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(54) **A PROCESS FOR THE MANUFACTURING OF A LOAD CARRIER**

VERFAHREN ZUM HERSTELLEN EINES LASTTRÄGERS

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(56) References cited:
DE-A- 2 401 624
SE-C2- 508 870
SE-C2- 508 874
US-A- 5 255 613

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Description

[0001] The present invention is related to a process for the manufacturing of non-reinforced load carrier of thermoplastic material.

[0002] Thermoplastic products are used in many different areas. These products can be achieved through a number of different manufacturing methods, the most commonly present being injection moulding, vacuum moulding, blow moulding and press moulding.

[0003] There is a desire to achieve high load absorption capacity within certain areas. Carrying structures made of materials such as concrete and steel will be able to withstand substantially the same load, independent of temperature and time. This is not the case with thermoplastic materials where a relatively light load might cause a remaining deformation at extended exposure. This phenomena is called creep strain or cold flow. A structure made of thermoplastic material will however be able to cope with loads that are tens of times higher at shorter times, without any remaining deformation. The amount of cold flow in respect of time and temperature is depending on thermoplastic material type and quality.

[0004] Load carrying thermoplastic products will most often have to be designed for the most unfavourable load i.e. longest time and highest temperature it might be exposed to during its useful life. It is, however, possible to reduce the amount of cold flow by adding fillers or reinforcing fibres to the thermoplastic material. Common fillers are usually minerals such as lime or mica while reinforcing materials usually comprises glass fibre, steel fibre or carbon fibre. It is also possible to reinforce a thermoplastic product by integrating a metal design in the product. This may for example be constituted of a metal rod placed in a hollow chamber intended for the purpose. Such additives will, however, deteriorate other desired properties the thermoplastic material, by nature, is provided with. One such property is that most thermoplastic materials are easy to keep clean and hygienic. This property will be lost when fillers are added. It will furthermore be impossible, or at least very difficult, to recover the material, both in cases where reinforcing bars and where fillers are used. Recycling of thermoplastic materials are almost mandatory nowadays.

[0005] Such load carrier is known from SE 508 870 or SE 508 874 which shows process for the manufacturing of non-reinforced thermoplastic products with a very high creep strain resistance. SE 508 870 and SE 508 874 shows processes where a number of product parts are manufactured from a number of preferably tube or sheet shaped work pieces. The work pieces are shaped, after being heated, by means of a mould and the influence of vacuum or pressure. The product parts produced are then allowed to cool and post-shrink. The product parts are hereafter assembled to a unit.

[0006] It has, through the present invention, quite unexpectedly, been made possible to achieve non-reinforced load carriers of thermoplastic material with a very high resistance towards cold flow. Non-reinforced means that the load carriers are free from reinforcing additives such as various forms of fibres added to the thermoplastic material and also free from reiforcing profiles, beams or bars made of a material not compatible with the material of the load carrier. Other reinforcements such as material elevations or profiles made of the same material as the load carrier itself may of course occur. The invention relates to a process for the manufacturing of non-reinforced load carriers of thermoplastic material. The process comprises the steps extrusion, vacuum moulding and/or blow moulding work pieces into upper and lower deck members of a thermoplastic material such as polyethylene, polypropylene or polybutene, which deck members are allowed to cool and post shrink after which they are welded to form a load carrier. The invention is characterised in that;

a, i) Work pieces in the shape of sheets are manufactured by means of an extruder. The work pieces are allowed to cool and post shrink uniformly after the manufacturing, suitably by an intermediate storing of 6 - 48 hours.

a, ii) Extended bar sections with a preferably rectangular or polygonal cross-section are also manufactured by means of an extruder. The bar sections are allowed to cool and post shrink uniformly after the manufacturing, suitably by an intermediate storing of 6 - 48 hours.

b, i) An upper deck member is then manufactured by heating and then moulding two of the uniformly post shrinked work pieces in a first mould comprising a first and a second mould half. The mould halves comprises one shaping cavity each. The two shaping cavities are, together, a negative representation of an upper deck member to a load carrier. The mould halves are arranged so that an intermediate space is formed between them and so that the cavities are facing each other. The two heated work pieces are hereby placed in the intermediate space between the two cavities after which they are moulded in each one cavity under influence of vacuum and/or pressure. The mould halves are then pressed together while the thermoplastic material is still hot so that the two work pieces are welded with each other and forms a hollow unit. The thermoplastic material is then allowed to cool somewhat before the mould is opened, the upper deck member is removed and the process can be repeated.

b, ii) A lower deck member is also manufactured by heating and then moulding two further, also uniformly post-shrinked, work pieces which after heating is formed in a second mould comprising a first and a second mould half. The mould halves each comprises one shaping cavity, which cavities together is a negative representation of a lower deck member to a load carrier. The two heated work pieces are hereby placed, moulded, welded and removed in a man-

ner similar to the manufacturing of the upper deck member.

b, iii) A skid is possibly also manufactured by heating and then moulding two of the extended bar sections in a third mould comprising a first and a second mould half comprising a first and a second mould half, which mould halves each comprises one shaping cavity, which two cavities together is a negative representation of a skid to a load carrier. The two heated bar sections are hereby placed, moulded, welded and removed in a manner similar to the manufacturing of the deck members.

c) The upper and the lower deck member and the possible skid are then allowed to cool and post shrink uniformly, after being removed from the mould, suitably by an intermediate storing of 6 - 24 hours.

d) A number of joining surfaces on the lower side of upper deck member, on the upper and lower side of the lower deck member and on the upper side of two or three bar sections or alternatively two or three skids, are then joined with each other. The surfaces are, in one or more steps, heated by means of infrared heating, laser or by being pressed against a heated weld core. The different parts are, in one or more steps, pressed together so that the molten thermoplastic material in the lower joining surfaces of the upper deck member and on the upper and lower joining surfaces of the lower deck member as well as the joining surfaces of the bar sections or the skids weld or melt joins. The thermoplastic material in the joining surfaces is then allowed to cool and solidify at least partly before the pressing is discontinued. A joined, non-reinforced load carrier of thermoplastic material is hereby achieved.

