

Description**Technical Field**

- 5 The present invention relates to a method for producing an endless drive belt from elastomeric belting. It also relates to an endless drive belt, and to a device for applying the method according to the invention.

Description of the Prior Art

- 10 Open-ended elastomeric belting complete with embedded load-carrying cording made of such high-strength materials as cotton, rayon, polyester and the like is well-known and has been extensively used in the past. The difficulties with this type of belting arise, however, when lengths of pre-formed open-ended belting, cut to size, have to be joined to form endless belts. While the ends of a thermoplastic belting body are easily joined by application of heat or adhesives, the problem arises with the load-carrying cords. Here, any number
15 of methods have been proposed, involving splices, overlaps, overlays, inlays, etc., none of which give really satisfactory results, producing as they do regions of different stiffness, increased minimum bending radii, vibrations and noise, and, altogether, reduced belt strength and service life, as well as increased wear of pulley bearings.

- 20 In view of the above, methods have been devised whereby an endless layer of reinforcing and load-carrying material is applied to the elastomeric belting after the latter has been joined to form an endless belt.

- Thus, in German Patent No. 2,361,244 and United States Patent No. 3,847,029 Ray discloses a method whereby an extruded strip consisting of a plurality of belt body elements integrally arranged side by side is wrapped around a core drum and welded to constitute an endless sleeve. After welding the sleeve is allowed to cool to ambient temperature. Each belt body element is provided on its top surface with a channel confined
25 by means of projections into which is wound, in a plurality of turns, an open-ended length of a load-carrying cord. The cord is coated during winding with a molten or liquid thermoplastic elastomer. By means of a heating device the coated cord is heated during winding to assure that the temperature of the thermoplastic elastomer is kept above its melt temperature at least until winding is finished. By the molten or liquid coating the channels are substantially filled and the cord comes into direct contact with the bottom surface of the channels. After
30 winding and cooling below the melt temperature, the sleeve is sliced to produce a plurality of separate belts.

- This method, however, has several drawbacks. The apparatus required is heavy and complex. A given core drum can produce only one belt size. For the liquid coating of the cord an applicator device is required such as an extruder which needs industrial support systems, room, etc. It is expensive to install and run. This method is therefore not suitable for shops and factories, small and large, which in order to avoid the need to keep a
35 costly stock for different drive-belt sizes, want to be able to produce their own belts only if and when required.

- As a further drawback the molten or liquid elastomer will not fully remain in the channels as the core drum rotates during winding, but will drop from the underside thereof. The elastomer does not sufficiently adhere to the surface of the channels. The solidification conditions of the cord coating are uncontrolled and different for different turns of the cord.

- 40 British Patent No. 886,754 relates to a Method of Producing Endless Belts from Synthetics Thermoplastic Materials. The method includes the steps of winding on a pre-formed thermoplastic sleeve (which is destined to constitute the major body of a belt) at least one reinforcing thread. The melting temperature of the thread is higher than that of the sleeve. Prior to winding, the thread (but not the sleeve) is heated to a temperature higher than the melting temperature of the thermoplastic sleeve. During the winding of the reinforcing thread,
45 pressure is applied to the sleeve (by a cylinder) to smooth the thermoplastic material of the sleeve over the reinforcing thread, the prior heating of which has caused it to locally melt, and become buried in, the sleeve. Subsequently a plurality of belts are cut from the sleeve-thread combination. During winding, the previously heated thread melts and penetrates the materials of the sleeve. The penetration of the thread produces grooves in the surface of the sleeve and accordingly, these grooves must be closed by a smoothing operation.
50 Subsequently, heat may be applied to the sleeve-thread combination to fuse the thermoplastic material of the sleeve over the thread. Instead of or in addition to heating of the thread, a heated cutting roller or stylus may premelt, cut or groove the sleeve with a plastic coated thread thereafter being placed in the consequent groove.

Summary of the Invention

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 It is one of the objects of the present invention to overcome the draw-backs and disadvantages of the prior art method and to provide a method for producing an endless drive belt from at least partially open-ended elastomeric belting, that facilitates preparation of improved endless drive belts of practically uniform strength and

stiffness along their entire length, by virtue of their load-carrying members being jointless and that permits the use of relatively simple and inexpensive equipment adapted to process pre-formed components.

According to the invention this is achieved by providing a method for producing an endless drive belt, comprising the steps of providing a pre-formed compression member belt comprising a solid but softenable elastic material comprising a first elastomer, winding a pre-formed load-carrying member comprising a cord embedded in a solid but softenable elastic material comprising a second elastomer being fusible with said first elastomer, along and around a surface of said compression member belt thereby forming a layer comprising a plurality but at least more than one full turn, and simultaneously causing the turns of said wound layer of said load-carrying member to become intimately bonded to said surface of said compression member belt by applying mutual pressure between said turns and said surface and by selectively softening of surface layers of both said load-carrying member and said compression member belt which are to come into contact with each other just prior to coming into contact with each other to at least such degree to allow the material of said surface layers under the mutual pressure applied to fuse and further to allow said turns to be at least partially embedded or impressed in said surface of said compression member belt.

It is a further object of the invention to provide a drive belt easily produced at any required size and at minimal costs and capital outlay.

According to the invention, this is achieved by providing a drive belt, comprising a compression member belt having a surface, and comprising a solid but softenable elastic material comprising a first elastomer, and a load-carrying layer, constituted by a plurality but at least more than one full turn of a load-carrying member wound along and around said surface of said compression member belt, said load-carrying member comprising a cord embedded in an envelope comprising a solid but softenable elastic material comprising a second elastomer being fusible with said first elastomer, wherein said turns of said wound layer of said load-carrying member are intimately bonded to said surface of said compression member belt, the interface between said turns and said surface comprising fused material from both an adjacent surface layer of said envelope of said cord of said load-carrying member and an adjacent surface layer of said surface of said compression member belt, said turns being at least partially embedded or impressed in said surface.

It is yet another object of the present invention to provide a relatively simple and inexpensive device for carrying out the method according to the invention which would permit in-house preparation of drive belts of any size as an economical proposition.

According to the invention, this is achieved by providing a device for producing an endless drive belt from pre-formed members, said members at least including a compression member belt and a load-carrying member comprising a solid but softenable elastic material each, the device comprising a belt-building pulley having a width just matching the width of at least one single compression member belt, drive means for rotating said belt-building pulley, an idler pulley arranged in alignment with said belt pulley and at a variable center distance therefrom, means to adjust said variable center distance to provide an appropriate tension in said compression member belt when mounted between said belt-building pulley and said idler pulley, pressurizing means for the application of mutual pressure between said compression member belt and said load-carrying member during winding thereof onto the outer surface of said compression member belt by rotation of said belt-building pulley, softening means for selectively softening of surface layers of both said load-carrying member and said compression member belt which are to come into contact with each other during winding just prior coming into contact with each other to at least such degree to allow the material of said surface layers under the mutual pressure applied to fuse and further to allow the turns of said load-carrying member to be at least partially embedded or impressed in said surface of said compression member belt.

Brief Description Of The Drawings

Preferred embodiments of the invention will now be described with reference to the following illustrative figures.

