 27 in the groove 26 and locking it by forcing the locking rib 29 behind the expanded end of an adjacent rib 28 of the strip 1, but a sealant can be applied to the join through, for instance, a tube T as shown in Figure 1. Sealant could be pre-applied to the strip or a sealing compound could be used, and if the helical tube is to be strengthened a strengthening member such as a wire or a high tensile ribbon could be fed in with the strip, for instance, at the area designated 131 in Figures 4 and 5 or at any of the areas 132 between the ribs when these are present.

Claims

1. The method of forming tubes from strip in which a strip (1) having a complementary rib (27) and groove (26) spaced apart on the strip, each to extend longitudinally and to be oppositely facing on the strip, is guided into a helical configuration to overlap the edges of the strip, with the rib (27) in register with the

speed and preferably with the main drive roller 55 turning at a constant speed. The roller 56 may be varied in speed under the control of the size sensing roller 85 to correct any change in diameter of the helical convolution being produced.

Any increase in the helical diameter causes the size sensing roller to rise from its normal position, which through electronic control means varies the speed of the motor 70 driving the roller 56, with the roller 56 then increasing in speed. This increase in speed of the roller 56 in relation to the roller 55 reduces the diameter of the helix being produced until the size-sensing roller 85 has returned to its normal position.

If the size-sensing roller drops below its normal position, the roller 56 will reduce in speed until the helix has caused the sensing roller to return to its normal position.

To change the diameter of the helical tube, the horizontal sensing rollers 104 are moved into position relative to the axial centre line of the helical tube. This change may be made at any time either before or during the time that the helix is being produced.

As the rollers 104 are connected to move with the roller 85 but through half the distance when the hand wheel 100 is rotated the sensing roller 85 will be positioned to vary the speed of the roller 56 and the diameter of the helical convolution which is being produced will change, thus permitting the diameter of a tube to be progressively varied as it is produced either to produce a tube having a constant taper along its length or a tube of varying dimension along its length.

As the tube being formed rotates in any of the foregoing embodiments support means are provided such as the frame bars 106 having on them anti-friction roller 109 which frame bars in turn may be carried by means of a "Y" shaped assembly mounted on a common base which in turn may be mounted on a mono-rail (not shown).

In the form shown in Figure 15 the joining roller 110, which corresponds to the roller 30 of Figure 7, and the feed roller 111, which corresponds to the compound feed roller 33 of Figure 7 are carried on a frame 112 which can rotate in a ring 113 on a chassis 114 provided with transport wheels 115, the frame 112 also carrying a motor 116 which drives the feed roller 111 through a chain 117. In this embodiment a strip 1 is fed between the rollers 110 and 111 and when a first convolution has been formed it is held against rotating in any suitable manner and if drive continues the rollers 110 and 111 force the frame 112 around in the ring, and the chassis 114 is moved forward as the helical tube is formed.

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Claims

1. The method of forming tubes from strip in which a strip (1) having a complementary rib (27) and groove (26) spaced apart on the strip, each to extend longitudinally and to be oppositely facing on the strip, is guided into a helical configuration to overlap the edges of the strip, with the rib (27) in register with the



groove (26), and in which the overlapping parts of the strip are pressed together on a joining roller (6; 30; 75—76; 110) characterised in that the overlapping parts of the strip are pressed together on a joining roller (6; 30; 75—76; 110) while maintaining a differential pressure in the direction of the feed of the strip between that part of the strip being moved to the said joining roller (6; 30; 75—76; 110) and that part of the tube formed by the helically wound strip beyond the said joining roller (6; 30; 75—76; 110).

2. The method of claim 1 characterised in that differential pressure is achieved by feeding the strip to the joining roller (6) by roller means (2, 4) ahead of the joining roller while guiding the strip beyond the said joining roller by engaging the strip on spaced rollers (7) having projecting collars (25) arranged around a circle and urging the strip into helical configuration by the rollers (7) and collars (25) to force the overlapping edges together on the joining roller.

3. The method of claim 1 characterised in that the said differential pressure is achieved by feeding the strip (1) between the joining roller (30; 75—76; 110) and a pressure roller (33; 55—56; 111), and driving one of the said rollers to move the said strip forward longitudinally.

4. The method of claim 3 characterised in that the strip (1) and the said convolution are passed between the rollers (30, 33) at a location where at least one said roller (33) has different diameters at the said strip and the said convolution whereby to achieve a differential driving pressure.