[0007] The sheet shaped work pieces are suitably oriented so that the direction of the extrusion coincides between the layers that forms the upper and lower deck members. The reason to this is that the contraction of the thermoplastic material is depending on the direction of the polymer chains. These polymer chains will be oriented during the extrusion process. Even if the main part of the contraction will take place within a couple of days, some additional contraction will occur during the main part of the useful life of the product. This contraction will be accelerated when the product is exposed to increased temperatures, such as for example during washing and drying. This contraction might cause bimetal-like warping of the product in cases where the layers aren't oriented in the same direction. Such a warping will most certainly increase as the product ages.

[0008] The post-shrinking of different parts is of the same reason controlled so that all parts included in one and the same load carrier is in mainly the same degree of contraction. This can be achieved in different ways. One way is to allow the work pieces to shrink so that at least 75% of the total contraction is obtained. This can be achieved by an intermediate storing of the parts from a couple of hours to a couple of days before the next step in the process is started. It is here important that the different parts has the same degree of contraction.

[0009] The contraction can be accelerated by letting the intermediate storing take place in an elevated temperature, for example 60 - 100°C. The later will also give the advantage that the heating will be less time consuming when for example moulding the deck members. An accelerated contraction might, however, be less suited before the final assembly as this will require some stability in the different parts.

[0010] Another way to solve the contraction problem is to "freeze" the different parts directly after each step of the process which involves thermoforming. This is suitably achieved by rapidly cooling the parts to below room temperature immediately after the moulding. The contraction will then stop almost completely and will not commence until the parts are heated.

[0011] It is also possible to mould and assemble all parts at predetermined junctures in the beginning of the contraction, for example when only 5 - 10% of the total contraction is obtained. The moulding of the deck members can for example take place 1 minute $\pm$5 seconds and the welding 5 minutes $\pm$10 seconds, after the extrusion of the work pieces.

[0012] The bar sections, which in the finished load carrier constitutes skids, are suitably massive. These bar sections are milled to the desired dimensions after cooling and post-shrinking, but before the assembly, whereby undesired cross-warping in the skid can be avoided.

[0013] These skids are alternatively hollow, extruded, profiles which preferably after cooling and post-shrinking and possibly before assembly is sealed at its both ends by means of plugs or by being thermoformed. The skid may according to yet another alternative be manufactured in the same manner as the deck members whereby it comprises an upper and a lower layer. The upper layer is preferably connected with the lower layer via distance sections. The distance sections forms an integrated part of either or both of the layers and are moulded together with the moulding of the respective layers.

[0014] The thermoplastic material used for manufacturing is preferably a polymer, for example polyethylene, polypropylene or polybutene with an average molecular weight in the range 200'000 - 2'000'000 preferably greater than 300'000. It is, in certain cases, as for example when moulding parts with thinner material thickness advantageous to use a material with the molecular weight in the range 1'000'000 - 2'000'000, while thicker parts most often are produced of a material with a molecular weight in the range 300'000 - 1'000'000.

[0015] The deck members are preferably provided with mainly vertical surfaces and mainly horizontal surfaces, whereby the joining surfaces are arranged on horizontal surfaces. Vertical surfaces are further arranged adjacent to, or envelopes said joining surfaces. The joining surfaces suitably has a goods thickness which is greater than the goods thickness of the sections located adjacent

to the joining surfaces.

[0016] The upper deck member and the lower deck member are each constituted of an upper layer and a lower layer, which upper layers preferably are connected with its respective lower layer via distance sections. These distance sections constitutes an integrated part of the respective layer and are moulded in connection to the moulding of the respective layers. It is suitable to join the two surfaces when larger flat surfaces are present by joining them with one another by means of tower- or ridge-like elevations. This will increase the rigidity and at the same time improve the dimension stability.

[0017] The different parts are preferably joined with each other by means of welding such as mirror welding, laser welding, friction welding and or filler rod welding.

[0018] Mirror welding is performed by heating two surfaces of thermoplastic material until it melts. The heating is performed by means of a so called weld core which is a plate made of metal. The heated thermoplastic surfaces are then pressed together while the molten material is allowed to cool.

[0019] When laser welding, one of the layers is at least somewhat translucent while the other one is opaque, most often by adding carbon black to the thermoplastic material. The two layers are pressed together whereby the surfaces to be joined are illuminated with a laser. The illumination is performed from the translucent side. The energy from the laser beam will be transformed into thermal energy when it hits the opaque layer whereby it melts and the parts are joined by welding.

[0020] When friction welding, the surfaces to be joined are rubbed against each other so that the material melts due to the friction heat. Commonly known friction welding methods are ultrasonic welding, low frequency welding and rotation welding.

[0021] Welding with filler rod in thermoplastic materials is similar to its metal counterpart. The joining surface and the filler rod, which are made of the same thermoplastic material, are heated with a so-called hot air insufflator. The filler rod is pressed into the joint while the hot air beam is slowly moved along the joint. This method may also be used as a complement in combination with the ones mentioned above.

[0022] Predetermined surfaces on the load carrier is suitably coated with friction enhancing material. The surfaces to be coated are suitably pre-treated by flame or corona treating whereupon the surface is spray coated with the friction enhancing material. The friction enhancing material comprises, for example, ethyl-vinyl-acetate or the combination polyurea-prepolymer and diisocynate. The friction coating is suitably performed after the joining of the different parts of the load carrier. The parts partly or completely coated are;

- the upper side of the upper deck member,
- the lower parts of the bar sections, and
- selected parts of the lower side of the lower deck member.

[0023] The process according to the present invention is suited for the manufacturing of pallets where the demands for mechanical stability are very high and where reinforcing profiles or additives are banished due to hygienic or environmental reasons. The process may also be used for other types of load carriers such as foldable or solid pallet containers and bulk containers.

[0024] The invention is illustrated further through a process scheme and through an enclosed figure which shows one embodiment of the invention whereby,

- figure 1 shows an embodiment of a load carrier 1 with an upper deck member 11, a lower deck member 12 and a skid 3', and
- figure 2 shows a process scheme of the manufacturing process.

[0025] Accordingly, figure 1 shows a load carrier with an upper deck member 11 a lower deck member 12 and skids 3'. Only parts of the load carrier 1 is shown on order to facilitate understanding of the invention. Parts has furthermore been cut off in order to illustrate the process. The process scheme shows, in steps, the different main events in the manufacturing process. The process is initiated by producing sheet-shaped work pieces 2 by means of an extruder. The sheet-shaped work pieces (not shown) are allowed to cool and post-shrink for about 12 hours. Extended bar sections 3 (not shown) with a mainly rectangular cross-section are also produced by means of an extruder. The bar sections are also allowed to cool and post-shrink for about 12 hours.