In the drawings:

- Fig. 1 is a perspective view showing the cross section of a drive belt produced by the method according to the invention;
- Fig. 2 shows a perspective view of a load-carrying member according to the invention;
- Fig. 3 is a perspective view of an embodiment incorporating a tension member with a load-carrying member;
- Fig. 4 illustrates a butt joint joining the ends of the compression member of a V-belt profile;
- Fig. 5 is a schematic presentation of a device according to the invention;
- Fig. 6 is a partial view of the molding pulley of the device, and
- Fig. 7 is a side view of the molding pulley, the guide block and the hot-air blower.

Description Of The Preferred Embodiments

Referring now to the drawings, there is seen in Fig. 1 a first embodiment of a plain V-belt produced by the method according to the invention.

The V-belt of Fig. 1 comprises a body member, known in the art as compression member, 2, and of a load-carrying layer 4 composed of several turns of a load-carrying member 6 which turns, in a method step to be discussed further below, have been intimately bonded both to the compression member 2 and to one another. The compression member 2 is made of or at least comprises a solid but softenable elastic material comprising a first elastomer. The load-carrying member 6 consists of a reinforcing, high-strength cord 8 embedded in an envelope 10 made of or at least also comprising a solid but softenable elastic material comprising a second elastomer. Both said first and said second elastomers are fusable with each other and are preferably thermoplastic elastomers such as polyurethanes (e.g. ESTANE by B.F. Goodrich), polyesters (e.g. HYTREL by Dupont), olefins (e.g. LEVAFLEX by Bayer) or alloys (e.g. SANTOPRENE by Monsanto).

Further seen is a so-called tension member 12, an optional component bonded to the layer 4 of load-carrying members 6. The tension-member 12 is also made of or at least comprises a solid but softenable elastic material comprising a third elastomer. Said third elastomer is fusable with at least said second elastomer and is preferably a thermoplastic elastomer of the kind as mentioned above, too.

While the tension member 12 in Fig. 1 is flat and smooth, tension members in, e.g., conveyor-belt applications may have non-rectangular, e.g., triangular cross sections, or may have a riffled surface.

The load-carrying member 6 represented in Fig. 2, pre-formed by conventional methods in open-ended reels, has a circular cross section and consists of a reinforcing cord 8 firmly embedded and enveloped in the above defined material 10 being compatible with material of the compression member 2, which has also been defined above. The cord 8 itself is made of high-strength materials such as cotton, rayon, polyester or aramid. Prior to embedding, the reinforcing cord 8 is advantageously coated with a primer such as an aqueous epoxy primer and an adhesive such as a polyurethane adhesive and may also be thermally treated for improved mechanical properties.

In certain applications, the cord 8 may be produced by twisting or braiding together at least two materials: one of high strength and one of good natural adhesion to the material of the envelope 10.

Embodiment of Fig. 3 incorporates the tension member 12 with the load-carrying member 6 to a single pre-formed member.

As already mentioned, all belt components: the compression member 2, the load-carrying member 6 and the (optional) tension member 12 are pre-formed by conventional methods such as extrusion, casting or molding. Setting out from these preformed components, the method according to the invention proposes the following steps:

A compression member belt is provided i.e. by cutting a piece of compression member 2 to the required length as determined by the respective pulley diameters and center distance. Preferably the free ends of the piece are then joined to form as in Fig. 4 for example, a butt joint 14. The actual joining method may be selected to best suit the properties of the material of the compression member 2 and the availability of tooling. Thus, for thermoplastic materials, joining can be effected by having both ends contact a hot plate or blade and then pressing the ends one against the other. Alternatively, a jet of hot air may be used or indeed any of the bonding technologies known which combine heat and pressure.

Another alternative for bonding is the use of adhesives, a method which is not restricted to thermoplastic materials and may be applied also to vulcanized rubber, cross-linked polyurethane and others.

The compression member belt may alternatively be produced in one single step by a casting or molding process. After the compression member belt has been provided by any one of the above discussed procedures, the load-carrying member 6, drawn off a reel of the preformed component is wound in a continuous spiral with the turns close to each other onto, and longitudinally around, the top surface 16 (Fig. 4) of the compression member belt 2, preferably substantially covering the width of the latter. Pressure forcing the load-carrying member 6 onto the belt surface 16 is applied during this winding. The pressure may be produced by keeping the load-carrying member 6 taut while winding or by means of at least one floating roller. During the winding stage in addition surface layers of both said load-carrying member and said compression member belt which are to come into contact with each other are simultaneously and selectively softened just prior to coming into contact with each other. Said softening is carried out by the application of heat and/or of an adhesive.

The heat or adhesive, and pressure, applied causes an intimate bond to be formed between a) the load-carrying member 6 as it is being laid down and the belt surface, and b) between the new turn and the previous turn of the load-carrying member 6. After the above-described application of the load-carrying layer 4, the interface between the load-carrying member 6 of this layer and the belt surface 16 consist in fact of fused material from both the softened surface layer of the cord envelope 10 and the softened material of the belt

surface. Also, due to the winding pressure applied, the load-carrying members 6 will be at least partially embedded or impressed in the belt surface 16, the groove like impressions 9 being clearly seen in Figs. 1 and 6. The load-carrying members should be impressed in the belt surface to a degree of at least 20%. Preferably no hollow spaces should remain between adjacent turns.

Preferably the thickness of the softened surface layer of the load-carrying member 6 is smaller than the thickness of the envelope 10 of cord 8 in order not to deteriorate the adhesion between the cord and its envelope, which preferably has been optimized during the pre-forming stage of the load-carrying member. To achieve this, a highly selective and well timed application of heat and/or of an adhesive is required.

It is further preferred to have the amount of heat and/or of an adhesive and the amount of pressure applied adjusted in such a way to obtain an optimal winding velocity.

Yet another method of producing the load-carrying layer 4 is the simultaneous winding of several load-carrying members 6 producing multiple ends and thus reducing the required time for preparing a drive belt.

A similar procedure is followed for applying the optional tension member 12, except that this member is obviously not applied spirally, but straight and in most cases in the form of one turn only. Using a member as shown in Fig. 3 the load-carrying member and the tension member are applied in one step only.

The method according to the invention will be better understood in conjunction with the device represented in the schematic drawings of Figs. 5 to 7, the task of which device is to provide the belting with a continuous, in fact endless, load-carrying layer. There is seen a belt-building or molding pulley 18 (Figs. 5,6), the groove profile of which matches the flanks 13 (Fig. 4) of the compression member 2, and which can be rotated either manually or, preferably, by means of variable-speed gearmotor 22. A second, idler, pulley 24 is arranged at a distance from, and in alignment with pulley 18.

The idler pulley 24 is rotatably mounted on a block 26 provided with an internal thread and riding on a screw 28 having one degree of freedom in rotation only. Thus, rotating the screw 28 (by means of a handle 30) will cause the block 26, including the idler pulley 24, to perform a translatable movement, permitting the center distance between pulley 18 and the idler pulley 24 to be varied. The bar 32 passing through a fork-like projection 34 attached to the block 26 prevents the latter from rotating about the screw 28, while allowing the above translatable movement. The screw 28 and the bar 32 are mounted between brackets 33 which are obviously stationary relative to the idler pulley 24 and its mounting block 26.

Further seen is a guide block 36 (see also Fig. 7) through which passes the load-carrying member 6, drawn off a supply reel 37, on its way to be wound onto the belt, as will be explained in greater detail further below.

