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(54) **METHOD AND APPARATUS FOR SHRINKING A HEAT-SHRINK FILM APPLIED AROUND AN, IN PARTICULAR PALLETIZED, GOODS STACK**

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(57) **ABSTRACT**

The invention relates to a shrinking a heat-shrink film around palletized goods. The heat-shrink film projects beyond the top edge of the goods stack. Firstly the heat-shrink film is shrunk in the region of a first lateral surface sub-region of the four lateral surface sub-regions of the goods stack. The shrinkage direction is from bottom to top and then the shrinkage direction is changed 90°. In a further step

either, the shrinkage direction is changed a further 90°, the heat-shrink film is shrunk from top to bottom in the region of that lateral surface sub-region of the goods stack,

or, the shrinkage direction is changed a further 90°, and the heat-shrink film is preheated from top to bottom in the region of that lateral surface sub-region which is located oppositely from the first lateral surface sub-region, and is then shrunk in the opposite direction from bottom to top.

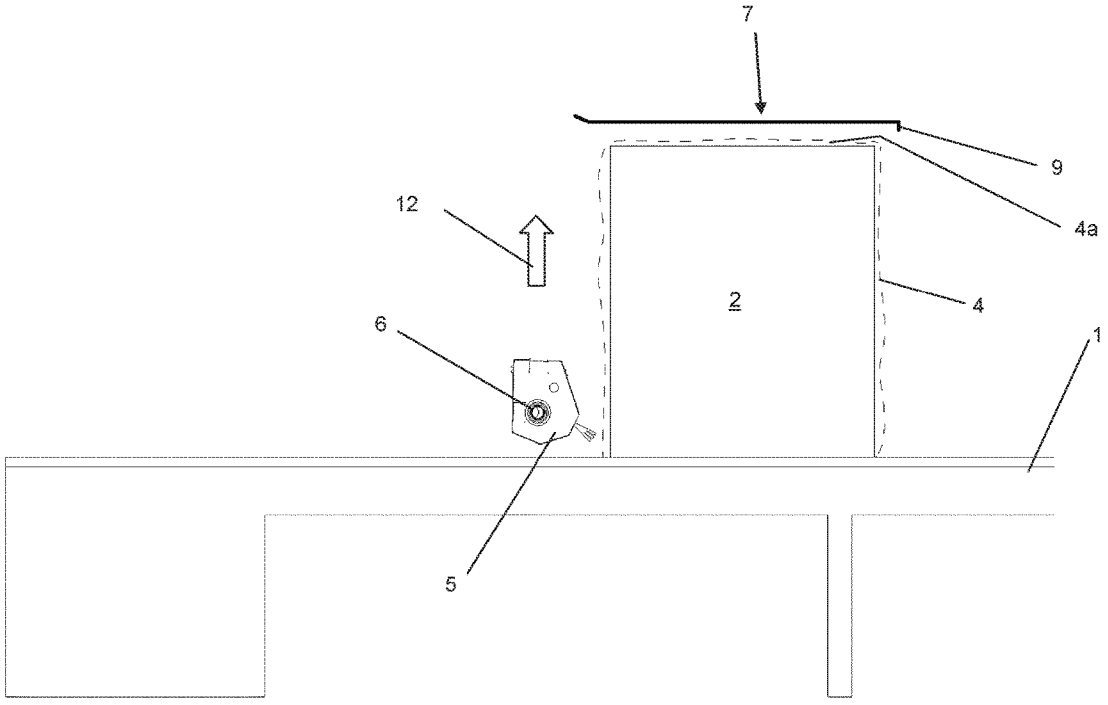
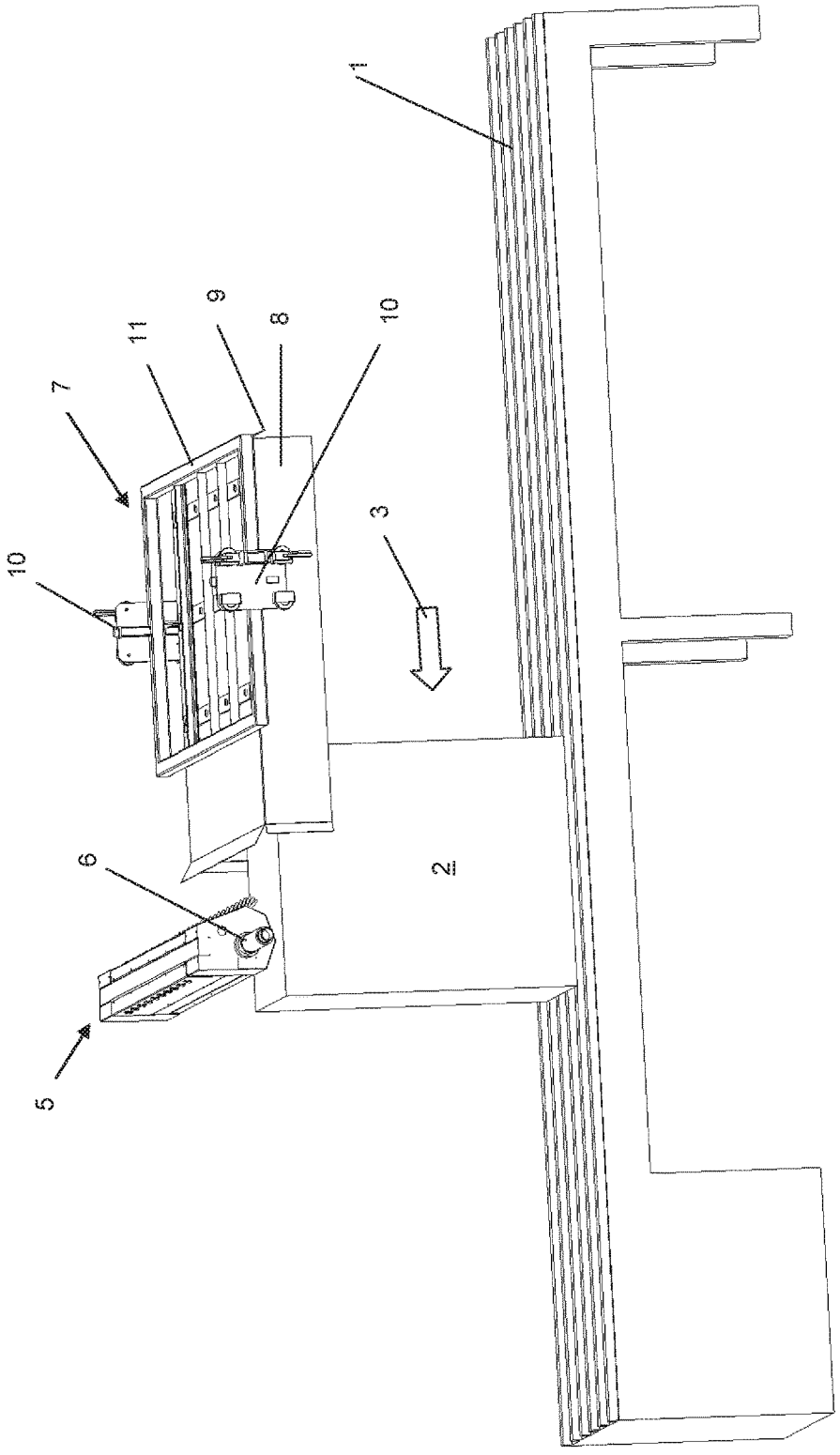