5. The method of claim 3 characterised in that the strip (1) and the said convolution are passed between the rollers (55—56, 75—76) but one roller (55—56) is divided to have two sections, one (55) to engage the said strip and the other (56) the said convolution, and the parts of the divided roller are driven at different rates of rotation whereby to achieve a differential driving pressure.

6. The method of claim 5 characterised in that the speed of at least one of the said sections of the said divided roller (55—56) is varied to vary the diameter of the helical tube being formed.

7. The method of claim 6 characterised in that the speed of the said roller is controlled by engaging a sensing member (85) on the said helical tube, and causing the said speed of said roller to be varied by the sensing member (85).

8. The method of any one preceding claim characterised in that the joining roller (110) engaging the strip to provide the differential driving pressure on the strip and helical convolution is free to move circularly about the axis of the tube being formed, and the helical convolution is held stationary about its longitudinal axis and whilst the said rollers are rotated to drive them about the said longitudinal axis.

9. A machine for forming tubes from strip,

which strip (1) has a complementary rib (27) and groove (26) spaced apart on said strip to each extend longitudinally and to be oppositely facing on said strip, comprising a joining roller (6; 30; 75—76; 110) rotationally supported on a support frame (9, 91, 112) to engage the strip on one side thereof, said joining roller being positioned to allow the said strip passing over it to be curved around into a helical convolution to again engage the said joining roller to overlap at least the edge portions of said strip and to align the rib (27) with the groove (26), and comprising means (2; 33; 55—56; 111) to press the overlapping portions together characterised by pressing the said overlapping edge portions together while maintaining a differential forward urging pressure on the two contiguous parts of the strip which are positioned on the said joining roller (6; 30; 75—76; 110) whereby to force the said rib (27) into the said groove (26) whilst progressively forming a helical tube from the said strip.

10. A machine according to claim 9 characterised by drive rollers (2, 4) to engage the strip ahead of the joining roller (6), a series of guide rollers (7) beyond the said joining roller arranged around a circle on spindles (8) on the said support frame (9) to deflect the said strip as it is urged forward into a helical convolution to overlap at least the edge portions of the said strip to align the said rib (27) and groove (26) and to force the convolution down on to the said joining roller (6) to engage the said rib with the said groove, whereby the said differential joining pressure is achieved by urging the said strip forward against the retarding effect of the said guide rollers (7) which engage the convolution of the strip.

11. A machine according to claim 10 further characterised by collars (25) on the said guide rollers (7) progressively displaced to guide the said strip into a helical path by engaging the edge of the said strip.

12. A machine according to claim 9, 10 or 11 characterised in that the said joining roller (110) and the said driving roller (111) are mounted on the frame member (112), and by means (120; 121; 113; 114) to allow the said frame member (112) to rotate about the axis of the said tube being formed.

13. A machine according to claim 9 characterised by a roller (33) also carried on the said support frame (9) positioned to engage the said strip on the remote side of the said strip to press the said strip on to the joining roller (30), at least one of the said rollers being driven to form a drive roller (33) and at least one of the said rollers (33) having a different diameter at the area where the said roller engages the said strip and where the convolution engages the said roller, whereby the said rib (27) is forced into the said groove (26) by differential pressure applied to the said strip and the said convolution between the said rollers.



14. A machine according to claim 13 characterised in that least one of the diameters of the said roller (33) is variable to change the diameter of the convolution produced thereby.

15. A machine according to claim 9 characterised by a roller (55—56) carried on the support frame (91) engaging the said strip on the other side of the said strip to press the said strip on to the joining roller (75—76), said roller (55—56) being divided to have one part (55) engage the said strip and the other part (56) to engage the said convolution at the said joining roller, and said machine being further characterised by means to cause the said two parts (55—56) of the roller to have different peripheral speeds.

16. A machine according to claim 15 characterised in that the said divided roller is arranged to be driven to have the two parts (55—56) with different peripheral speeds.

17. A machine according to claim 16 characterised in that the said two parts (55—56) of the driven roller are of similar diameter but are arranged to be driven at different rates of rotation.

18. A machine according to claim 15, 16 or 17 characterised in that the roller parts (55—56) are at least faced with a resilient rubber-like material.