The guide block 36 is capable of a translatable movement in a direction parallel to the axis of a lead screw 38 which, when rotated, will cause the block 36 to perform such a translatable movement. The lead screw 38 is either operated manually or, preferably, is connected to another variable-speed motor 40, the speed of which can be maintained at a predeterminable ratio relative to the gear-motor 22 driving the molding pulley 18, by means of a control element 42. The importance of the controllability of this ratio will be explained further below.

Mounted below the guide block 36 either fixedly or taking part in the translatable movement of the latter, there is seen a blower 44 producing a jet of hot air which a nozzle 46 directs towards the point where the load-carrying member 6, having passed the guide block 36, makes contact with the belt surface. Alternatively, the heat required for the bonding process could also be provided by a source of concentrated radiating heat, a source of concentrated ultrasonic vibrations or by a source of concentrated electromagnetic oscillations. In the latter case it is, however, required that the material of the cord envelope and/or of the compression member belt comprises small metallic particles.

The compression member 2, having been produced by any of the above-mentioned procedures, is mounted on the two pulleys, the molding pulley 18 and the idler pulley 24 which, by turning handle 30 are then moved apart until the endless compression member belt is fairly tight. The end of the load-carrying member 6 is then drawn off the supply reel 37, threaded through the guide block 36 (which has been set to the initial transversal position, i.e., opposite the left edge of the belt) and attached to the belt, e.g., by being spot-welded to the belt. The hot-air jet (or the respective different heat source) is now turned on and the molding pulley 18 set rotating by actuating the gear motor 22, setting in motion the belt 2, and, thereby dragging along the load-carrying member 6 which, heated by the jet, is bonded to the equally heated (and thereby softened) belt surface. The tightness required for orderly winding is produced by the counterpull generated by friction offered to the moving load-carrying member as it passes through the guide block 36. Bonding pressure is produced by the same counterpull due to the deflection of the load-carrying member 6 as it makes contact with the arched portion of the belt surface in the pulley 18. As already mentioned the required pressure could as well or in addition be applied by at least one floating roller (not shown).

As the belt 2 starts moving, drawing along the load-carrying members, the lead screw 38 has also started to rotate, and slowly carries the guide block 36 towards the right. Thus, while rotation of the pulley 18, i.e., movement of the belt, causes the load-carrying member 6 to be wound around the belt 2, the transverse move-

ment of the guide block 36 produces the spiral path that will produce an orderly load-carrying layer 4.

The required relationship between the rotational speed of the pulley 18 and the linear speed of the guide block 36 is not only a function of the width of the belt 2 and the diameter or width of the load-carrying member 6, but also of the surface speed of the belt and on belt length. Hence the importance of the control element 42.

Another configuration calls for stepping action of the guide block 36 at the completion of each revolution of the compression member 2.

Application, to the now reinforced belt of the optional tension member 12 follows similar lines, except that a different guide block is required and that the latter performs no transverse movement, being in fixed alignment with the belt 2. Also, while the nozzle 46 produces a rather narrow hot-air jet, the relatively wide tension member requires a wide and flat jet (or a number of pointed jets).

For use of the device with adhesives, the blower assembly 44, 46 is replaced by an adhesive dispenser. Such dispenser could of course as well be provided in addition to a heat source.

Although the embodiments given to illustrate the inventions describes a plain V-belt, it should be understood that the method and device discussed are also suitable for the production of other drive-belt types, such as cogged V-belts, flat belts and synchronous or timing belts.

It would for example also be possible as a first step to spirally wind a load-carrying member on at least one mounting pulley having a substantially flat outer surface, thereby forming a layer comprising a plurality but at least more than one full turn and as a second step to wind just one full turn of a pre-formed open-ended compression member profile along and around the outer surface of said layer of said load-carrying member, thereby simultaneously causing said compression member profile in the same manner as explained above to become intimately bonded to said surface of said turns of said wound layer of said load-carrying member.

Claims

1. A method for producing an endless drive belt, comprising the steps of:

Providing a compression member belt (2) comprising a solid but softenable elastic material comprising a first elastomer; and

winding a pre-formed load-carrying member (6) comprising a cord (8) embedded in a material (10) comprising a second elastomer, along and around a surface of said compression member belt (2) thereby forming a layer (4) comprising a plurality but at least more than one full turn;

said method being characterized in that said material in which said cord is embedded is a solid but softenable elastic material in that said second elastomer is fusable with said first elastomer and in that simultaneously with said winding

the turns of said wound layer (4) of said load-carrying member (6) are caused to become intimately bonded to said surface of said compression member belt (2) by applying mutual pressure between said turns and said surface and by selectively softening of surface layers of both said load-carrying member (6) and said compression member belt (2) which are to come into contact with each other just prior to coming into contact with each other to at least such degree to allow the material of said surface layers under the mutual pressure applied to fuse and further to allow said turns to be at least partially impressed in said surface of said compression member belt (2).

2. The method as claimed in claim 1, comprising the further steps of:

winding at least one, full turn of a pre-formed open-ended tension member profile (12) comprising a solid but softenable elastic material comprising a third elastomer being fusable with said second elastomer around, and on top of, said layer (4) of said load-carrying member (6); and simultaneously

causing said at least one turn of said tension member profile (12) to become intimately bonded to said load-carrying layer (4) by applying mutual pressure between said tension member profile (12) and said load-carrying layer (4) and by selectively softening of surface layers of both said load-carrying layer (4) and said tension member profile (12) coming into contact with each other just prior to coming into contact with each other to at least such degree to allow the material of said surface layers under the pressure applied to fuse.

3. The method as claimed in claim 1 or claim 2, wherein the thickness of the softened surface layer of the load-carrying member (6) is smaller than the thickness of the solid but softenable elastic material (10) in which the cord is embedded,



ment of the guide block 36 produces the spiral path that will produce an orderly load-carrying layer 4.

The required relationship between the rotational speed of the pulley 18 and the linear speed of the guide block 36 is not only a function of the width of the belt 2 and the diameter or width of the load-carrying member 6, but also of the surface speed of the belt and on belt length. Hence the importance of the control element 42.

Another configuration calls for stepping action of the guide block 36 at the completion of each revolution of the compression member 2.

Application, to the now reinforced belt of the optional tension member 12 follows similar lines, except that a different guide block is required and that the latter performs no transverse movement, being in fixed alignment with the belt 2. Also, while the nozzle 46 produces a rather narrow hot-air jet, the relatively wide tension member requires a wide and flat jet (or a number of pointed jets).

For use of the device with adhesives, the blower assembly 44, 46 is replaced by an adhesive dispenser. Such dispenser could of course as well be provided in addition to a heat source.

Although the embodiments given to illustrate the inventions describes a plain V-belt, it should be understood that the method and device discussed are also suitable for the production of other drive-belt types, such as cogged V-belts, flat belts and synchronous or timing belts.

It would for example also be possible as a first step to spirally wind a load-carrying member on at least one mounting pulley having a substantially flat outer surface, thereby forming a layer comprising a plurality but at least more than one full turn and as a second step to wind just one full turn of a pre-formed open-ended compression member profile along and around the outer surface of said layer of said load-carrying member, thereby simultaneously causing said compression member profile in the same manner as explained above to become intimately bonded to said surface of said turns of said wound layer of said load-carrying member.