Fig. 1



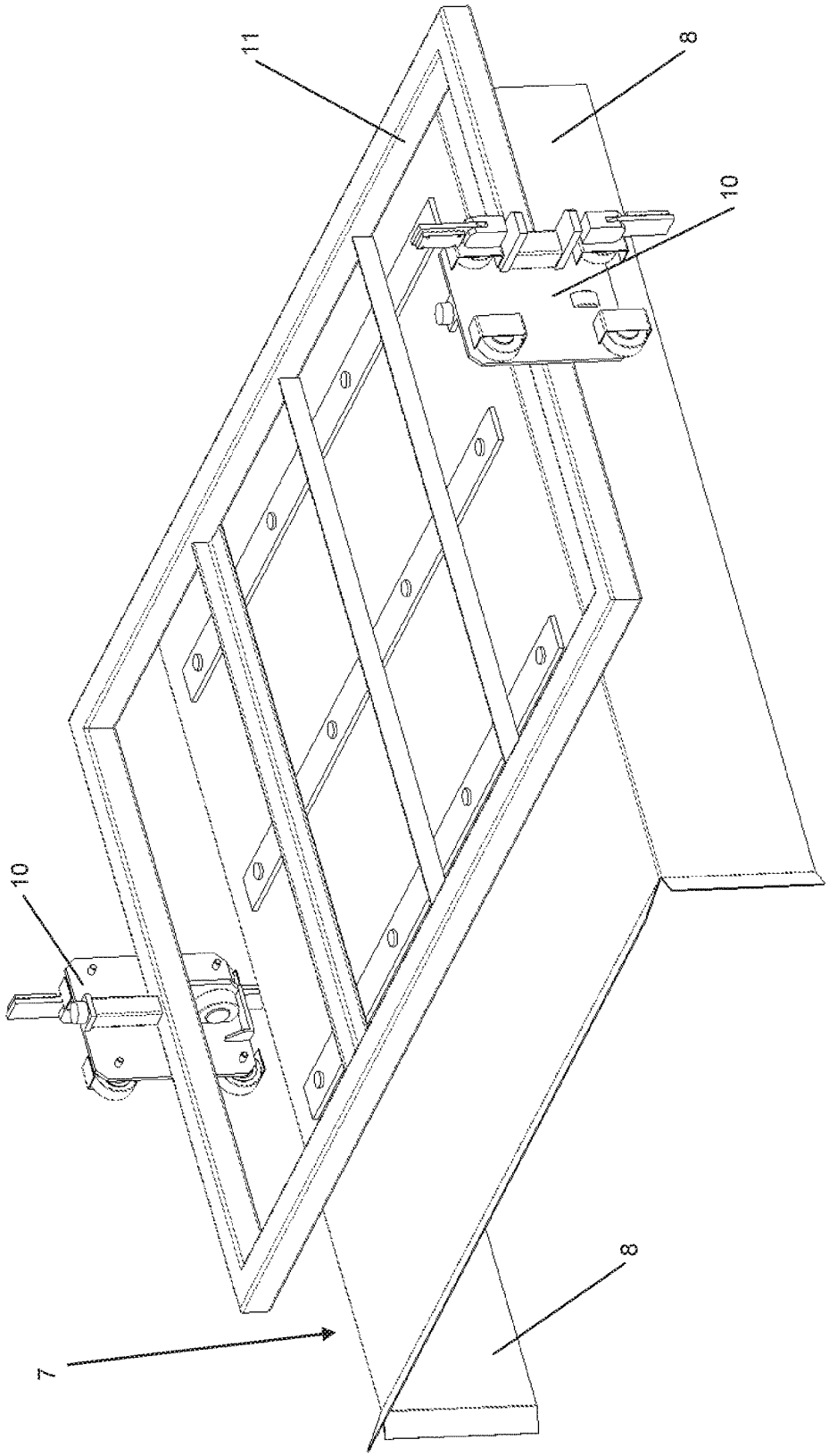


Fig. 2

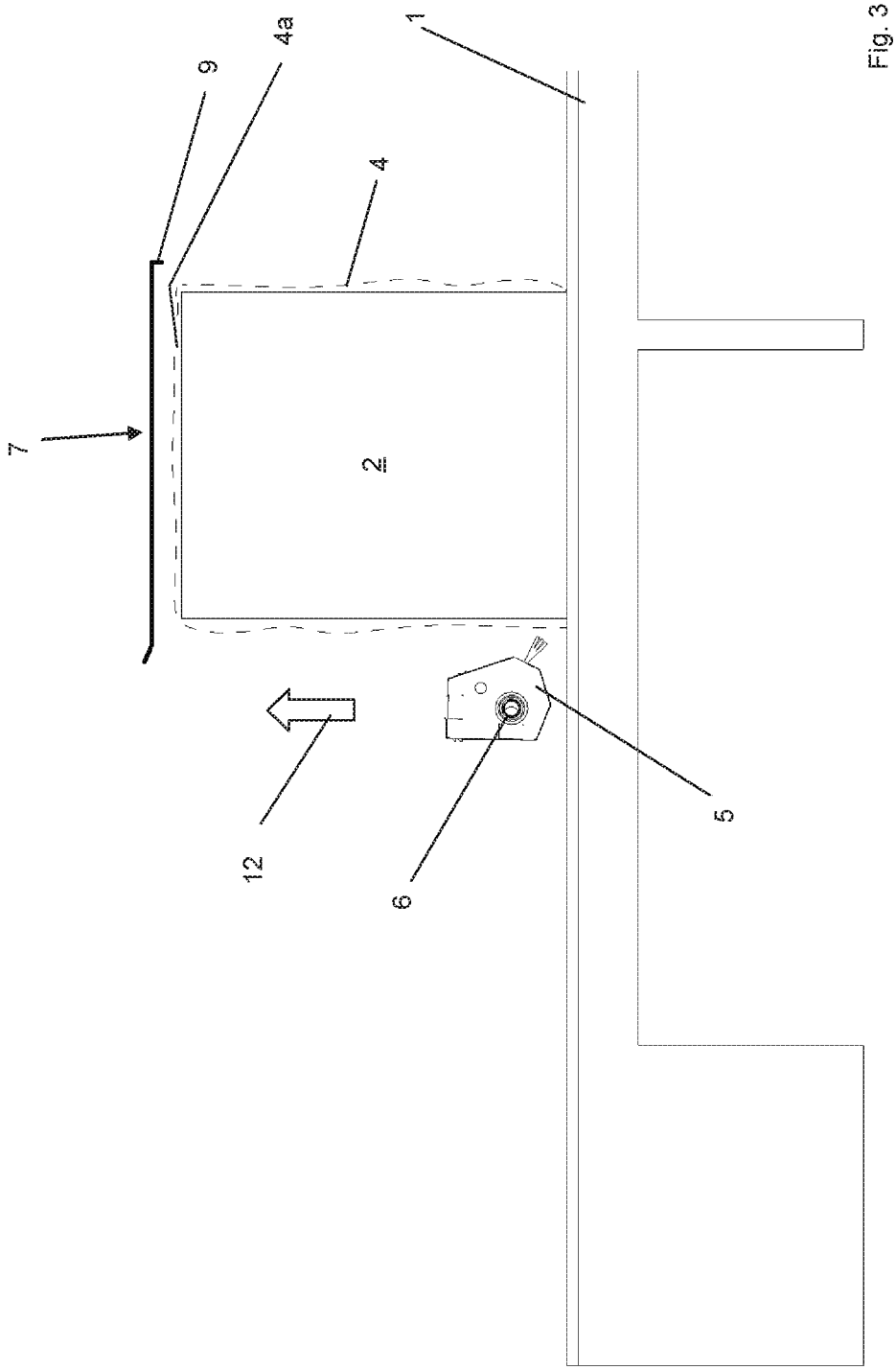


Fig. 3

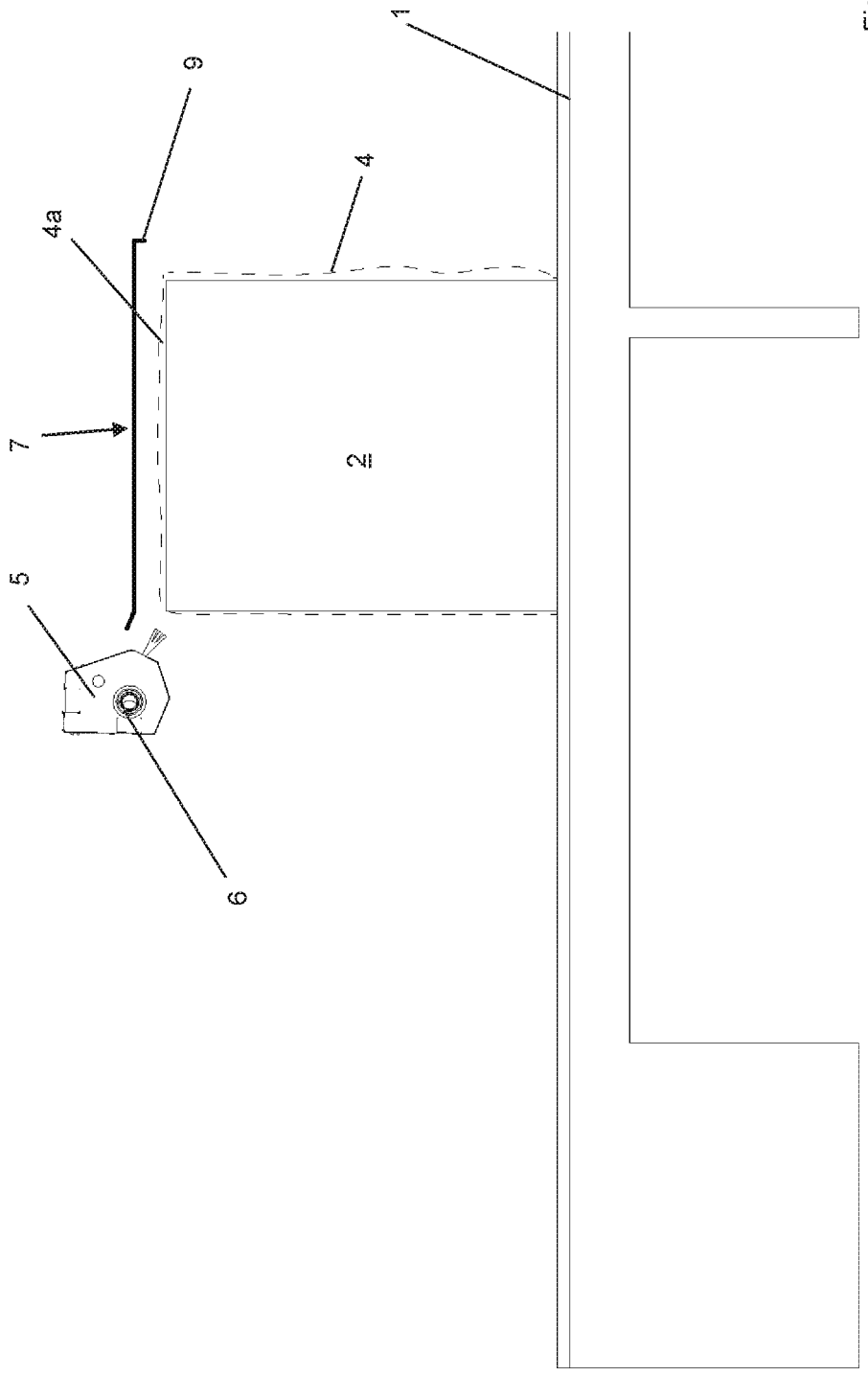


Fig. 4

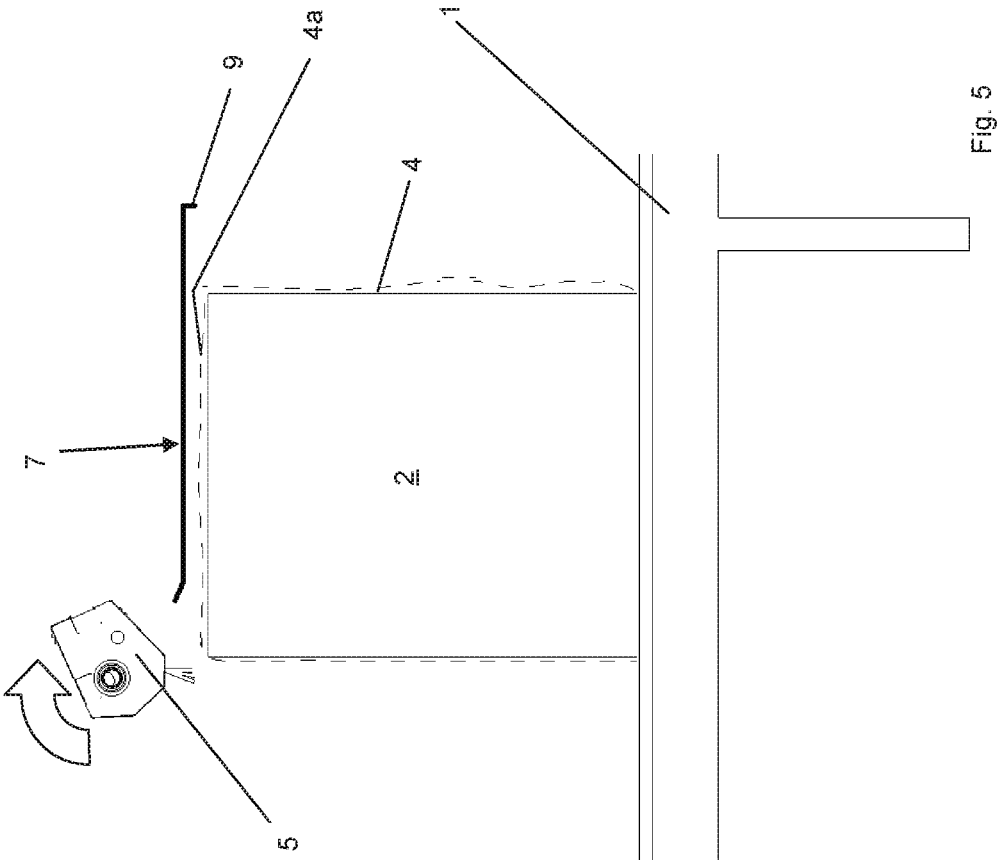


Fig. 5

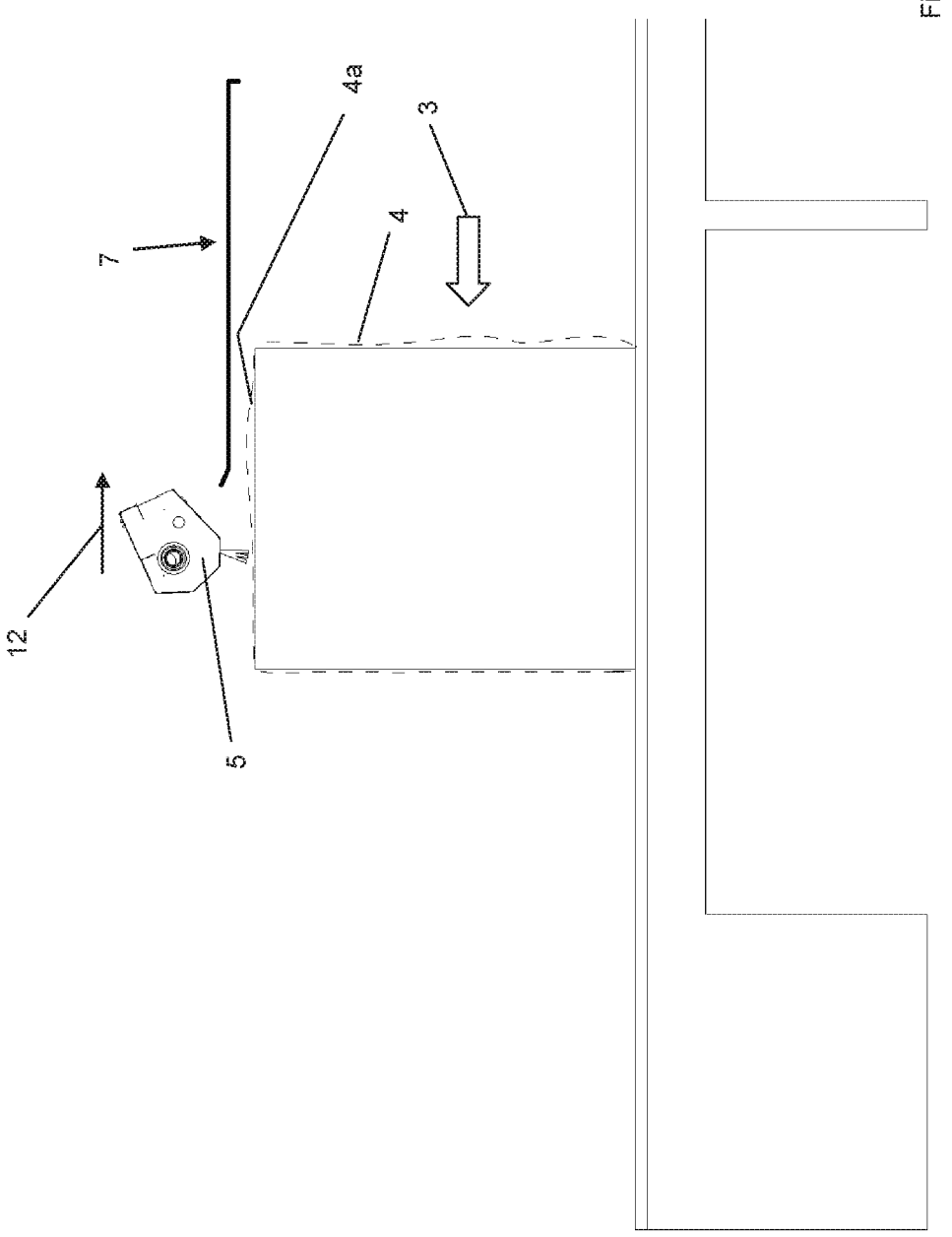


Fig. 6

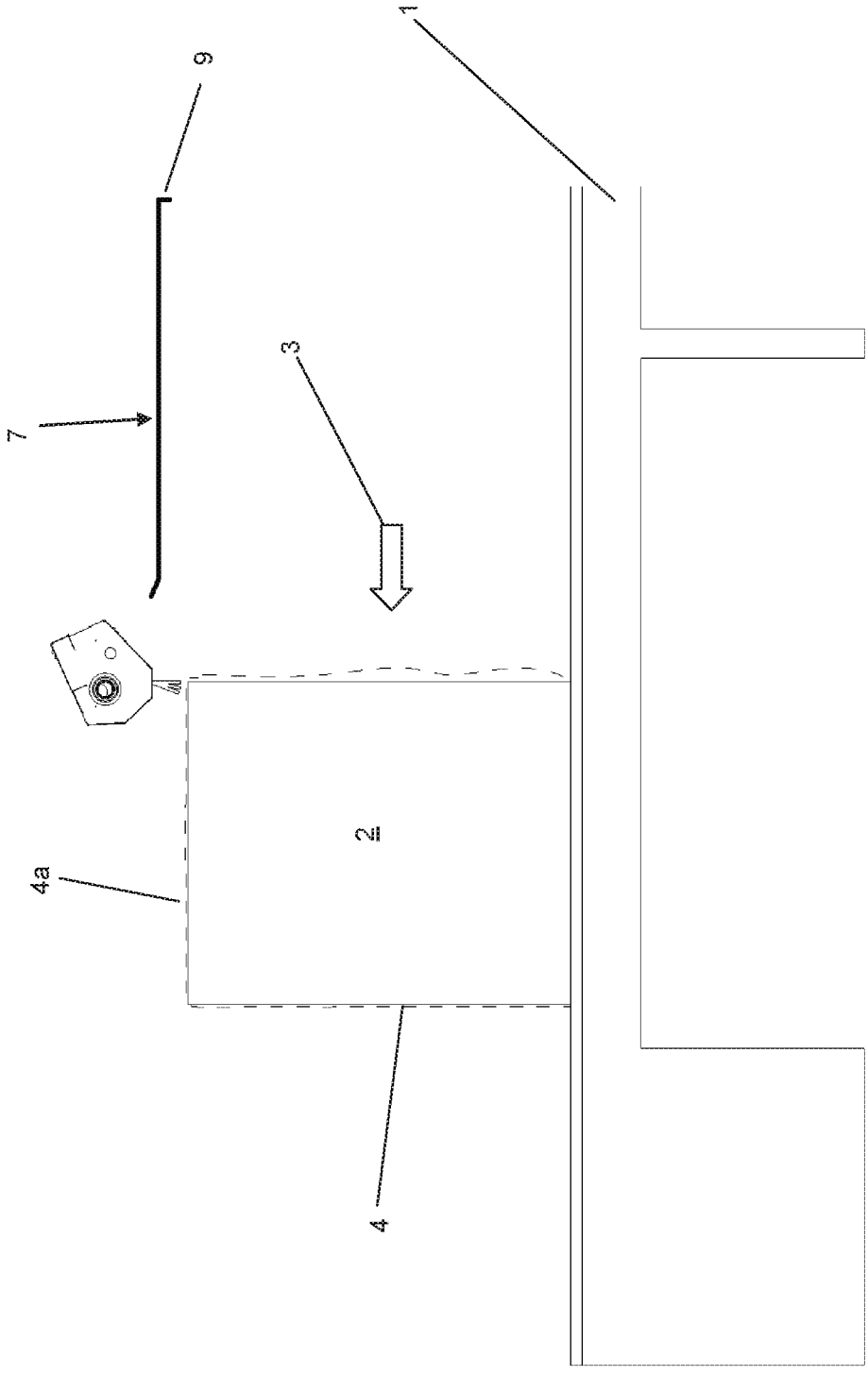


Fig. 7

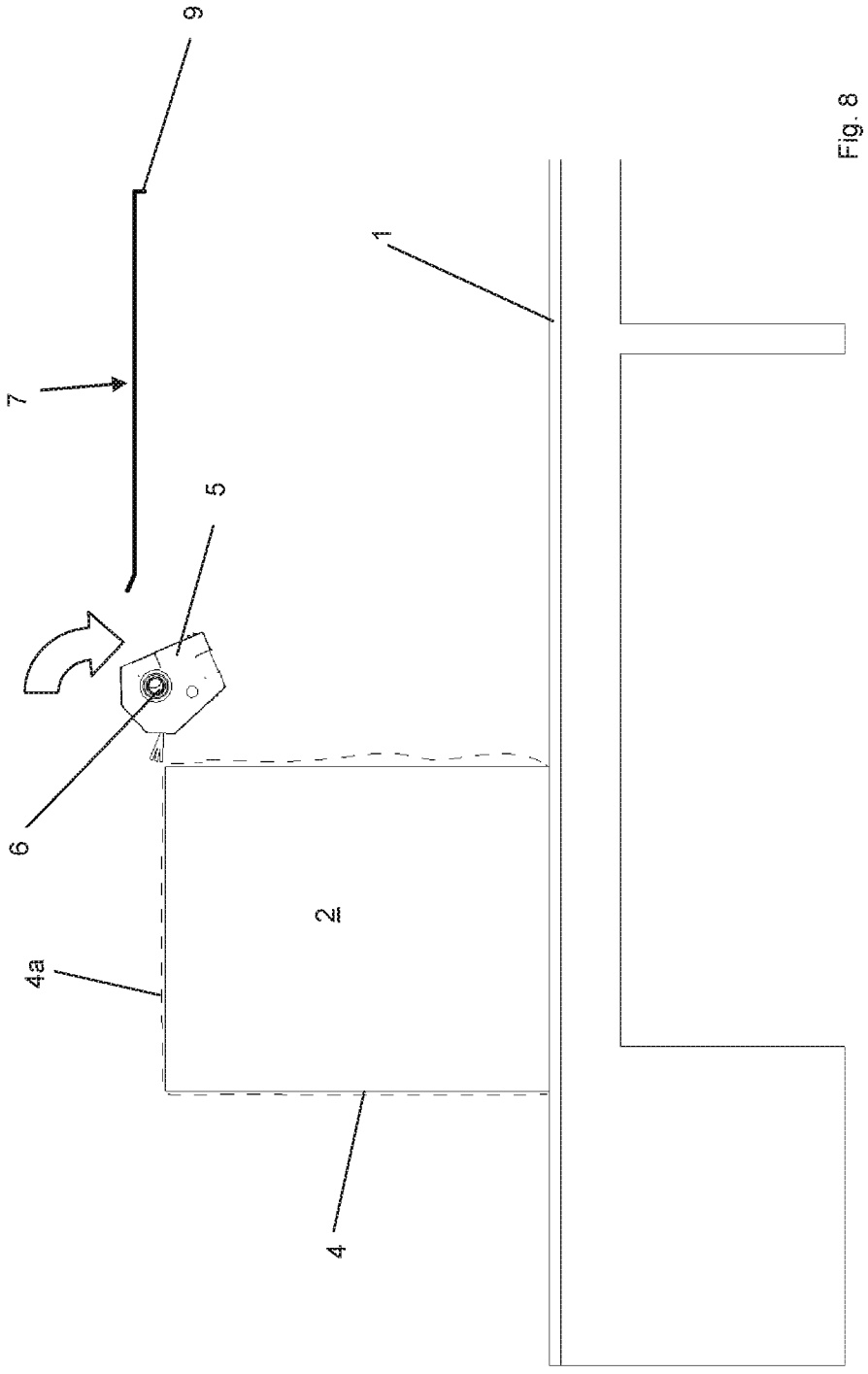


Fig. 8

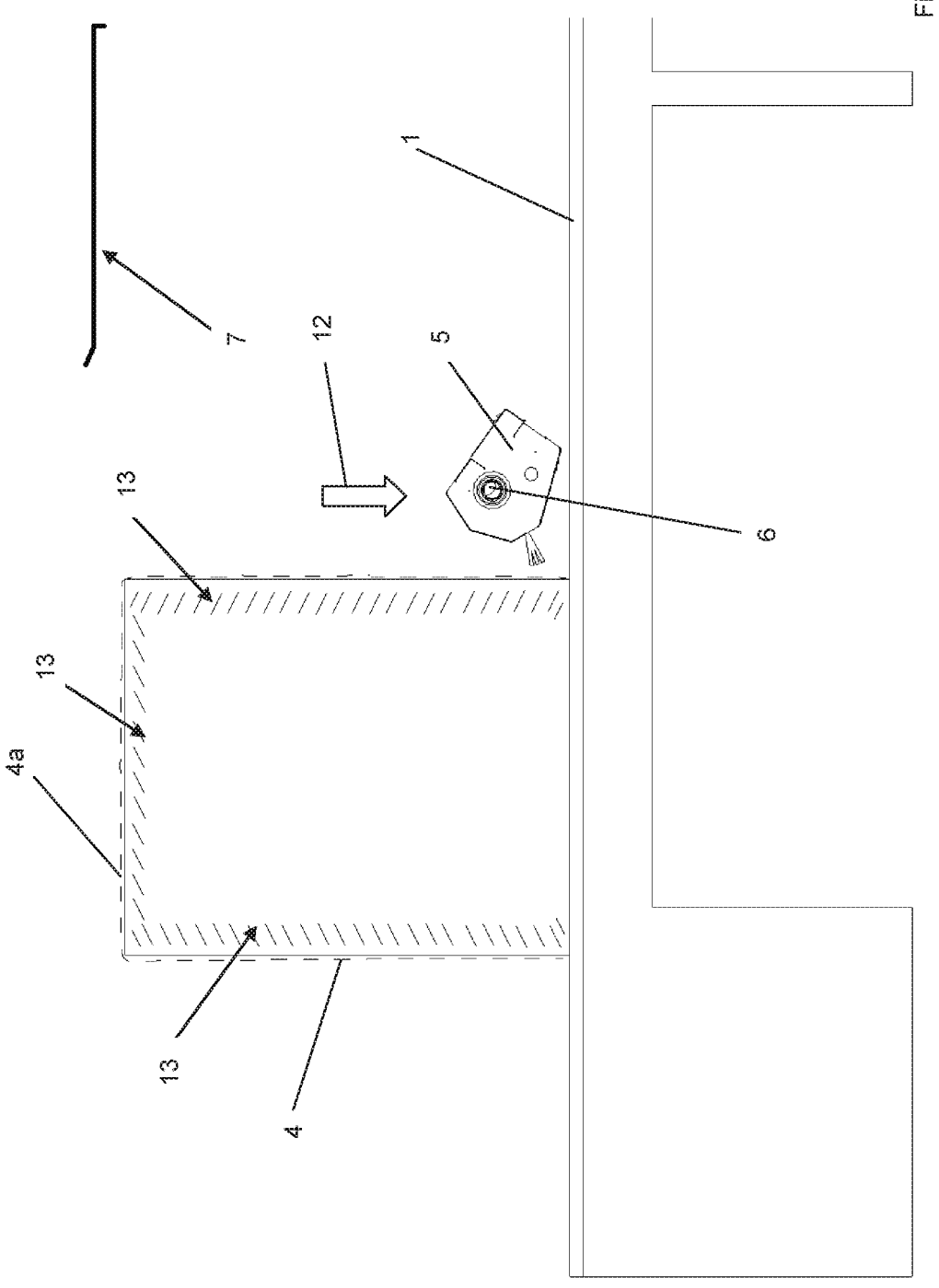


Fig. 9

METHOD AND APPARATUS FOR SHRINKING A HEAT-SHRINK FILM APPLIED AROUND AN, IN PARTICULAR PALLETIZED, GOODS STACK

CROSS-REFERENCE TO RELATED APPLICATIONS AND CLAIM TO PRIORITY

[0001] This application is related to application No. 16000486.7, filed Mar. 1, 2016 in the European Patent Office, the disclosure of which is incorporated herein by reference and to which priority is claimed.

FIELD OF THE INVENTION