19. A machine according to any one of claims 15 to 18 characterised in that the driving means for the roller parts have the rate of rotation of at least one of the said rollers variable by mechanism connected to a sensing member (85) in the path of a said helical convolution formed from the strip whereby to maintain a selected diameter of the said helical convolution by increasing or decreasing the differential speed of the roller parts according to the pressure applied on the sensing member (85).

20. A machine according to claim 19 characterised in that one of the roller parts (55—56) is mounted coaxially with the other on coaxial shafts supported in bearings on a support frame (91), said frame also supporting a pair of guide members (104) positioned one toward each side of the roller parts (55—56) so as to engage opposite sides of a helical convolution formed by a strip urged forward by the one roller part (55) together with the sensing member (85) which is disposed between the guide members (104) but opposite the roller parts (55—56) in relation to the helical convolution, and characterised by a speed control for at least one of the driving means for the roller parts (55—56), means interconnecting the sensing member (85) with the speed control, and means to move the guide members (104) simultaneously to define a larger or smaller circle passing through a plane between the roller parts (55—56) and the joining roller (75) whereby to vary the differential drive between roller parts (55—56) to vary the diameter of a tube being formed.

Patentansprüche

1. Das Verfahren zum Formen von Rohren aus Streifenmaterial, bei dem ein Materialstreifen (1), der eine komplementäre Rippe (27) und eine Nut (26) aufweist, die auf dem Materialstreifen in einem Abstand voneinander so angeordnet sind, daß sie sich jeweils in der Längsrichtung erstrecken und auf dem Materialstreifen voneinander abgewandt sind, in eine schraubenlinienförmige Gestalt geführt wird, um die Ränder des Materialstreifens so zur Überlappung zu bringen, daß die Rippe (27) in Deckung mit der Nut (26) kommt, und bei dem die sich überlappenden Teile des Materialstreifens auf einer Zusammenfüguingsrolle (6; 30; 75—76; 110) zusammengepreßt werden, dadurch gekennzeichnet, daß die sich überlappenden Teile des Materialstreifens auf einer Zusammenfüguingsrolle (6; 30; 75—76; 110) zusammengepreßt werden, während ein Differentialdruck in der Richtung des Vorschubs des Materialstreifens zwischen demjenigen Teil des Materialstreifens, der in Richtung auf die genannte Zusammenfüguingsrolle (6; 30; 75—76; 110) bewegt wird, und demjenigen Teil des Rohres aufrechterhalten wird, welcher durch den schraubenlinienförmig gewirkelten Materialstreifen jenseits der genannten Zusammenfüguingsrolle (6; 30; 75—76; 110) gebildet wird.

2. Das Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Differentialdruck dadurch hervorgerufen wird, daß der Materialstreifen der Zusammenfüguingsrolle (6) durch Rollenmittel (2, 4) vor der Zusammenfüguingsrolle zugeführt wird, während der Materialstreifen über die Zusammenfüguingsrolle hinaus dadurch geführt wird, daß der Materialstreifen durch in Abständen voneinander angeordnete Rollen (7) erfaßt wird, die mit vorspringenden Bunden (25) versehen und auf einem Kreis angeordnet sind, und daß der Materialstreifen durch die Rollen (7) und Bunde (25) in die schraubenlinienförmige Gestalt gebracht wird, um die sich überlappenden Ränder auf der Zusammenfüguingsrolle unter Kraftaufwand zusammenzubringen.

3. Das Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der genannte Differentialdruck dadurch hervorgerufen wird, daß der Materialstreifen (1) zwischen der Zusammenfüguingsrolle (30; 75—76; 110) und einer Druckrolle (33; 55—56; 111) zugeführt wird und daß eine der genannten Rollen angetrieben wird, um den genannten Materialstreifen in der Längsrichtung vorwärtszubewegen.

4. Das Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß der Materialstreifen (1) und die genannte Wendel zwischen den Rollen (30, 33) an einer Stelle hindurchgeführt werden, an der mindestens eine der genannten Rollen (33) unterschiedliche Durchmesser an dem genannten Materialstreifen und der



genannten Wendel aufweist, um hierdurch einen Differentialantriebsdruck zu erzeugen.