Claims

1. A method for producing an endless drive belt, comprising the steps of:

Providing a compression member belt (2) comprising a solid but softenable elastic material comprising a first elastomer; and

winding a pre-formed load-carrying member (6) comprising a cord (8) embedded in a material (10) comprising a second elastomer, along and around a surface of said compression member belt (2) thereby forming a layer (4) comprising a plurality but at least more than one full turn;

said method being characterized in that said material in which said cord is embedded is a solid but softenable elastic material in that said second elastomer is fusable with said first elastomer and in that simultaneously with said winding

the turns of said wound layer (4) of said load-carrying member (6) are caused to become intimately bonded to said surface of said compression member belt (2) by applying mutual pressure between said turns and said surface and by selectively softening of surface layers of both said load-carrying member (6) and said compression member belt (2) which are to come into contact with each other just prior to coming into contact with each other to at least such degree to allow the material of said surface layers under the mutual pressure applied to fuse and further to allow said turns to be at least partially impressed in said surface of said compression member belt (2).

2. The method as claimed in claim 1, comprising the further steps of:

winding at least one, full turn of a pre-formed open-ended tension member profile (12) comprising a solid but softenable elastic material comprising a third elastomer being fusable with said second elastomer around, and on top of, said layer (4) of said load-carrying member (6); and simultaneously

causing said at least one turn of said tension member profile (12) to become intimately bonded to said load-carrying layer (4) by applying mutual pressure between said tension member profile (12) and said load-carrying layer (4) and by selectively softening of surface layers of both said load-carrying layer (4) and said tension member profile (12) coming into contact with each other just prior to coming into contact with each other to at least such degree to allow the material of said surface layers under the pressure applied to fuse.

3. The method as claimed in claim 1 or claim 2, wherein the thickness of the softened surface layer of the load-carrying member (6) is smaller than the thickness of the solid but softenable elastic material (10) in which the cord is embedded,



4. The method as claimed in one of the claims 1 - 3, wherein the surface layers of said members (2,6) coming into contact with each other are softened to at least such degree to allow the materials of said surface layers to flow into and to fill up hollow spaces between said members and to allow said turns of said load-carrying member (6) to be at least 20 % impressed in said surface of said endless compression member belt (2).
5. The method as claimed in one of the claims 1 - 4, wherein the turns of said load-carrying member (6) forming said layer (4) are wound across the substantially entire width of said surface of said compression member belt (2).
6. The method as claimed in one of claims 1 - 5, wherein said softening is carried out by melting by the application of heat.
7. The method as claimed in claim 6, wherein said heat is applied by means of a hot-air nozzle (4,6).
8. The method as claimed in claim 6, wherein said heat is applied by a source of concentrated radiating heat.
9. The method as claimed in claim 6, wherein said heat is applied by a source of concentrated ultrasonic mechanical vibrations.
10. The method as claimed in claim 6, wherein the material of at least one of the members (2,6,12) to be bonded to each other comprises metallic particles and wherein said heat is applied by a source of concentrated electromagnetic oscillations.
11. The method as claimed in one of claims 1 - 5, wherein said softening is carried out by the application of an adhesive.
12. The method as claimed in one of claims 1 - 11, wherein said softening is carried out both by the application of heat and of an adhesive.
13. The method as claimed in one of claims 1 - 12, wherein said mutual pressure is applied by keeping said load-carrying member (6) taut the during winding thereof.
14. The method as claimed in one of claims 1 - 12, wherein said mutual pressure is applied by means of at least one floating roller.
15. The method as claimed in one of claims 1 - 14, wherein said first, second and/or third elastomer is mainly a thermoplastic elastomer.
16. An endless drive belt, comprising:
 - a compression member belt (2) having a surface and comprising a solid but softenable elastic material comprising a first elastomer; and
 - a load-carrying layer (4), constituted by a plurality but at least more than one full turn of a load-carrying member (6) wound along and around said surface of said compression member belt (2), said load-carrying member comprising a cord (8) embedded in an envelope (10) comprising a solid but softenable elastic material comprising a second elastomer; characterized in that said second elastomer is fusible with said first elastomer and that
 - said turns of said wound layer (4) of said load-carrying member (6) are intimately bonded to said surface of said compression member belt (2), the interface between said turns and said surface comprising fused material from both an adjacent surface layer of said envelope (10) of said cord (8) of said load-carrying member (6) and an adjacent surface layer of said surface of said compression member belt (2), said turns being at least partially impressed in said surface.
17. The endless drive belt as claimed in claim 16, further comprising around, and on top of, said wound layer (4) of said load-carrying member (6) a tension member (12) comprising a solid but softenable elastic material comprising a third elastomer being fusible with said second elastomer, wherein said tension member (12) is intimately bonded to said wound layer (4), the interface between said wound layer (4) and said tension member (12) comprising fused material from both an adjacent surface layer of said envelope (10) of said cord (8) of said load-carrying member (6) and an adjacent surface layer of said tension member (12).



18. The endless drive belt as claimed in claim 16 or claim 17, wherein the material of said cord (8) is selected from a group comprising cotton, rayon, polyester, aramid, and the like.
- 5 19. The endless drive belt as claimed in one of claims 16 - 18, wherein said cord (8) is a cord that has been heat treated prior to having become coated with said solid, but softenable elastic material.
20. The endless drive belt as claimed in one of claims 16 - 19, wherein said cord (8) is a cord that has been coated with an aqueous epoxy primer and/or an adhesive prior to having become embedded in said solid, but softenable elastic material.
- 10 21. The endless drive belt as claimed in one of claims 16 - 20, wherein said cord (8) consists of at least two mechanically combined materials, one of high strength and one of good natural adhesion to the material in which said cord (8) is embedded.
- 15 22. The endless drive belt as claimed in one of claims 16 - 21, wherein said turns substantially cover the entire width of said surface.
23. The endless drive belt as claimed in one of claims 16 - 22, wherein said turns are at least 20% impressed in said surface of said compression member belt (2).
- 20 24. A device for producing an endless drive belt from pre-formed members, said members at least including a compression member belt (2) and a load-carrying member (6) comprising a solid but softenable elastic material each, the device comprising:
a belt-building pulley (18) having a width just matching the width of at least one single compression member belt (2);
25 drive means (22) for rotating said belt-building pulley (18);
an idler pulley (24) arranged in alignment with said belt building pulley (18) and at a variable center distance therefrom;
means to adjust said variable center distance to provide an appropriate tension in said compression member belt (2) when mounted between said belt-building pulley (18) and said idler pulley (24);
30 pressurizing means for the application of mutual pressure between said compression member belt (2) and said load-carrying member (6) during winding thereof onto the outer surface of said compression member belt (2) by rotation of said belt-building pulley (18);
35 softening means for selectively softening of surface layers of both said load-carrying member (6) and said compression member belt (2) which are to come into contact with each other during winding just prior coming into contact with each other to at least such degree to allow the material of said surface layers under the mutual pressure applied to fuse and further to allow the turns of said load-carrying member (6) to be at least partially impressed in said surface of said compression member belt (2).
- 40 25. A device as claimed in claim 24, wherein said softening means are heater means and are disposed in such a way as to be capable of applying the heat simultaneously and selectively to said load-carrying member (6) and to said surface of said compression member belt (2) in the proximity of the point at which the load-carrying member (6) during winding thereof onto said surface of said compression member belt (2) comes into contact with said surface.
- 45 26. A device as claimed in claim 25, wherein said heater means comprise an electric blower (44) and a nozzle (46) producing a jet of hot air.
27. A device as claimed in claim 25, wherein said heater means comprise a source of concentrated radiating heat.
- 50 28. A device as claimed in claim 25, wherein said heater means comprise a source of concentrated electromagnetic oscillations.
29. A device as claimed in claim 25, wherein said heater means comprise a source of concentrated ultrasonic mechanical vibrations.
- 55 30. A device as claimed in claim 24, wherein said softening means are dispenser means for applying an adhesive at least to said load-carrying member (6) just prior to the disposition thereof onto said surface of said compression member belt (2).