[0026] An upper deck member 11 is then produced by first heating and then moulding two of the sheet-shaped work pieces 2 in a first mould. The mould comprises a first and a second mould half, which mould halves comprises each one shaping cavity. The two shaping cavities are together a negative representation of an upper deck member 11 to a load carrier 1. The mould halves are arranged so that an intermediate space is formed between them and that the cavities are facing each other. The two heated work pieces (not shown) are hereby placed in the intermediate space between the two cavities after which they are shaped by one cavity each under influence of vacuum and/or pressure whereupon the mould halves are pressed together while the thermoplastic material is still hot so that the two work pieces are welded with each other and forms a hollow unit. A tube can be inserted between the two layers before they are joined. Compressed air is then injected through the tube once the two layers are joined. It will hereby be possible to more accurately mould the part, especially in sharp corners and transitions. The thermoplastic material is then allowed to cool somewhat before the mould is opened. The upper deck member 11 is then removed and the process can be repeated.

[0027] A lower deck member 12 is also manufactured by heating and then moulding two further work pieces 2,

which after heating is moulded in a second mould. This second mould comprises a first and a second mould half, which mould halves each comprises one shaping cavity. The two cavities are together a negative representation of a lower deck member 12 to a load carrier 1. The two heated work pieces are placed, shaped, welded and removed in a manner similar to the manufacturing of the upper deck member 11. It is, of course possible to mould the two deck members 11 and 12 respectively completely independent of each other.

[0028] A skid 3' is furthermore manufactured by first heating and then moulding two of the extended bar sections 3 (not shown) in a third mould. This mould comprises a first and a second mould half. The mould halves includes each one shaping cavity, which cavities together are a negative representation of a skid 3' to a load carrier 1. The two extended heated bar sections 3 are placed, moulded and welded in a manner similar to the manufacturing of the deck members 11 and 12 above. It is of course possible to mould the skid 3' as well as the deck members 11 and 12 completely independent of each other. The sheet-shaped work pieces 2 are oriented so that the direction of the extrusion coincides between the layers that forms the parts. The reason to this is that the contraction of the thermoplastic material is depending on the direction of the polymer chains. These polymer chains will be oriented in connection to the extrusion. Even if the main part of the contraction will take place within a couple of days, some additional contraction will occur during the main part of the useful life of the product. This contraction will be accelerated when the product is exposed to increased temperatures, such as for example during washing and drying. This contraction might cause warping of the product in cases where the layers aren't oriented in the same direction. Such a warping will most certainly increase as the product ages.

[0029] The upper deck member 11, the lower deck member 12 and the skid 3' is allowed to cool and post-shrink for 8 hours after being removed from the moulds.

[0030] The upper deck member 11 and the lower deck member 12 are each constituted by upper layers 11' and 12' respectively and lower layer 11" and 12" respectively.

[0031] The upper layers 11' and 12' respectively are connected to their respective lower layer via distance sections 11"' and 12"' respectively. The distance sections 11"' and 12"' respectively constitutes an integrated part of the respective layer 11', 11" and 12', 12" respectively and are moulded together with the moulding of the respective layer 11', 11" and 12', 12" respectively. The skid 3' is also provided with distance sections as above according to the enclosed embodiment.

[0032] The deck members 11 and 12 respectively, and the skids 3' are provided with a number of joining areas 10 in connection to the moulding. These are arranged on the lower side of the upper deck member 11, on the upper and lower side of the lower deck member 12 and on the upper side of the skids 3'. The joining areas 10 are arranged in connection to, or enveloped by mainly vertical surfaces. The risk for a collapse in the different parts during welding are thereby reduced. The joining areas 10 are of the same reason provided with goods thickness greater than the parts located adjacent to the joining areas 10. The joining areas 10 are heated by being pressed against a heated weld core. The different parts are thereafter pressed against each other so that the molten thermoplastic material of the lower joining area 10 of the upper deck member 11 and the upper joining area 10 of the lower deck member 12 welds with each other and that the lower joining area 10 of the lower deck member 12 welds with the upper joining area 10 of the skid 3'. The thermoplastic material in the joining area 10 is then allowed to cool and solidify, at least somewhat, before the pressing cycle is terminated, whereby a joined non-reinforced load carrier 1 of thermoplastic material is achieved

[0033] The different joining operations may result in that burrs forms along the joining lines of the load carrier 1. The burrs are suitably removed in one or more operations by means of thermal or mechanical treatment. This operation may become necessary after manufacturing of the different parts 11, 12 and 3' and after the final assembly.

[0034] The load carrier 1 according to the present embodiment is manufactured of a polyolefin, most often polyethylene. The friction coefficient of this material is rather low which may result in problems when using the same. Predetermined surfaces of the load carrier 1 is therefore coated with a friction enhancing material after the assembly. The surfaces that is to be coated are first flame or corona treated and thereafter spray coated with the friction enhancing material. The friction enhancing material is comprises a combination of a polyureaprepolymer and diisocyanate. The surfaces coated are;

- the upper side of the upper deck member 11,
- the lower sides of the skids 3' and,
- selected parts of the lower side of the lower deck member 12.

[0035] The invention is not limited to the embodiment shown since it can be varied in different ways within the scope of the invention. Skids 3' may for example be constituted of a massive or hollow extruder profile, which also is illustrated in the process scheme. This alternative manufacturing process for skids 3' is, in the process scheme marked with dashed lines. The step where the skid 3' is vacuum moulded may then be excluded from the process. It may however be necessary to calibrate the outer dimensions of the skid 3' after the post-shrink phase.

[0036] It is also possible to provide the load carrier with a friction enhancing coating earlier in the process. It is, for example, possible to coat the sheet-shaped work pieces 2 as well as the extended bar sections 3 already after the extrusion. This might prove advantageous as the following treatment may improve the adhesion between the friction coating and the different load carrier

parts.