5. Das Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß der Materialstreifen (1) und die genannte Wendel zwischen den Rollen (55—56; 75—76) hindurchgeführt werden, daß jedoch eine Rolle (55—56) in zwei Abschnitte unterteilt ist, von denen einer (55) den genannten Materialstreifen und der andere (56) die genannte Wendel erfaßt, und daß die Abschnitte der unterteilten Rolle mit verschiedenen Drehgeschwindigkeiten angetrieben werden, wodurch ein Differentialantriebsdruck hervorgerufen wird.

6. Das Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß die Geschwindigkeit mindestens eines der genannten Abschnitte der genannten unterteilten Rolle (55—56) variiert wird, um den Durchmesser des zu formenden schraubenlinienförmigen Rohres zu variieren.

7. Das Verfahren nach Anspruch 6, dadurch gekennzeichnet, daß die Geschwindigkeit der genannten Rolle dadurch geregelt wird, daß ein Fühlelement (85) zur Anlage an dem schraubenlinienförmigen Rohr gebracht wird, und daß veranlaßt wird, daß die genannte Geschwindigkeit der genannten Rolle durch das Fühlelement (85) variiert wird.

8. Das Verfahren nach jedem beliebigen vorausgehenden Anspruch, dadurch gekennzeichnet, daß die Zusammenfüguingsrolle (110), die an dem Materialstreifen angreift, um den Differentialantriebsdruck auf den Materialstreifen und die schraubenlinienförmige Wendel aufzubringen, ungehindert Kreisbewegungen um die Achse des zu formenden Rohres ausführen kann und daß die schraubenlinienförmige Wendel gegenüber ihrer Längsachse ortsfest gehalten wird, während die genannten Rollen gedreht werden, um sie um die genannte Längsachse herum anzutreiben.

9. Eine Maschine zum Formen von Rohren aus Streifenmaterial, wobei der Materialstreifen (1) eine komplementäre Rippe (27) und eine Nut (26) aufweist, die auf dem Materialstreifen durch einen Abstand voneinander getrennt und so angeordnet sind, daß sie sich in der Längsrichtung erstrecken und auf dem Materialstreifen voneinander abgewandt sind, umfassend eine Zusammenfüguingsrolle (6; 30; 75—76; 110), die auf einem Traggestell (9, 91, 112) drehbar gelagert ist, um mit dem Materialstreifen auf einer Seite desselben zusammenzuarbeiten, wobei die genannte Zusammenfüguingsrolle so angeordnet ist, daß sie es dem genannten Materialstreifen ermöglicht, sich über sie hinwegzubewegen, um zu einer schraubenlinienförmigen Wendel gebogen zu werden und erneut mit der genannten Zusammenfüguingsrolle zusammenzuarbeiten, um mindestens die Randabschnitte des genannten Materialstreifens zu überlappen und die Rippe (27) auf die Nut (26) auszurichten, wobei Mittel (2; 33; 55—56; 111) vorhanden sind, um die sich überlappenden Abschnitte

zusammenzupressen, dadurch gekennzeichnet, daß die genannten sich überlappenden Randabschnitte zusammengepreßt werden, während ein in der Vorwärtsrichtung wirkender Differentialdruck auf die beiden aneinander angrenzenden Teile des Materialstreifens aufrechterhalten wird, die auf der genannten Zusammenfüguingsrolle (6; 30; 75—76; 110) angeordnet sind, um die genannte Rippe (27) in die genannte Nut (26) hineinzudrücken, während aus dem genannten Materialstreifen, fortschreitend ein schraubenlinienförmiges Rohr geformt wird.

10. Maschine nach Anspruch 9, gekennzeichnet durch Antriebsrollen (2, 4) zum Erfassen des Materialstreifens vor der Zusammenfüguingsrolle (6), einen Satz von Führungsrollen (7), die jenseits der genannten Zusammenfüguingsrolle über einen Kreis verteilt auf Achsen (8) auf dem genannten Traggestell (9) angeordnet sind, um den genannten Materialstreifen umzulenken, während er unter Kraftaufwand in der Vorwärtsrichtung bewegt und zu einer schraubenlinienförmigen Wendel geformt wird, um mindestens die Randabschnitte des genannten Materialstreifens zu überlappen, damit die genannte Rippe (27) auf die Nut (26) ausgerichtet und die Wendel nach unten gegen die genannte Zusammenfüguingsrolle (6) gedrückt wird, um die genannte Rippe in Eingriff mit der genannten Nut zu bringen, wobei der genannte Differentialzusammenfüguingsdruck dadurch hervorgerufen wird, daß der genannte Materialstreifen unter Kraftaufwand in der Vorwärtsrichtung entgegen der verzögernden Wirkung der genannten Führungsrollen (7) bewegt wird, welche mit der Wendel des Materialstreifens zusammenarbeiten.