31. A device as claimed in one of claims 25 - 30, wherein said softening means include heater means and dispenser means for applying an adhesive.
- 5 32. A device as claimed in one of claims 24 - 31, wherein said pressurizing means are guiding means (36) for guiding and keeping taut the load-carrying member (6) during winding thereof onto said compression member belt (2), said guide means (36) being adapted to offer a resistance to the movement of said load-carrying member (6) therethrough.
- 10 33. A device as claimed in one of claims 25 - 31, wherein said pressurizing means are floating rollers.
34. A device as claimed in one of claims 24 - 33, further comprising guide means (36) for guiding said load-carrying member (6) during winding thereof onto said compression member belt (2).
- 15 35. A device as claimed in claim 34, further comprising second drive means (40) to impart said guide means (36) a translatory movement during rotation of said belt building-pulley (18) in a direction perpendicular to the longitudinal extend of said compression member belt (2) as mounted between said belt-building pulley (18) and said idler pulley (24).
- 20 36. A device as claimed in claim 35, further comprising means (42) to control the relationship between the rotational speed of said belt-building pulley (18) and the speed of the translatory movement of said means (36).
- 25 37. The method as claimed in claim 1, wherein said compression member belt (2) is provided by permanently joining the two ends of a pre-formed open-ended compression member profile cut to a required length.

Patentansprüche

1. Verfahren zur Herstellung eines endlosen Treibriemens, umfassend folgende Schritte:
- 30 Herstellen eines Druckelementriemens (2) der ein festes, jedoch aufweichbares elastisches Material mit einem ersten Elastomer enthält; und
- Wickeln eines vorgeformten Zugträgerelements (6) mit einem Faden (8), der in einem Material (10) mit einem zweiten Elastomer eingebettet ist, entlang und um eine Oberfläche des Druckelementriemens (2), wobei eine Schicht (4) gebildet wird, die eine Vielzahl,
- 35 mindestens jedoch mehr als eine volle Windung umfasst; dadurch gekennzeichnet,
- dass das Material, in welchem der Faden eingebettet ist, ein festes, jedoch aufweichbares elastisches Material ist,
- dass das zweite Elastomer verschmolzen werden kann mit dem ersten Elastomer, und
- 40 dass gleichzeitig mit dem genannten Wickeln die Windungen der Wickelschicht (4) des Zugträgerelements (6) gut verbunden werden mit der Oberfläche des Druckelementriemens (2), indem gegenseitiger Druck zwischen den Windungen und der Oberfläche angewendet wird und indem selektiv die Oberflächenschichten des Zugträgerelements (6) und des Druckelementriemens (2), die in Kontakt miteinander kommen sollen, erweicht werden, unmittelbar bevor sie in Kontakt miteinander kommen, und zwar mindestens
- 45 in einem solchen Ausmass, dass das Material dieser Oberflächenschichten unter dem angewendeten gegenseitigen Druck verschmelzen kann und um den Windungen zu erlauben, wenigstens teilweise in die besagte Oberfläche des Druckelementriemens eingedrückt zu werden.
2. Verfahren nach Anspruch 1, mit folgenden weiteren Schritten:
- 50 Wickeln von wenigstens einer vollen Windung eines vorgeformten, offen-endigen Zugelementprofils (12), das ein festes, jedoch erweichbares elastisches Material mit einem dritten Elastomer enthält, das verschmelzbar ist mit dem zweiten Elastomer, rund um und oben auf die Schicht (4) des Zugträgerelements (6); und gleichzeitig
- 55 Bewirken, dass die mindestens eine Windung des Zugelementprofils (12) mit der Zugträgerschicht (4) gut verbunden wird, indem gegenseitiger Druck zwischen dem Zugelementprofil (12) und der Zugträgerschicht (4) angewendet wird und durch selektives Erweichen von Oberflächenschichten von sowohl der Zugträgerschicht (4) als auch dem Zugelementprofil (12), die in Kontakt miteinander kommen sollen kurz bevor sie in Kontakt miteinander kommen zumindest in einem solchen Ausmass, dass diese Oberflächen unter dem angewendeten Druck verschmelzen können.



3. Verfahren nach Anspruch 1 oder 2, wobei die Dicke der erweichten Oberflächenschicht des Zugträger-
elements (6) kleiner ist als die Dicke des festen, jedoch erweichbaren elastischen Materials (10), in das
der Faden eingebettet ist.
- 5 4. Verfahren nach einem der Ansprüche 1-3, wobei die Oberflächenschichten der Elemente (2,6), die in Kon-
takt miteinander kommen, mindestens in dem Ausmass erweicht werden, dass die Materialien dieser
Oberflächenschichten in die Hohlräume zwischen den genannten Elementen hineinfließen und diese fül-
len können, und um den Windungen des Zugträgerelements (6) zu erlauben, wenigstens 20 % in die Ober-
10 fläche des endlosen Druckelementriemens (2) eingedrückt zu werden.
5. Verfahren nach einem der Ansprüche 1-4, wobei die Windungen des Zugträgerelements (6), die die ge-
nannte Schicht (4) bilden, im wesentlichen quer über die ganze Breite der Oberfläche des Druckelement-
riemens (2) gewickelt werden.
- 15 6. Verfahren nach einem der Ansprüche 1-5, wobei das Erweichen ein Verflüssigen durch die Anwendung
von Wärme ist.
7. Verfahren nach Anspruch 6, wobei zur Erwärmung eine Heissluftdüse (4,6) verwendet wird.
- 20 8. Verfahren nach Anspruch 6, wobei zur Erwärmung eine Quelle konzentrierter Wärmestrahlung verwen-
det wird.
9. Verfahren nach Anspruch 6, wobei zur Erwärmung eine Quelle von konzentrierten mechanischen Ultra-
schallschwingungen verwendet wird.
- 25 10. Verfahren nach Anspruch 6, wobei das Material von mindestens einem der Elemente (2,6,12), die mitein-
ander verbunden werden sollen, Metallteilchen enthält, und wobei zur Erwärmung eine Quelle von kon-
zentrierten elektromagnetischen Schwingungen verwendet wird.
- 30 11. Verfahren nach einem der Ansprüche 1-5, wobei das Erweichen durch die Anwendung eines Adhäsions-
mittels erreicht wird.
12. Verfahren nach einem der Ansprüche 1-11, wobei das Erweichen sowohl durch die Anwendung von War-
me als auch eines Adhäsionsmittels erreicht wird.
- 35 13. Verfahren nach einem der Ansprüche 1-12, wobei der gegenseitige Druck erzeugt wird, indem das Zug-
trägerelement (6) während des Wickelns straff gehalten wird.
14. Verfahren nach einem der Ansprüche 1-12, dadurch gekennzeichnet, dass der gegenseitige Druck mit
Hilfe mindestens einer Andruckrolle erzeugt wird.
- 40 15. Verfahren nach einem der Ansprüche 1-14, dadurch gekennzeichnet, dass das erste, zweite und/oder drit-
te Elastomer im wesentlichen ein thermoplastisches Elastomer ist.
16. Endloser Treibriemen mit:
45 einem Druckelementriemen (2) mit einer Oberfläche, der ein festes, aber erweichbares elastisches Ma-
terial mit einem ersten Elastomer enthält; und
einer Zugträgerschicht (4), bestehend aus einer Vielzahl, mindestens jedoch mehr als einer vollen Win-
dung eines Zugträgerelements (6), das entlang und um die Oberfläche des Druckelementriemens (2) ge-
wickelt ist und das mit einem Faden (8) versehen ist, der in einem Überzug (10) eingebettet ist, die ein
50 festes, jedoch erweichbares elastisches Material einem zweiten Elastomer enthält,
dadurch gekennzeichnet,
dass das zweite Elastomer mit dem ersten Elastomer verschmelzbar ist, und
dass die Windungen der Wickelschicht (4) des Zugträgerlements (6) gut verbunden sind mit der Oberflä-
che des Druckelementriemens (2), wobei der Übergangsbereich zwischen den Windungen und der Ober-
55 fläche geschmolzenes Material aus sowohl einer angrenzenden Oberflächenschicht des Ueberzugs (10)
des Fadens des Zugträgerlements (6) und einer angrenzenden Oberflächenschicht der Oberfläche des
Druckelementriemens (2) enthält, und wobei die Windungen wenigstens teilweise in die Oberfläche ein-
gedrückt sind.