Claims

1. Process for the manufacturing of non-reinforced load carriers (1) of thermoplastic material, which process comprises the steps extrusion, vacuum moulding and/or blow moulding work pieces (2) into upper and lower deck members (11 and 12 respectivel y) of a thermoplastic material such as polyethylene, polypropylene or polybutene, which deck members (11 and 12 respectivel y) are allowed to cool and post shrink after which they are welded to form a load carrier (1) **characterised in that**;

   a, i) the work pieces (2), in the shape of sheets are manufactured by means of an extruder, which work pieces (2) are allowed to cool and post shrink uniformly after the manufacturing, suitably by an intermediate storing of 6 - 48 hours, and that,
   a, ii) extended bar sections (3) with a preferably rectangular or polygonal cross-section is manufactured by means of an extruder, which bar sections (3) are allowed to cool and post shrink uniformly after the manufacturing, suitably by an intermediate storing of 6 - 48 hours, whereupon,
   b, i) the upper deck member (11) is manufactured by heating and then moulding two uniformly post shrinked work pieces (2) in a first mould comprising a first and a second mould half, which mould halves comprises each one shaping cavity, which two shaping cavities together are a negative representation of an upper deck member (11) to a load carrier (1), whereby the mould halves are arranged so that an intermediate space is formed between them and that the cavities are facing each other, whereupon the two heated work pieces (2) are placed in the intermediate space between the two cavities after which they are moulded by one cavity each under influence of vacuum and/or pressure whereupon the mould halves are pressed together while the thermoplastic material is still hot so that the two work pieces are welded with each other and forms a hollow unit whereupon the thermoplastic material is allowed to cool somewhat before the mould is opened, the upper deck member (11) is removed and the process can be repeated, and that,
   b, ii) the lower deck member (12) is manufactured by heating and then moulding two further, also uniformly post shrinked, work pieces (2), which after heating is formed in a second mould comprising a first and a second mould half, which mould halves each comprises one shaping cavity, which two cavities together is a negative representation of a lower deck member (12) to a load carrier (1), whereby the two heated work pieces are placed, moulded, welded and removed in a manner similar to the manufacturing of the upper deck member (11), and possibly that,
   b, iii) a skid (3') is manufactured by heating and then forming two of the extended bar sections (3) in a third mould comprising a first and a second mould half comprising a first and a second mould half, which mould halves each comprises one shaping cavity, which two cavities together is a negative representation of a skid (3') to a load carrier (1), whereby the two heated bar sections (3) are placed, moulded, welded and removed in a manner similar to the manufacturing of the deck members (11 and 12 respectively), whereupon,
   c) the upper and the lower deck member (11 and 12 respectively) are allowed to cool and post shrink uniformly, after being removed from the mould, suitably by an intermediate storing of 6 - 24 hours, whereupon,
   d) a number of joining surfaces (10) on the lower side of upper deck member (11), on the upper and lower side of the lower deck member (12) and on the upper side of two or three bar sections (3) or alternatively two or three skids (3'), which, in one or more steps, are heated by means of infrared heating, laser or by being pressed against a heated weld core, whereby the different parts, in one or more steps, are pressed together so that the molten thermoplastic material in the lower joining surfaces (10) of the upper deck member (11) and on the upper and lower joining surfaces (10) of the lower deck member (12) as well as the joining surfaces (10) of the bar sections (3) or the skids (3') weld or melt joins, whereby the thermoplastic material in the joining surfaces is allowed to cool and solidify at least partly before the pressing is discontinued,

   whereby a joined, non-reinforced load carrier (1) of thermoplastic material is achieved.

2. A process according to claim 1, **characterised in that** the thermoplastic material is constituted by a polymer with an average molecular weight in the range 200'000 - 2'000'000 preferably greater than 300'000.

3. A process according to claim 1 or 2, **characterised in that** the deck members (11 and 12 respectively) are provided with mainly vertical surfaces and mainly horizontal surfaces, whereby the joining surfaces (10) are arranged on horizontal surfaces and that vertical surfaces are arranged adjacent to, or enve-

lopes said joining surfaces (10).

4. A process according to claim 3, **characterised in that** the joining surfaces (10) has a goods thickness which is greater than the goods thickness of the sections located adjacent to the joining surfaces (10).

5. A process according to any of the claims 1 - 4, **characterised in that** the bar sections (3), which in the finished load carrier (1) serves as skids (3'), are massive and that these bar sections (3') after cooling and post-shrinking but before joining, are milled to the desired dimension, whereby unwanted cross warping in the finished skid (3') can be avoided.

6. A process according to any of the claims 1 - 4, **characterised in that** the bar sections (3), which in the finished load carrier (1) serves as skids (3'), are hollow extruded profiles and that these bar sections (3), preferably after cooling, post-shrinking and possibly before joining are sealed in both ends by means of plugs or by being thermoformed.

7. A process according to any of the claims 1 - 4, **characterised in that** the upper deck member (11) and the lower deck member (12) each are constituted of an upper layer (11' and 12' respectively) and a lower layer (11" and 12" respectivelly) which upper layers (11' and 12' respectively) are connected with its respective lower layer (11" and 12'' respectively) via distance sections (11''' and 12"' respectively) which distance sections (11''' and 12"' respectively) constitutes an integrated part of the respective layer (11', 11" and 12', 12" respectively) and are moulded in connection to the moulding of the respective layers (11', 11" and 12', 12" respectively).

8. A process according to any of the claims 1 - 4, **characterised in that** the skid (3') is constituted by an upper and a lower layer, which upper layer is connected with the lower layer via distance sections, which distance sections constitutes an integrated part of either or both of the layers and is moulded in connection to the moulding of the respective layers.

9. A process according to claim 1, **characterised in that** the friction coating is performed after the joining of the different parts of the load carrier (1), whereby the parts partly or completely coated are; the upper side of the upper deck member (11), the lower parts of the bar sections (3) and selected parts of the lower side of the lower deck member (12).

10. A process according to claim 1, **characterised in that** the sheet shaped work pieces (2) are oriented so that the direction of extrusion coincides between the layers of the upper and lower deck members (11 and 12 respectively).

11. A process according to claim 1, **characterised in that** the extended bar sections or profiles (3) are oriented so that the direction of extrusion coincides with the different parts the load carrier (1) is made of.