[0002] The invention relates to a method for shrinking a heat-shrink film applied around an, in particular palletized, goods stack that comprises a bottom surface, a cover surface, and a circumferential lateral surface that is made up of four lateral surface sub-regions, with at least one heating device for shrinking the heat-shrink film by heating, the heat-shrink film covering the lateral surface of the goods stack at least in its top region, preferably the entire height of the lateral surface, and the heat-shrink film projecting at the top, at least with a heat-shrink film sub-region, beyond the top edge of the goods stack for formation of a top shrink. The heat-shrink film sub-region thus forms a circumferential protrusion. The heat-shrink film can of course also project at the bottom, at least with a heat-shrink film sub-region, beyond the bottom edge of the goods stack or beyond the bottom edge of a pallet on which the goods stack is placed, for formation of a bottom shrink.

BACKGROUND OF THE INVENTION

[0003] A goods stack usually has a cuboidal conformation. A pallet usually has a rectangular contour made up of two oppositely located long sides and two oppositely located short sides. A heat-shrink film in the form of a heat-shrink film wrapper is usually applied around a goods stack, the heat-shrink film wrapper projecting at the top, with a circumferential heat-shrink film sub-region, beyond the top edge of the goods stack for formation of a top shrink. In addition, a cover sheet film is located on the cover surface of the goods stack. The heat-shrink film sub-region is firstly folded over so that it rests in substantially planar fashion on the cover film. This can be accomplished in a separate machine. In addition, the heat-shrink film sub-region can have been fastened, for example in the region of at least one corner, by spot heat-sealing, so that the as-yet unshrunk heat-shrink film wrapper does not slide downward when the goods stack is transported. Local heat-sealing of this kind in the region of the top side in order to