- 5 17. Endloser Treibriemen nach Anspruch 16, weiter umfassend ein um und auf der Wickelschicht (4) des Zugträgerelements (6) angeordnetes Zugelement (12) aus einem festen, aber erweichbaren elastischen Material mit einem dritten Elastomer, das verschmelzbar ist mit dem zweiten Elastomer, wobei das Zugelement (12) gut verbunden ist mit der Wickelschicht (4), wobei der Übergangsbereich zwischen der Wickelschicht (4) und dem Zugelement (12) geschmolzenes Material aus sowohl einer angrenzenden Oberflächenschicht des Ueberzugs (10) des Fadens (8) des Zugträgerelements (6) und einer angrenzenden Oberflächenschicht des Zugelements (12) enthält.
- 10 18. Endloser Treibriemen nach Anspruch 16 oder 17, wobei das Material des Fadens (8) ausgewählt ist aus einer Gruppe enthaltend Baumwolle, Kunstseide, Polyester, Aramid, und dergleichen.
19. Endloser Treibriemen nach einem der Ansprüche 16 - 18, wobei der Faden (8) vor seiner Einbettung in das feste, jedoch erweichbare elastische Material mit Wärme behandelt wurde.
- 15 20. Endloser Treibriemen nach einem der Ansprüche 16 - 19, wobei der Faden (8) vor seiner Einbettung in das feste, jedoch erweichbare elastische Material mit einem wässrigen Epoxyd-Grundierungsmittel und/oder einem Adhäsionsmittel behandelt wurde.
- 20 21. Endloser Treibriemen nach einem der Ansprüche 16-20, wobei der Faden (8) aus mindestens zwei mechanisch miteinander verbundenen Materialien besteht, einem hochfesten Material und einem Material mit guter natürlicher Adhäsion an das Material, in welches der Faden (8) eingebettet ist.
22. Endloser Treibriemen nach einem der Ansprüche 16-21, wobei die Windungen im wesentlichen die ganze Breite der Oberfläche bedecken.
- 25 23. Endloser Treibriemen nach einem der Ansprüche 16 - 22, wobei die Windungen mindestens 20% eingedrückt sind in die Oberfläche des Druckelementriemens (2).
- 30 24. Vorrichtung zur Herstellung eines endlosen Treibriemens aus vorgeformten Elementen, wobei die Elemente mindestens einen Druckelementriemen (2) und ein Zugträgerelement (6) umfassen, die ihrerseits jeweils aus einem ein festes, jedoch erweichbares elastisches Material enthaltenden Material bestehen, und wobei die Einrichtung versehen ist mit:
 einer Riemenmontagerolle (18) mit einer Breite, die der Breite von mindestens einem einzelnen Druckelementriemen (2) entspricht;
 35 Antriebsmitteln (22) zum Drehantrieb der Riemenmontagerolle (18);
 einer Freilaufrolle (24) in einer Ebene mit der Riemenmontagerolle (18) und in einer variablen Mittelpunktsdistanz davon;
 Hilfsmitteln, um die variable Mittelpunktsdistanz anzupassen und um in einem um die Riemenmontagerolle (18) und die Freilaufrolle (24) geführten Druckelementriemen (2), einen angemessenen Zug zu erzeugen;
 40 Druckerzeugungsmitteln für die Anwendung von gegenseitigem Druck zwischen dem Druckelementriemen (2) und dem Zugträgerelement (6) während des Wickelns des Zugträgerelements (6) auf die äussere Oberfläche des Druckelementriemens (2) durch die Rotation der Riemenmontagerolle (18);
 Aufweichmitteln zum selektiven Aufweichen von Oberflächenschichten von sowohl dem Zugträgerelement (6) als auch dem Druckelementriemen (2), die während des Wickelns miteinander in Kontakt kommen, kurz bevor sie in Kontakt mit einander kommen und zwar mindestens in einem solchen Ausmass, dass das Material der Oberflächenschichten unter dem gegenseitig angewendeten Druck verschmelzen kann und weiter, damit die Windungen des Zugträgerelements (8) wenigstens teilweise eingedrückt werden können in die Oberfläche des Druckelementriemens (2).
- 45 25. Vorrichtung nach Anspruch 24, wobei die Aufweichmittel Heizmittel und in einer solchen Weise angeordnet sind, dass sie Wärme gleichzeitig und selektiv auf das Zugträgerelement (6) und die Oberfläche des Druckelementriemens (2) in der Nähe des Punktes applizieren, an dem das Zugträgerelement (6) während des Wickelns auf die Oberfläche des Druckelementriemens (2) in Kontakt kommt mit dieser Oberfläche.
- 50 26. Vorrichtung nach Anspruch 25, wobei die Heizmittel ein elektrisches Gebläse (44) und eine Düse (46) umfassen, die einen heissen Luftstrom erzeugen.
- 55 27. Vorrichtung nach Anspruch 25, wobei die Heizmittel eine Quelle von konzentrierter Wärmestrahlung umfassen.