11. Maschine nach Anspruch 10, ferner gekennzeichnet durch Bunde (25) an den genannten Führungsrollen (7), die fortschreitend so gegeneinander versetzt sind, daß sie den genannten Streifen längs einer schraubenlinienförmigen Bahn dadurch führen, daß sie mit dem Rand des genannten Materialstreifens zusammenarbeiten.

12. Eine Maschine nach Anspruch 9, 10 oder 11, dadurch gekennzeichnet, daß die genannte Zusammenfüguingsrolle (110) und die genannte Antriebsrolle (111) auf dem Gestellteil (112) gelagert sind, sowie durch Mittel (120; 121; 113; 114), die es dem genannten Gestellteil (112) ermöglichen, um die Achse des genannten zu formenden Rohres zu rotieren.

13. Eine Maschine nach Anspruch 9, gekennzeichnet durch eine Rolle (33), die ebenfalls auf dem genannten Traggestell (9) gelagert und so angeordnet ist, daß sie mit dem genannten Materialstreifen auf der abgewandten Seite des genannten Materialstreifens zusammenarbeitet, um den genannten Materialstreifen an die Zusammenfüguingsrolle (30) anzupressen, wobei mindestens eine der genannten Rollen angetrieben wird, um eine Antriebsrolle (33) zu bilden, und wobei mindestens eine der genann-



ten Rollen (33) einen anderen Durchmesser an der Stelle hat, an der die genannte Rolle mit dem genannten Materialstreifen zusammenarbeitet, sowie dort, wo die Wendel mit der genannten Rolle zusammenarbeitet, so daß die genannte Rippe (27) in die genannte Nut (26) durch einen Differentialdruck hineingedrückt wird, der auf den genannten Materialstreifen und die genannte Wendel zwischen den genannten Rollen aufgebracht wird.

14. Eine Maschine nach Anspruch 13, dadurch gekennzeichnet, daß mindestens einer der Durchmesser der genannten Rolle (33) variabel ist, um den Durchmesser der durch sie erzeugten Wendel zu verändern.

15. Eine Maschine nach Anspruch 9, gekennzeichnet durch eine Rolle (55—56), die auf einem Traggestell (91) gelagert ist und mit dem genannten Materialstreifen auf der anderen Seite des genannten Materialstreifens zusammenarbeitet, um den genannten Materialstreifen an die Zusammenfüguingsrolle (75—76) anzupressen, daß die genannte Rolle (55—56) unterteilt ist, so daß sie einen Abschnitt (55) aufweist, der mit dem genannten Materialstreifen zusammenarbeitet, während der andere Abschnitt (56) mit der genannten Wendel an der genannten Zusammenfüguingsrolle zusammenarbeitet, und daß die genannte Maschine ferner gekennzeichnet ist durch Mittel, um zu veranlassen, daß sich die beiden genannten Abschnitte (55—56) der Rolle mit verschiedenen Umfangsgeschwindigkeiten bewegen.

16. Eine Maschine nach Anspruch 15, dadurch gekennzeichnet, daß die genannte unterteilte Rolle so antriebbar ist, daß sich die beiden Abschnitte (55—56) mit verschiedenen Umfangsgeschwindigkeiten bewegen.

17. Eine Maschine nach Anspruch 16, dadurch gekennzeichnet, daß die genannten beiden Abschnitte (55—56) der angetriebenen Rolle von ähnlichem Durchmesser, jedoch so eingerichtet sind, daß sie mit verschiedenen Drehgeschwindigkeiten antreibbar sind.

18. Eine Maschine nach Anspruch 15, 16 oder 17, dadurch gekennzeichnet, daß die Rollenabschnitte (55—56) mindestens mit einem elastischen gummiähnlichen Material überzogen sind.