Patentansprüche

1. Verfahren zur Herstellung eines nicht verstärkten Lastenträgers (1) aus thermoplastischem Material, welches Verfahren die Extrusion, das Vakuumformen und/oder das Blasformen von Werkstücken (2) in obere und untere Deckelemente (11 bzw. 12) aus einem thermoplastischen Material wie beispielsweise Polyethylen, Polypropylen oder Polybuten aufweist, welche Deckelemente (11 bzw. 12) abkühlen und nachschrumpfen können, wonach sie verschweißt werden, um einen Lastenträger (1) zu bilden,
dadurch gekennzeichnet, dass

a1) die Werkstücke (2) in Gestalt von Materialbahnen mittels eines Extruders hergestellt werden, welche Werkstücke (2) nach der Herstellung geeignet gleichmäßig abkühlen und nachschrumpfen können, und zwar durch eine Zwischenlagerung von 6 - 48 Stunden, und dass
a2) verlängerte Stangenabschnitte (3) mit einem vorzugsweise rechteckigen oder polygonalen Querschnitt mittels eines Extruders hergestellt werden, welche Stangenabschnitte (3) nach der Herstellung geeignet durch eine Zwischenlagerung von 6 - 58 Stunden gleichmäßig abkühlen und nachschrumpfen können, wonach
b1) das obere Deckelement (11) hergestellt wird, indem zwei gleichmäßig nachgeschrumpfte Werkstücke (2) in einer ersten Form erhitzt und geformt werden, die eine erste und eine zweite Halbform aufweist, welche Halbformen jeweils einen Gestaltungshohlraum aufweisen, welche zwei Gestaltungshohlräume zusammen eine negative Wiedergabe eines oberen Dekkelements (11) eines Lastenträgers (1) sind, wobei die Halbformen so angeordnet sind, dass ein Zwischenraum zwischen ihnen ausgebildet ist und dass die Hohlräume zueinander hin weisen, wonach die beiden erhitzten Werkstücke (2) in den Zwischenraum zwischen den beiden Hohlräumen platziert werden, wonach sie jeweils durch einen Hohlraum unter dem Einfluss von Vakuum und/oder Druck geformt werden, wobei anschließend die Halbformen zusammengepresst werden, während das thermoplastische Material noch heiß ist, so dass die beiden Werkstücke miteinander verschweißt werden und eine hohle Einheit bilden, wonach das thermoplastische Material etwas abkühlen kann, bevor die

Form geöffnet wird, das obere Dekkelement (11) entfernt wird und das Verfahren wiederholt werden kann, und dass

b2) das untere Deckelement (12) hergestellt wird, indem zwei weitere, ebenfalls gleichmäßig nachgeschrumpfte Werkstücke (2) erhitzt und geformt werden, welche nach dem Erhitzen in einer zweiten Form geformt werden, die eine erste und eine zweite Halbform aufweist, welche Halbformen zusammen einen Gestaltungshohlraum bilden, welche zwei Hohlräume zusammen eine negative Darstellung eines unteren Deckelements (12) eines Lastenträgers (1) sind, wobei die beiden erhitzten Werkstücke platziert, geformt, verschweißt und entfernt werden genau wie bei der Herstellung des oberen Dekkelements (11), und dass möglicherweise

b3) ein Hemmschuh (3') hergestellt wird, indem zwei der verlängerten Stangenabschnitte (3) in einer dritten Form erhitzt und dann geformt werden, die eine erste und eine zweite Halbform aufweist, welche Formhälften jeweils einen Gestaltungshohlraum aufweisen, welche zwei Hohlräume zusammen eine negative Darstellung eines Hemmschuhs (3') eines Lastenträgers (1) sind, wobei die beiden erhitzten Stangenabschnitte (3) platziert, geformt, verschweißt und entfernt werden genau wie bei der Herstellung der Deckelemente (11 bzw. 12), wonach

c) das obere und das untere Deckelement (11 bzw. 12) geeignet gleichmäßig abkühlen und nachschrumpfen können, nachdem sie aus der Form entfernt worden sind, und zwar durch eine Zwischenlagerung von 6 bis 24 Stunden, wonach

d) eine Anzahl von Verbindungsflächen (10) auf der unteren Seite des oberen Deckelements (11), auf der oberen und unteren Seite des unteren Deckelements (12) sowie auf der oberen Seite von zwei oder drei Stangenabschnitten (3) oder alternativ zwei oder drei Hemmschuhen (3'), welche in zumindest einem Schritt durch Infraroterhitzen, Lasern oder indem sie gegen einen erhitzten Schweißkern gepresst werden, erhitzt werden, wobei die unterschiedlichen Teile in zumindest einem Schritt zusammengepresst werden, so dass das geschmolzene thermoplastische Material in den unteren Verbindungsflächen (10) des oberen Eckelements (11) und an den oberen und unteren Verbindungsflächen (10) des unteren Deckelements (12) sowie den Verbindungsflächen (10) der Stangenabschnitte (3) oder der Hemmschuhe (3') schweißt oder schmelzverbindet, wobei das thermoplastische Material in den Verbindungsflächen sich zumindest teilweise abkühlen und verfestigen kann, bevor das Pressen nicht mehr fortgesetzt wird, wodurch ein verbundener, nicht verstärkter Lastenträger (1) aus thermoplastischem Material geschaffen wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** das thermoplastische Material durch ein Polymer mit einem durchschnittlichen Molekulargewicht im Bereich von 200.000 bis 2.000.000, vorzugsweise oberhalb von 300.000, gebildet wird.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Deckelemente (11 bzw. 12) mit hauptsächlich vertikalen Flächen und hauptsächlich horizontalen Flächen versehen sind, wobei die Verbindungsflächen (10) an horizontalen Flächen angeordnet sind, und dass vertikale Flächen angrenzend an diese Verbindungsflächen (10) angeordnet sind oder diese umhüllen.

4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** die Verbindungsflächen (10) eine Warendicke haben, die größer ist als die Warendicke der Abschnitte, die sich angrenzend an die Verbindungsflächen (10) befinden.

5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Stangenabschnitte (3), die in dem fertigen Lastenträger (1) als Hemmschuhe (3') dienen, massiv sind und dass diese Stangenabschnitte (3') nach dem Abkühlen und Nachschrumpfen, aber vor dem Verbinden, auf ihre gewünschten Abmessungen nachbearbeitet bzw. nachgefräst werden, wodurch ein unerwünschtes Querverziehen in dem fertigen Hemmschuh (3') vermieden werden kann.

6. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Stangenabschnitte (3), welche in dem fertigen Lastenträger (1) als Hemmschuhe (3') dienen, hohle extrudierte Profile sind und dass diese Stangenabschnitte (3), vorzugsweise nach dem Abkühlen, nachschrumpfen und möglicher Weise vor dem Verbinden, in beiden Enden mittels Stopfen abgedichtet werden oder dadurch, dass sie thermogeformt werden.

7. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** das obere Deckelement (11) und das untere Deckelement (12) jeweils aus einer oberen Schicht (11' bzw. 12') und einer unteren Schicht (11" bzw. 12") gebildet werden, welche oberen Schichten (11' bzw. 12') mit den jeweiligen unteren Schichten (11" bzw. 12") über Abstandsabschnitte (11"' bzw. 12"') verbunden sind, welche Abstandsabschnitte (11"' bzw. 12"') einen integralen Teil der jeweiligen Schicht (11', 11" bzw. 12', 12") bilden und in Verbindung zu dem Ausbilden der jeweiligen Schichten (11', 11" bzw. 12', 12") aus-

geformt sind.

8. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** der Hemmschuh (3') aus einer oberen und einer unteren Schicht besteht, welche obere Schicht mit der unteren Schicht über Abstandsabschnitte verbunden ist, welche Abstandsabschnitte einen integralen Bestandteil zumindest einer der Schichten bilden und in Verbindung mit dem Formen der jeweiligen Schichten ausgeformt sind.

9. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Reibungsbeschichtung nach dem Verbinden der unterschiedlichen Teile des Lastenträgers (1) durchgeführt wird, wodurch die Teile, die zumindest teilweise beschichtet werden, folgende sind: die obere Seite des oberen Deckelements (11), die unteren Teile der Stangenabschnitte (3) und ausgewählte Teile der unteren Seite des unteren Deckelements (12).

10. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Werkstücke (2) in Gestalt einer Materialbahn so orientiert sind, dass die Richtung der Extrusion zwischen den Schichten der oberen und unteren Deckelemente (11 bzw. 12) zusammenfällt.

11. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die verlängerten Stangenabschnitte oder Profile (3) so orientiert sind, dass die Richtung der Extrusion mit den unterschiedlichen Teilen zusammenfällt, aus denen der Lastenträger (1) gemacht ist.

Revendications

1. Procédé de fabrication d'un porteur de charge (1) non renforcé en matériau thermoplastique, lequel procédé comprend les étapes d'extrusion, de moulage sous vide et/ou de moulage soufflé de pièces (2) en des éléments de plate-forme inférieur et supérieur (respectivement 11 et 12) faits d'un matériau thermoplastique comme du polyéthylène, du polypropylène ou du polybutène, lesquels éléments de plate-forme (respectivement 11 et 12) peuvent refroidir et effectuer un post-retrait après qu'ils ont été soudés pour former un porteur de charge 1, **caractérisé en ce que**

   a, i) les pièces (2) sous la forme de feuilles sont réalisées au moyen d'une extrudeuse, lesquelles pièces (2) peuvent refroidir et effectuer un post-retrait uniformément après la fabrication, de manière convenable par un stockage intermédiaire de 6 à 48 heures, et **en ce que**

   a, ii) des sections en barre (3) allongées avec une section transversale de préférence rectangulaire ou polygonale sont fabriquées au moyen d'une extrudeuse, lesquels sections en barre (3) peuvent refroidir et effectuer un post-retrait uniformément après la fabrication, de manière convenable par un stockage intermédiaire de 6 à 48 heures, après quoi,

   b, i) l'élément de plate-forme supérieur (11) est fabriqué en chauffant et ensuite moulant deux pièces (2) ayant effectué un post-retrait uniforme dans un premier moule comprenant une première et une seconde moitié de moule, lesquelles moitiés de moule comprennent chacune une cavité de formage, lesquelles deux cavités de formage forment ensemble une représentation négative d'un élément de plate-forme supérieur (11) d'un porteur de charge (1), moyennant quoi les deux moitiés de moule sont agencées de telle manière qu'un espace intermédiaire est formé entre elles et que les cavités se font face l'une à l'autre, après quoi les deux pièces (2) chauffées sont placées dans l'espace intermédiaire entre les deux cavités après quoi elles sont moulées par une cavité chacune sous l'influence du vide et/ou de la pression, après quoi les moitiés de moule sont pressées ensemble alors que le matériau thermoplastique est encore chaud de telle manière que les deux pièces sont soudées l'une à l'autre et forment une unité creuse, après quoi le matériau thermoplastique peut refroidir un peu avant que le moule soit ouvert, l'élément de plate-forme supérieur 11 est enlevé est le procédé peut être répété, et **en ce que**,

   b, ii) l'élément de plate-forme inférieur (12) est fabriqué en chauffant et ensuite moulant deux autres pièces (2) ayant aussi effectué un post-retrait uniforme, qui après chauffage sont formées dans un second moule comprenant une première et une seconde moitié de moule, lesquelles moitiés de moule comprennent chacune une cavité de formage, lesquelles deux cavités sont ensemble une représentation négative d'un élément de plate-forme inférieur (12) d'un porteur de charge 1, moyennant quoi les deux pièces chauffées sont placées, moulées, soudées et enlevées d'une manière similaire à la fabrication de l'élément de plate-forme supérieur (11), et peut-être **en ce que**,

   b, iii) un patin (3') est fabriqué en chauffant et ensuite formant deux des sections en barre (3) dans un troisième moule comprenant une première et une seconde moitié de moule, lesquelles moitiés de moule comprennent chacune une cavité de formage, lesquelles deux cavités de formage sont ensemble une représentation négative d'un patin (3') d'un porteur de charge (1),

moyennant quoi les deux sections en barre (3) chauffées sont placées, moulées, soudées et enlevées d'une manière similaire à la fabrication des éléments de plate-forme (respectivement 11 et 12), après quoi,

c) les éléments de plate-forme inférieur et supérieur (respectivement 11 et 12) peuvent refroidir et effectuer un post-retrait uniformément, après avoir été enlevés du moule, de manière convenable par un stockage intermédiaire de 6 à 48 heures, après quoi,

d) un certain nombre de surfaces de jonction (10) sur le côté inférieur de l'élément de plate-forme supérieur (11), sur les côtés inférieur et supérieur de l'élément de plate-forme inférieur (12) et sur le côté supérieur de deux des trois sections en barre (3) ou en variante de deux ou trois des patins (3'), qui, en une ou plusieurs étapes, sont chauffées au moyen d'un chauffage infrarouge, laser ou en étant pressé contre un noyau de soudure chauffé, moyennant quoi les différentes parties, en une ou plusieurs étapes, sont pressées ensemble de telle manière que le matériau thermoplastique dans les surfaces de jonction (10) de l'élément de plate-forme supérieur (11) et sur les surfaces de jonction (10) de l'élément de plate-forme inférieur (12) ainsi que les surfaces de jonction (10) des sections en barre (3) ou des patins (3') se joignent par soudure ou par fusion, moyennant quoi, le matériau thermoplastique dans les surfaces de jonction peut refroidir et se solidifier au moins en partie avant que le pressage soit arrêté, moyennant quoi, un porteur de charge (1) non renforcé en matériau thermoplastique est obtenu.