prevent downward sliding can also be accomplished by way of a horizontally oriented and vertically movable heat-sealing bar. The four lateral surface sub-regions of the heat-shrink film wrapper are then shrunk by the fact that the goods stack is moved through two vertically oriented heating devices.

[0004] It is disadvantageous in this context that as shrinking and subsequent cooling occur, the heat-shrink film wrapper contracts not only in a longitudinal direction but also in a transverse direction. This results in formation of a half-moon in particular in the region of the long sides of a goods stack, since the heat-shrink film wrapper pulls upward here because of the transverse shrinkage.

[0005] The object of the invention is to eliminate the aforesaid disadvantages and to describe a method in which half-moon formation can be avoided so that the goods stack is effectively protected by the heat-shrink film and, if it is arranged on a pallet, is optimally secured on the pallet.

SUMMARY OF THE INVENTION

[0006] This object is achieved by the fact that firstly the heat-shrink film is shrunk in the region of a first lateral surface sub-region of the four lateral surface sub-regions of the goods stack, the shrinkage direction being from bottom to top; then, the shrinkage direction being changed approximately 90°, that heat-shrink film sub-region of the heat-shrink film which projects at the top beyond the top edge of the goods stack is shrunk, beginning from the top edge of the first lateral surface sub-region along the cover surface to the top edge of that lateral surface sub-region which is located oppositely from the first lateral surface sub-region; and in a further step

[0007] either, the shrinkage direction being changed approximately a further 90°, the heat-shrink film is shrunk from top to bottom in the region of that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region,

[0008] or, the shrinkage direction being changed approximately a further 90°, the heat-shrink film is preheated from top to bottom in the region of that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region, and is then shrunk in the opposite direction from bottom to top.

[0009] "The shrinkage direction being changed approximately 90°" means in each case a change of from 70° to 110°. If the first change is greater than 90°, the second change is preferably selected so that in total, a change of approximately 180° occurs as a result of these two changes.

[0010] The shrinkage direction in the context of shrinkage of a first of the four lateral surface sub-regions, and the shrinkage direction in the context of shrinkage of that lateral surface sub-region which is located oppositely to the first lateral surface sub-region, are thus oppositely directed if that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region is shrunk from top to bottom in the further step.