28. Vorrichtung nach Anspruch 25, wobei die Heizmittel eine Quelle von konzentrierten elektromagnetischen Schwingungen umfassen.
- 5 29. Vorrichtung nach Anspruch 25, wobei die Heizmittel eine Quelle von konzentrierten mechanischen Ultraschallschwingungen umfassen.
30. Vorrichtung nach Anspruch 24, wobei die Aufweichmittel Spendermittel zum Auftrag eines Adhäsionsmittels mindestens auf das Zugträgerlement (6) kurz vor seiner Ablage auf der Oberfläche des Druckelementriemens (2) sind.
- 10 31. Vorrichtung nach einem der Ansprüche 25 - 30, wobei die Aufweichmittel Heizmittel und Spendermittel für den Auftrag eines Adhäsionsmittels einschliessen.
32. Vorrichtung nach einem der Ansprüche 24 - 31, wobei die Druckerzeugungsmittel Führungsmittel (36) zur Führung und zum Straffhalten des Zugträgerelements (6) während des Wickelns auf den Druckelementriemen (2) sind, wobei die Führungsmittel (36) so ausgebildet sind, dass sie der Bewegung des Zugträgerelements (6) einen Widerstand entgegensetzen.
- 15 33. Vorrichtung nach einem der Ansprüche 25 - 31, wobei die Druckmittel nachgiebige Andruckrollen sind.
- 20 34. Vorrichtung nach einem der Ansprüche 24 - 33, wobei Führungsmittel (36) zur Führung des Zugträgerelements (6) während des Wickelns auf den Druckelementriemen (2) vorgesehen sind.
35. Vorrichtung nach Anspruch 34, weiter umfassend zweite Antriebsmittel (40), die den Führungsmitteln (36) eine Translationsbewegung während der Rotation der Riemenmontagerolle (18) vermitteln in einer Richtung senkrecht zur Längsausdehnung des zwischen der Riemenmontagerolle (18) und der Freilaufrolle (24) montierten Druckelementriemens (2).
- 25 36. Vorrichtung nach Anspruch 35, weiter umfassend Mittel (42), um die Beziehung zwischen der Rotationsgeschwindigkeit der Riemenmontagerolle (18) und der Geschwindigkeit der Translationsbewegung der Führungsmittel (36) zu kontrollieren.
- 30 37. Verfahren nach Anspruch 1, wobei der genannte Druckelementriemen (2) durch dauerhaftes Verbinden der beiden Enden eines vorgeformten, offen-endigen, auf die erforderliche Länge zugeschnittenen Druckelementprofils hergestellt wird.
- 35

Revendications

- 40 1. Procédé de fabrication d'une courroie sans fin d'entraînement, comprenant les étapes suivantes :
la disposition d'une courroie (2) à organe de compression comprenant une matière élastique solide mais qui peut être ramollie et contenant un premier élastomère, et
l'enroulement d'un organe préformé (6) d'encaissement de forces comprenant un câble (8) enrobé dans une matière (10) contenant un second élastomère, le long d'une surface de la courroie (2) à organe de compression et autour de cette surface, avec formation de cette manière d'une couche (4) contenant
45 plusieurs spires complètes en nombre au moins supérieur à un,
le procédé étant caractérisé en ce que la matière du câble est enrobée dans une matière élastique solide mais qui peut être ramollie, en ce que le second élastomère est un élastomère qui peut être associé par fusion avec le premier élastomère, et en ce que, simultanément à l'enroulement, les spires de la couche enroulée (4) de l'organe (6) d'encaissement de forces sont liées intimement à la surface de la courroie
50 (2) à organe de compression par application d'une pression mutuelle entre les spires et la surface et par ramollissement sélectif des couches de surface à la fois de l'organe (6) d'encaissement de forces et de la courroie (2) à organe de compression qui doivent venir en contact mutuel, juste avant leur mise en contact mutuel, au moins à un degré tel que les matières des couches de surface s'associent par fusion
55 sous l'action de la pression mutuelle appliquée et que les spires peuvent s'imprimer au moins partiellement à la surface de la courroie (2) de l'organe de compression.
2. Procédé selon la revendication 1, caractérisé en ce qu'il comporte en outre les étapes suivantes :
l'enroulement d'au moins une spire complète d'un organe profilé préformé (12) de tension ayant



une extrémité libre, contenant une matière élastique solide, mais qui peut être ramollie, et qui contient un troisième élastomère qui peut être associé par fusion au second élastomère, placé autour de la couche (4) de l'organe (6) d'encaissement de forces et sur cette couche, et simultanément

5 la liaison intime de la spire au moins de l'organe profilé (12) de tension avec la couche (4) d'encaissement de forces par application d'une pression mutuelle entre l'organe profilé (12) de tension et la couche (4) d'encaissement de forces et par ramollissement sélectif des couches superficielles de l'organe (4) d'encaissement de forces et de l'organe profilé (12) de tension qui sont mis en contact mutuel, juste avant cette mise en contact mutuel, avec un degré au moins tel que la matière des couches superficielles
10 s'associe par fusion sous l'action de la pression appliquée.

3. Procédé selon la revendication 1 ou 2, dans lequel l'épaisseur de la couche superficielle ramollie de l'organe (6) d'encaissement de forces est inférieure à l'épaisseur de la matière élastique solide (10) mais qui peut être ramollie et dans laquelle est enrobé le câble.

15 4. Procédé selon l'une des revendications 1 à 3, dans lequel les couches superficielles desdits organes (2, 6) venant en contact mutuel sont ramollies au moins d'un degré tel que les matières des couches superficielles s'écoulent dans les espaces formés entre les organes et remplissent ces espaces et que les spires de l'organe (6) d'encaissement de forces sont imprimées d'au moins 20 % à la surface de la courroie sans fin (2) à organe de compression.
20

5. Procédé selon l'une des revendications 1 à 4, dans lequel les spires de l'organe (6) d'encaissement de forces formant la couche (4) sont enroulées sur pratiquement toute la largeur de la surface de la courroie (2) à organe de compression.

25 6. Procédé selon l'une des revendication 1 à 5, dans lequel le ramollissement est réalisé par fusion par application de chaleur.

7. Procédé selon la revendication 6, dans lequel la chaleur est appliquée par une buse (4, 6) de soufflage d'air chaud.

30 8. Procédé selon la revendication 6, dans lequel la chaleur est appliquée par une source de chaleur rayonnante concentrée.

35 9. Procédé selon la revendication 6, dans lequel la chaleur est appliquée par une source de vibrations mécaniques ultrasonores concentrées.

10. Procédé selon la revendication 6, dans lequel la matière de l'un au moins des organes (2, 6, 12) destinés à être liés mutuellement contient des particules métalliques, et dans lequel la chaleur est appliquée par une source d'ondes électromagnétiques concentrées.

40 11. Procédé selon l'une des revendications 1 à 5, dans lequel le ramollissement est réalisé par application d'un adhésif.

12. Procédé selon l'une des revendications 1 à 11, dans lequel le ramollissement est réalisé à la fois par application de chaleur et d'un adhésif.

45 13. Procédé selon l'une des revendications 1 à 12, la pression mutuelle est appliquée par maintien tendu de l'organe (6) d'encaissement de forces pendant son enroulement.

50 14. Procédé selon l'une des revendications 1 à 12, dans laquelle la pression mutuelle est appliquée par au moins un rouleau flottant.

15. Procédé selon l'une des revendications 1 à 14, dans lequel, le premier, le second et/ou le troisième élastomère sont essentiellement un élastomère thermoplastique.