2. Procédé selon la revendication 1, **caractérisé en ce que** le matériau thermoplastique est constitué d'un polymère ayant un poids moléculaire compris entre 200 000 et 2 000 000 de préférence plus grand que 300 000.

3. Procédé selon la revendication 1 ou 2, **caractérisé en ce que** les éléments de plate-forme (respectivement 11 et 12) sont pourvus de surfaces principalement verticales et de surfaces principalement horizontales, moyennant quoi les surfaces de jonction (10) sont agencées sur des surfaces horizontales et **en ce que** les surfaces verticales sont agencées adjacentes à, ou enveloppent lesdites surfaces de jonction (10).

4. Procédé selon la revendication 3, **caractérisé en ce que** les surfaces de jonction (10) ont une épaisseur qui est supérieure à l'épaisseur des sections situées adjacentes aux surfaces de jonction (10).

5. Procédé selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** les sections en barre (3), qui dans le porteur de charge (1) terminé servent de patins (3'), sont massives et **en ce que** les sections en barre (3) après refroidissement et post-retrait, mais avant jonction, sont meulées à la dimension souhaitée, moyennant quoi des gauchissements non souhaités dans le patin (3') fini sont évités.

6. Procédé selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** les sections en barre (3), qui dans le porteur de charge (1) terminé servent de patins (3'), sont des profilés creux extrudés et **en ce que** les sections en barre (3), de préférence après refroidissement, post-retrait, et si possible avant jonction, sont fermées aux deux extrémités au moyen de pinces ou en étant thermoformées.

7. Procédé selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** l'élément de plate-forme supérieur (11) et l'élément de plate-forme inférieur (12) sont chacun constitués d'une couche supérieure (respectivement 11' et 12') et d'une couche inférieure (respectivement 11" et 12") lesquelles couches supérieures (respectivement 11' et 12') sont connectées avec leur couche inférieure respective (respectivement 11" et 12") par l'intermédiaire de sections d'écartement (respectivement 11"' et 12"') lesquelles sections d'écartement (respectivement 11"' et 12"') constitue une partie intégrante de la couche respective (respectivement 11', 11", et 12', 12") et sont moulées en liaison avec le moulage des couches respectives (respectivement 11', 11", et 12', 12").

8. Procédé selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** le patin (3') est constitué d'une couche inférieure et d'une couche supérieure, laquelle couche supérieure est connectée avec la couche inférieure par l'intermédiaire de sections d'écartement, lesquelles sections d'écartement constituent une partie intégrante d'une ou deux des couches et sont moulées en liaison avec le moulage des couches respectives.

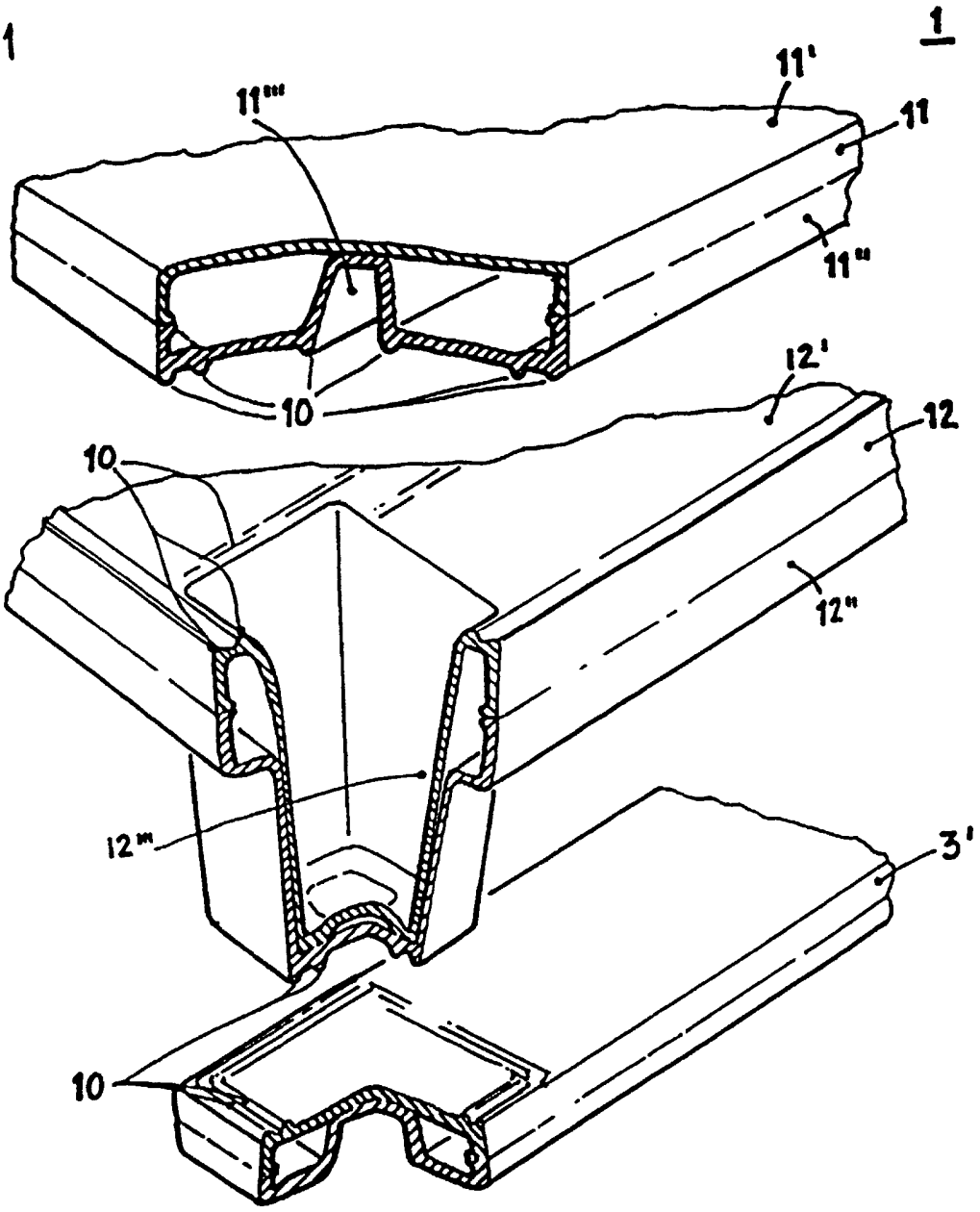
9. Procédé selon la revendication 1, **caractérisé en ce que** le revêtement de frottement est réalisé après la jonction des différentes parties du porteur de charge (1), moyennant quoi les parties complètement ou en partie recouvertes sont : les parties inférieures des sections en barre (3) et des parties choisies du côté inférieur de l'élément de plate-forme inférieur (12).