19. Eine Maschine nach einem jeden der Ansprüche 15 bis 18, dadurch gekennzeichnet, daß bei den Antriebsmitteln für die Rollenteile die Drehgeschwindigkeit mindestens einer der genannten Rollen mittels eines Mechanismus variabel ist, der mit einem Fühlelement (85) in der Bahn der genannten, aus dem Materialstreifen gebildeten schraubenlinienförmigen Wendel verbunden ist, wodurch ein gewählter Durchmesser der genannten schraubenlinienförmigen Wendel dadurch aufrechterhalten wird, daß die Differentialgeschwindigkeit der Rollenteile entsprechend dem auf das Fühlelement (85) aufgebrachten Druck vergrößert oder verkleinert wird.

20. Eine Maschine nach Anspruch 19, dadurch gekennzeichnet, daß einer der Rollenteile (55—56) gleichachsrig mit dem anderen auf gleichachsigen Wellen gelagert ist, die in Lagern auf einem Traggestell (91) gelagert sind, daß das genannte Gestell ferner ein Paar von Führungsteilen (104) unterstützt, von denen jeweils eines jeder Seite der Rollenteile (55—56) zugewandt ist, so daß sie mit voneinander abgewandten Seiten einer schraubenlinienförmigen Wendel zusammenarbeiten, die durch einen Materialstreifen gebildet wird, welcher durch den einen Rollenteil (55) unter Kraftaufwand zusammen mit dem Fühlelement (85) in der Vorwärtsrichtung bewegt wird, das zwischen den Führungsteilen (104), jedoch geneigt über den Rollenteilen (65, 66) in Beziehung zu der schraubenlinienförmigen Wendel angeordnet ist, und gekennzeichnet durch einen Geschwindigkeitsregler für mindestens eines der Antriebsmittel für die Rollenteile (55—56), Mittel, die das Fühlelement (85) mit dem Geschwindigkeitsregler verbinden, sowie Mittel, um die Führungsteile (104) gleichzeitig zu bewegen, um einen größeren oder kleineren Kreis zu bestimmen, der durch eine Ebene zwischen den Rollenteilen (55—56) und der Zusammenfüguingsrolle (75) verläuft, um den Differentialantrieb zwischen den Rollenteilen (55—56) zu verstellen, um den Durchmesser eines zu formenden Rohres zu variieren.

Revendications

1. Procédé pour former des tubes à partir d'une bande, dans lequel une bande (1) comportant une nervure (27) et une rainure (26) complémentaires espacées l'une de l'autre sur la bande, de manière à s'étendre chacune longitudinalement et à être orientées de façon opposée sur cette bande, et guidées suivant une configuration hélicoïdale de manière que les bords de la bande se recouvrent, la nervure (27) se trouvant en regard de la rainure (26), et dans lequel les parties de la bande qui se recouvrent sont pressées ensemble contre un rouleau d'assemblage (6; 30; 75—76; 110), caractérisé par le fait que les parties de la bande qui se recouvrent sont pressées ensemble contre un rouleau d'assemblage (6; 30; 75—76; 110) pendant qu'une pression différentielle est maintenue dans la direction d'avance de la bande entre la partie de la bande qui est déplacée, jusqu'audit rouleau d'assemblage (6; 30; 75—76; 110) et la partie du tube formée par la bande enroulée hélicoïdalement au-delà dudit rouleau d'assemblage (6; 30; 75—76; 110).

2. Procédé suivant la revendication 1, caractérisé par le fait que l'on obtient la pression différentielle en avançant la bande jusqu'au rouleau d'assemblage (6) à l'aide d'un agencement de rouleaux (2, 4) se trouvant en avant du rouleau d'assemblage tout en guidant la bande au-delà dudit rouleau d'assemblage en la faisant venir contre les rouleaux espacés (7) qui com-



porte des collets saillants (25) et qui sont disposés autour d'un cercle et en poussant la bande pour qu'elle prenne une configuration hélicoïdale à l'aide des rouleaux (7) et des collets (25) de manière à refouler ensemble contre le rouleaux d'assemblage les bords qui se recouvrent.

3. Procédé suivant la revendication 1, caractérisé par le fait que l'on obtient ladite pression différentielle en avançant la bande (1) entre le rouleau d'assemblage (30; 75—76; 110) et un rouleau presseur (33; 55—56; 111) et en entraînant un desdits rouleaux de manière qu'il déplace ladite bande vers l'avant longitudinalement.