55 16. Courroie d'entraînement sans fin comprenant :
une courroie (2) à organe de compression ayant une surface et contenant une matière élastique solide mais qui peut être ramollie et contenant un premier élastomère, et
une couche (4) d'encaissement de forces, constituée par plusieurs spires complètes en nombre au moins supérieur à un d'un organe (6) d'encaissement de forces enroulé le long la surface de la courroie



- (2) à organe de compression et autour de cette surface, l'organe d'encaissement de forces comprenant un câble (8) enrobé dans une enveloppe (10) contenant une matière élastique solide mais qui peut être ramollie et contenant un second élastomère, caractérisée en ce que le second élastomère peut être associé par fusion au premier élastomère, et en ce que :
- les spires de la couche enroulée (4) de l'organe (6) d'encaissement de forces sont liées intimement à la surface de la courroie (2) à organe de compression, l'interface des spires et de la surface comprenant les matières de la couche adjacente de surface de l'enveloppe (10) du câble (8) de l'organe (6) d'encaissement de forces et d'une couche superficielle adjacente de la surface de la courroie (2) à organe de compression associées par fusion, les spires étant au moins partiellement imprimées dans la surface.
17. Courroie d'entraînement sans fin selon la revendication 16, comprenant en outre, autour de la couche enroulée (4) de l'organe (6) d'encaissement de forces et sur cette couche, un organe (12) de tension contenant une matière élastique solide mais qui peut se ramollir et contenant une troisième élastomère qui peut être associé par fusion au second élastomère, dans laquelle l'organe de tension (12) est lié intimement à la couche enroulée (4), l'interface de la couche enroulée (4) et de l'organe de tension (12) contenant une matière fondue provenant à la fois d'une couche superficielle adjacente de l'enveloppe (10) du câblé (8) de l'organe (6) d'encaissement de forces et d'une couche superficielle adjacente de l'organe de tension (12).
 18. Courroie d'entraînement sans fin selon la revendication 16 ou 17 dans laquelle la matière du câble (8) est sélectionnée dans le groupe comprenant le coton, la rayonne, le polyester, l'aramide et analogue.
 19. Courroie d'entraînement sans fin selon l'une des revendications 16 à 18, dans laquelle le câblé (8) est un câblé qui a été traité thermiquement avant d'avoir été revêtu de la matière élastique solide mais qui peut se ramollir.
 20. Courroie d'entraînement sans fin selon l'une des revendications 16 à 19, dans laquelle le câble (8) est un câble qui a été revêtu d'une couche époxyde aqueuse d'accrochage et/ou d'un adhésif avant d'être enrobé dans la matière élastique solide mais qui peut se ramollir.
 21. Courroie d'entraînement sans fin selon l'une des revendications 16 à 20, dans laquelle le câble (8) est formé d'au moins deux parties mécaniquement combinées, l'une ayant une résistance mécanique élevée et une autre ayant une bonne adhérence naturelle vis-à-vis de la matière dans laquelle le câble (8) est enrobé.
 22. Courroie d'entraînement sans fin selon l'une des revendications 16 à 21, dans laquelle les spires recouvrent pratiquement toute la largeur de la surface.
 23. Courroie d'entraînement sans fin selon l'une des revendications 16 à 22, dans laquelle les spires sont imprimées d'au moins 20 % à la surface de la courroie (2) à organe de compression.
 24. Appareil de fabrication d'une courroie sans fin d'entraînement à partir d'organes préformés, les organes comprenant au moins une courroie (2) à organe de compression et un organe (6) d'encaissement de forces, contenant chacun une matière élastique solide mais qui peut être ramollie, l'appareil comprenant :
 - une poulie (18) de confection de courroie ayant une largeur correspondant juste à la largeur d'au moins une seule courroie (2) à organe de compression,
 - un dispositif (22) d'entraînement en rotation de la poulie (18) de confection de courroie,
 - une poulie folle (24) disposée dans l'alignement de la poulie (18) de confection de courroie, avec une distance variable entre les centres des poulies,
 - un dispositif d'ajustement de la distance variable des centres afin qu'une tension convenable soit créée dans la courroie (2) à organe de compression lorsqu'elle est montée entre la poulie (18) de confection de courroie et la poulie folle (24),
 - un dispositif de mise sous pression destiné à appliquer une pression mutuelle entre la courroie (2) à organe de compression et l'organe (6) d'encaissement de forces pendant l'enroulement à la surface externe de la courroie (2) d'organe de compression par rotation de la poulie (18) de confection de courroie, et
 - un dispositif de ramollissement sélectif des couches de surface à la fois de l'organe (6) d'encaissement de forces et de la courroie (2) à organe de compression qui doivent venir en contact mutuel pendant l'enroulement, juste avant qu'elles ne viennent en contact mutuel, à un degré au moins tel que la



matière des couches de surface peut s'associer par fusion sous l'action de la pression mutuelle appliquée, et en outre que les spires de l'organe (6) d'encaissement de forces sont au moins partiellement imprimées à la surface de la courroie (2) à organe de compression.

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25. Appareil selon la revendication 24, dans lequel le dispositif de ramollissement est constitué par un dispositif de chauffage et est placé de manière qu'il puisse appliquer de la chaleur simultanément et sélectivement à l'organe (6) d'encaissement de forces et à la surface de la courroie (2) à organe de compression à proximité du point auquel l'organe (6) d'encaissement de forces, pendant l'enroulement sur la surface de la courroie (2) à organe de compression, vient au contact de cette surface.
26. Appareil selon la revendication 25, dans lequel le dispositif de chauffage comprend un ventilateur électrique (44) et une buse (46) qui forment un jet d'air chaud.
27. Appareil selon la revendication 25, dans lequel le dispositif de chauffage est une source de chaleur rayonnante concentrée.
28. Appareil selon la revendication 25, dans lequel le dispositif de chauffage est une source d'ondes électromagnétiques concentrées.
29. Appareil selon la revendication 25, dans lequel le dispositif de chauffage est une source de vibrations mécaniques ultrasonores concentrées.
30. Appareil selon la revendication 24, dans lequel le dispositif de ramollissement est constitué par un dispositif distributeur destiné à appliquer un adhésif au moins à l'organe (6) d'encaissement de forces juste avant le dépôt à la surface de la courroie (2) à organe de compression.
31. Appareil selon l'une des revendications 25 à 30, dans lequel le dispositif de ramollissement comporte un dispositif de chauffage et un dispositif distributeur destiné à appliquer un adhésif.
32. Appareil selon l'une des revendications 24 à 31, dans lequel le dispositif de mise sous pression est un dispositif (36) de guidage de l'organe (6) d'encaissement de forces et de maintien tendu de cet organe pendant son enroulement sur la courroie (2) à organe de compression, le dispositif de guidage (36) étant destiné à créer une résistance au déplacement de l'organe (6) d'encaissement de forces lors de son passage.
33. Appareil selon l'une des revendications 25 à 31, dans lequel le dispositif de mise sous pression est constitué de rouleaux flottants.
34. Appareil selon l'une des revendications 24 à 33, comprenant un dispositif (36) de guidage de l'organe (6) d'encaissement de forces pendant son enroulement sur la courroie (2) à organe de compression.
35. Appareil selon la revendication 34, comprenant en outre un second dispositif (40) d'entraînement destiné à donner au dispositif de guidage (36) un mouvement de translation pendant la rotation de la poulie (18) de confection de courroie en direction perpendiculaire à la dimension longitudinale de la courroie (2) à organe de compression montée entre la poulie (18) de confection de courroie et la poulie folle (24).
36. Appareil selon la revendication 35, comprenant en outre un dispositif (42) de réglage de la relation entre la vitesse de rotation de la poulie (18) de confection de courroie et la vitesse du mouvement de translation du dispositif de guidage (36).
37. Procédé selon la revendication 1, dans lequel la courroie (2) à organe de compression est réalisée par raccordement permanent des deux extrémités d'un organe profilé préformé de compression à extrémités libres, coupé à la longueur nécessaire.