10. Procédé selon la revendication 1, **caractérisé en ce que** les pièces (2) en forme de feuille sont orientées de telle manière que la direction de l'extrusion coïncide entre les couches des éléments de plate-

forme inférieur et supérieur (respectivement 11 et 12).

11. Procédé selon la revendication 1, **caractérisé en ce que** les sections en barre ou profilés (3) allongés sont orientés de telle manière que la direction d'extrusion coïncide avec les différentes parties dont sont faites le porteur de charge (1).

Fig. 1



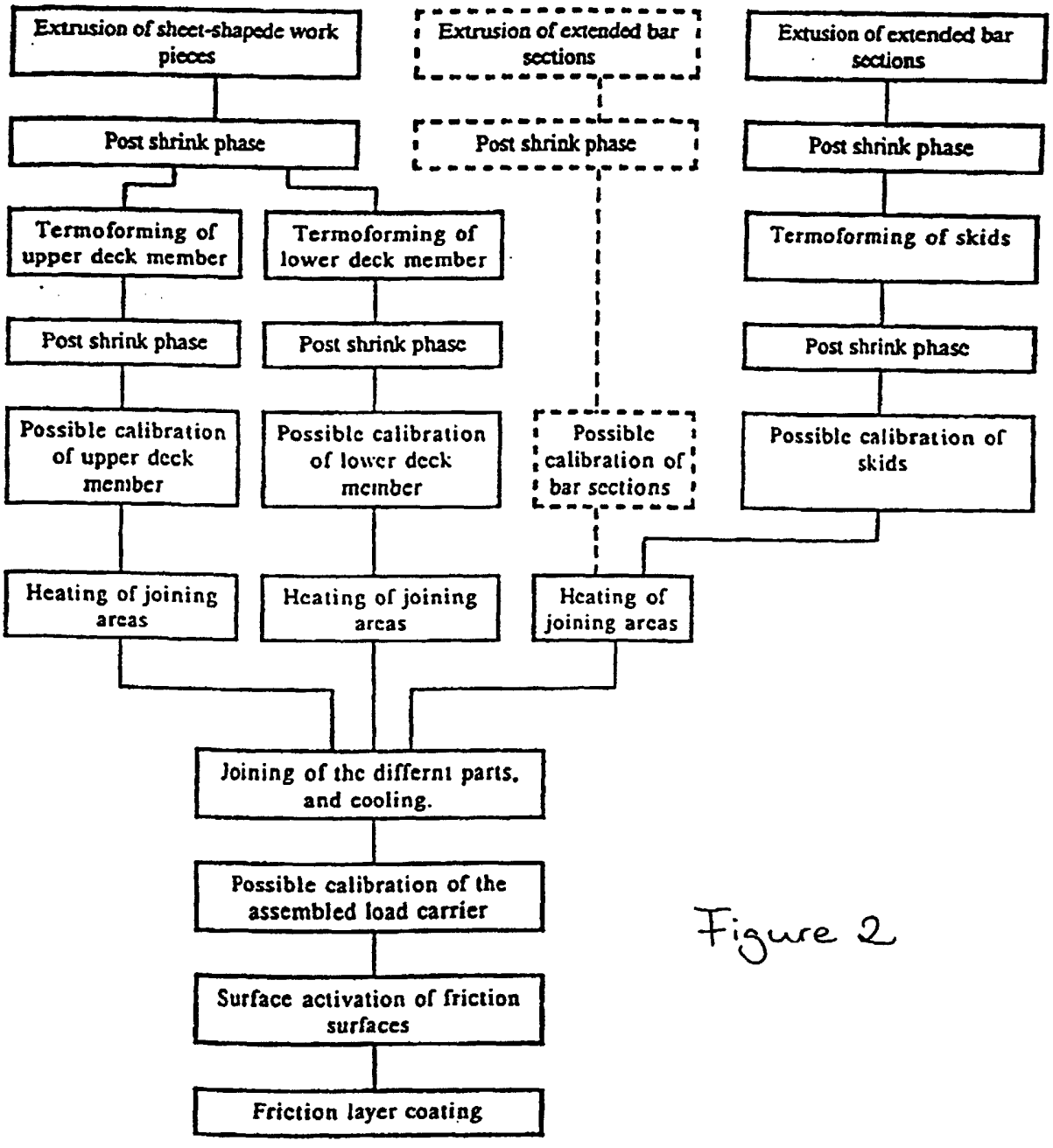

Extrusion of sheet-shapede work pieces
Extrusion of extended bar sections
Extusion of extended bar sections
Post shrink phase
Post shrink phase
Post shrink phase
Termoforming of upper deck member
Termoforming of lower deck member
Termoforming of skids
Post shrink phase
Post shrink phase
Post shrink phase
Possible calibration of upper deck member
Possible calibration of lower deck member
Possible calibration of bar sections
Possible calibration of skids
Heating of joining areas
Heating of joining areas
Heating of joining areas
Joining of the differnt parts, and cooling.
Possible calibration of the assembled load carrier
Surface activation of friction surfaces
Friction layer coating

Figure 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- SE 508870 **[0005] [0005]**
- SE 508874 **[0005] [0005]**