4. Procédé suivant la revendication 3, caractérisé par le fait que l'on fait passer la bande (1) et ladite spire entre les rouleaux (30, 33) à un endroit où au moins un desdits rouleaux (33) a des diamètres différents à l'endroit de ladite bande et de ladite spire, grâce à quoi on obtient une pression d'entraînement différentielle.

5. Procédé suivant la revendication 3, caractérisé par le fait que l'on fait passer la bande (1) et ladite spire entre les rouleaux (55—56; 75—76) mais qu'un rouleau (55—56) est divisé de manière à comporter deux sections, l'une (55) de ces sections étant destinée à porter contre ladite bande et l'autre (56) de ces sections étant destinée à porter contre ladite spire, et que les parties du rouleau divisé sont entraînées à des vitesses de rotation différentes, grâce à quoi on obtient une pression d'entraînement différentielle.

6. Procédé suivant la revendication 5, caractérisé par le fait que l'on modifie la vitesse d'au moins une desdites sections dudit rouleau divisé (55—56) pour modifier la diamètre du tube hélicoïdal que l'on forme.

7. Procédé suivant la revendication 6, caractérisé par le fait que l'on commande la vitesse dudit rouleau en faisant porter un élément de détection (85) contre ledit tube hélicoïdal et en faisant varier ladite vitesse dudit rouleau à l'aide de l'élément de détection (85).

8. Procédé suivant l'une quelconque des revendications précédentes, caractérisé par le fait que le rouleau d'assemblage (110) portant contre la bande pour appliquer la pression d'entraînement différentielle à cette bande et à la spire hélicoïdale peut se déplacer librement circulairement autour de l'axe du tube en cours de formation et que la spire hélicoïdale est maintenue fixe autour de son axe longitudinal et cela pendant que lesdits rouleaux sont entraînés en rotation de manière qu'ils soient entraînés autour dudit axe longitudinal.

9. Machine pour former des tubes à partir d'une bande, cette bande (1) comportant une nervure (27) et une rainure (26) complémentaires espacées l'une de l'autre sur ladite bande de manière à s'étendre chacune longitudinalement et à être orientées de façon opposée sur ladite bande, comprenant un rouleau d'assemblage (6; 30; 75—76; 110)

supporté de façon tournante sur un bâti de support (9; 91; 112) de manière à porter contre la bande sur un des côtés de celle-ci, ledit rouleau d'assemblage étant positionné de manière à permettre à ladite bande passant sur ce rouleau de se courber autour de ce dernier en formant une spire hélicoïdale pour venir porter de nouveau contre ledit rouleau d'assemblage de manière qu'au moins les parties de bord de ladite bande se recouvrent et que la nervure (27) soit alignée avec la rainure (26) et comprenant un moyen (2; 33; 55—56; 111) pour presser l'une contre l'autre les parties qui se recouvrent, caractérisée par le fait que lesdites parties de bord qui se recouvrent sont pressées l'une contre l'autre tandis qu'une pression différentielle de poussée vers l'avant est maintenue sur les deux parties contiguës de la bande qui se trouvent sur ledit rouleau d'assemblage (6; 30; 75—76; 110) de manière à refouler ladite nervure (27) dans ladite rainure (26) tout en formant progressivement un tube hélicoïdal à partir de ladite bande.

10. Machine suivant la revendication 9, caractérisée par des rouleaux d'entraînement (2, 4) destinés à porter contre la bande en avant du rouleau d'assemblage (6), une série de rouleaux de guidage (7) se trouvant au-delà dudit rouleau d'assemblage et disposées autour d'un cercle sur des axes (8) montés sur ledit bâti du support (9) pour dévier ladite bande lorsqu'elle est poussée en avant en formant une spire hélicoïdale de manière qu'au moins les parties de bord de ladite bande se recouvrent et que ladite nervure (27) et ladite rainure (26) soient alignées et de manière que la spire soit refoulée vers le bas contre ledit rouleau d'assemblage (6) pour engager ladite nervure dans ladite rainure, grâce à quoi on obtient ladite pression différentielle d'assemblage en poussant ladite bande vers l'avant à l'encontre de l'effet de retardement desdits rouleaux de guidage (7) qui portent contre la spire de la bande.

11. Machine suivant la revendication 10, caractérisée en outre par des collets (25) disposés sur lesdits rouleaux de guidage (7) et décalés progressivement de manière à guider ladite bande suivant un trajet hélicoïdal en portant contre le bord de ladite bande.

12. Machine suivant les revendications 9, 10 ou 11, caractérisée par le fait que ledit rouleau d'assemblage (110) et ledit rouleau d'entraînement (111) sont montés sur l'élément de bâti (112) et qu'un moyen (120; 121; 113; 114) permet audit élément de bâti (112) de tourner autour de l'axe dudit tube en cours de formation.

13. Machine suivant la revendication 9, caractérisée par un rouleau (33) supporté également par le bâti de support (9) disposé de manière à porter contre ladite bande, sur le côté opposé de celle-ci, pour presser ladite bande contre le rouleau d'assemblage (30), au moins un desdits rouleaux étant entraîné de manière à former un rouleau d'entraînement (33) et au



moins un desdits rouleaux (33) ayant un diamètre différent à l'endroit de la zone où ledit rouleau porte contre ladite bande et où la spire porte contre ledit rouleau, grâce à quoi ladite nervure (27) est refoulée dans ladite rainure (26) par la pression différentielle appliquée à ladite bande et à ladite spire entre lesdits rouleaux.

14. Machine suivant la revendication 13, caractérisée par le fait qu'au moins un des diamètres dudit rouleau (33) peut être modifié pour modifier le diamètre de la spire produit par ce rouleau.

15. Machine suivant la revendication 9, caractérisée par un rouleau (55—56) supporté par le bâti de support (91) et portant contre ladite bande sur l'autre côté de cette dernière pour presser ladite bande contre ledit rouleau d'assemblage (75—76), ledit rouleau (55—56) étant divisé de manière à comporter une partie (55) portant contre ladite bande et une autre partie (56) portant ladite spire à l'endroit dudit rouleau d'assemblage, et ladite machine étant en outre caractérisée par un moyen grâce auquel les deux parties précitées (55—56) du rouleau ont des vitesses périphériques différentes.

16. Machine suivant la revendication 15, caractérisée par le fait que ledit rouleau divisé est agencé pour être entraîné de manière que les deux parties (55—56) aient des vitesses périphériques différentes.

17. Machine suivant la revendication 16, caractérisée par le fait que les deux parties précitées (55—56) du rouleau entraîné ont un diamètre similaire mais sont agencées de manière à être entraînées à des vitesses de rotation différentes.

18. Machine suivant la revendication 15, 16 ou 17, caractérisée par le fait que les parties de rouleau (55—56) sont au moins garnies par une matière élastique analogue à du caoutchouc.

19. Machine suivant l'une quelconque des revendications 15 à 18, caractérisée par le fait que les moyens d'entraînement des parties de rouleau peuvent modifier la vitesse de rotation d'au moins un desdits rouleaux à l'aide d'un mécanisme relié à un élément de détection (85) se trouvant dans le trajet de ladite spire hélicoïdale formée à partir de la bande, grâce à quoi un diamètre choisi de ladite spire hélicoïdale est maintenue par augmentation ou diminution de la vitesse différentielle des parties de rouleau selon la pression appliquée à l'élément de détection (85).

20. Machine suivant la revendication 19, caractérisée par le fait qu'une première desdites parties de rouleau (55—56) est montée coaxialement à la seconde partie sur des axes coaxiaux supportés dans des paliers sur un bâti de support (91), ledit bâti supportant aussi une paire d'éléments de guidage (104) dont un est positionné vers chaque côté des parties de rouleau (55—56) de manière à porter contre les côtés opposés d'une spire hélicoïdale formée par une bande poussée vers l'avant par la première partie de rouleau (55) conjointement avec l'élément de détection (85) qui est disposé entre les éléments de guidage (104) mais à l'opposée des parties de rouleau (55—56) par rapport à la spire hélicoïdale, et caractérisée par une commande de vitesse pour au moins un des moyens d'entraînement des parties de rouleau (55—56), un moyen reliant mutuellement l'élément de détection (85) à la commande de vitesse, et un moyen pour déplacer les éléments de guidage (104) simultanément de manière à définir un cercle plus grand ou plus petit passant par un plan compris entre des parties de rouleau (55—56) et le rouleau d'assemblage (75) de manière à modifier ainsi l'entraînement différentiel entre les parties de rouleau (55—56) pour modifier le diamètre d'un tube en cours de formation.