[0011] If that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region is shrunk from bottom to top in the further step, the shrinkage direction in the context of shrinkage of the first lateral surface sub-region and of that lateral surface sub-region which is located oppositely from the first lateral surface sub-region is identical.

[0012] In the further step, the shrinkage direction being changed a further 90°, the heat-shrink film is shrunk directly from top to bottom in the region of that lateral sub-region of the goods stack which is located oppositely from the first lateral surface sub-region. Alternatively, the shrinkage direction being changed a further 90°, the heat-shrink film is firstly preheated from top to bottom in the region of that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region, and is then shrunk in the opposite direction from bottom to top.

[0013] A heating device that is configured in oblong fashion and is oriented horizontally and parallel to the first of the four lateral surface sub-regions, the lengthwise dimension of the heating device extending at least approximately

over the width of the goods stack, can be used, for example, for heat impingement. The heating device is preferably arranged vertically adjustably, and preferably is mounted pivotably around an axis oriented parallel to its lengthwise dimension. In the context of shrinkage, the heating device is oriented so that the hot air is directed, preferably directly, onto the lateral surface sub-region to be shrunk or onto the heat-shrink film sub-region to be shrunk. If only one heating device is used in the entire shrinking process, the discharge direction of the hot air must be modified in the context of shrinkage.

[0014] The method according to the present invention allows the heat-shrink film also to be tensioned in the two oppositely located lateral surface sub-regions that are oriented orthogonally to the first of the four lateral surface sub-regions and to the oppositely located lateral surface sub-region, with no pulling up in those two unshrunk lateral surface sub-regions at least in the center region of the bottom edge of the goods stack or of an optional pallet. Formation of the undesired half-moons therefore does not occur. Tensioning also does not cause any creases, so that these two oppositely located lateral surface sub-regions can be optimally used, for example, for advertising purposes or for other imprints. The two oppositely located unshrunk lateral surface sub-regions are preferably the long sides in the context of a rectangular goods stack. In addition, energy can be saved because not all of the lateral surface sub-regions are, as in the existing art, completely shrunk.

[0015] With the method according to the present invention, the first lateral surface sub-region and that lateral surface sub-region which is located oppositely from the first lateral surface sub-region are completely shrunk. That circumferential heat-shrink film sub-region of the heat-shrink film which projects at the top beyond the top edge of the goods stack is also completely shrunk. The result is that according to the present invention, the two oppositely located lateral surface sub-regions are heated, and if applicable slightly shrunk, either not at all or at most in their marginal regions that adjoin the shrunk first lateral surface sub-region or adjoin the shrunk oppositely located lateral surface sub-region or adjoin the cover surface.

[0016] It is useful if the heat-shrink film used is one that exhibits, in the state applied around the goods stack, a maximum shrinkage coefficient parallel to the circumferential direction of the goods stack which preferably is greater than 70%, while the shrinkage coefficient viewed parallel to the height of the goods stack is as low as possible, preferably less than 10%. The shrinkage coefficient indicates the percentage shortening of the heat-shrink film as a consequence of shrinking.

[0017] The goods stack can be stationary during shrinking, and at least one, preferably vertically adjustable, heating device can be guided along the goods stack. A gantry of frame-like configuration can be provided for this purpose, for example, adjacently to the goods stack, on which gantry the relevant heating device is guided, for example, by means of a carriage.

[0018] Alternatively, in the context of shrinkage the goods stack can be moved in a conveying direction by means of a conveying device whose conveying speed is preferably regulatable, the first of the four lateral surface sub-regions of the goods stack facing in the conveying direction; and at least one heating device can be arranged pivotably around an axis oriented parallel to its lengthwise dimension but in stationary fashion in relation to the conveying direction. Such a configuration allows shrinking using a continuous process.

[0019] In the context of the relative displacement between the goods stack and at least one, preferably vertically adjustable, heating device in the context of shrinkage, a narrow marginal region of the heat-shrink film on at least one of the two lateral surface sub-regions oriented parallel to the shrinkage direction during shrinking of the cover surface, which region adjoins the edge to the first lateral surface sub-region of the goods stack (vertically oriented lateral edge with respect to the first lateral surface sub-region) and/or adjoins the edge to the top side of the goods stack (horizontally oriented top edge of the lateral surface sub-region) and/or adjoins the edge to that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region (vertically oriented lateral edge to the oppositely located lateral surface sub-region) can additionally be shrunk. When a lateral surface sub-region oriented parallel to the shrinkage direction during shrinking of the cover surface is shrunk in the three marginal regions (edge to the first lateral surface sub-region of the goods stack, and edge to the top side of the goods stack, and edge to that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region), the shrunk region of the lateral surface sub-region oriented parallel to the shrinkage direction during shrinking of the cover surface produces an upside-down "U." Load security is thereby enhanced. The remaining area of this lateral surface sub-region remains unshrunk.

[0020] The heat-shrink film can be embodied as a heat-shrink film wrapper. A heat-shrink film wrapper has no cover and also no bottom. The heat-shrink film wrapper can project at the bottom with respect to the underside of the, in particular palletized, goods stack. It is useful in such a case if the, in particular palletized, goods stack is lifted in the context of shrinking so that the downwardly projecting margin of the heat-shrink film wrapper can be shrunk for formation of a bottom shrink.

[0021] A cover sheet film, preferably projecting beyond at least one lateral edge of the cover surface of the goods stack, can be arranged on the top side of the goods stack, which film is heat-sealed to that heat-shrink film sub-region of the heat-shrink film, embodied as a heat-shrink film wrapper, which projects beyond the top edge of the goods stack. If the heat-shrink film sub-region projecting beyond the top edge of the goods stack is heat-sealed to the cover sheet film over the entire length, i.e. in circumferential fashion, the goods stack is water-tight from the top. Upon application of the heat-shrink film sub-region of the heat-shrink film wrapper, which can also be accomplished in an upstream apparatus, a foldover onto the top side occurs if the cover sheet film exhibits a laterally projecting marginal region.

[0022] Simultaneously with or after shrinking of that heat-shrink film sub-region of the heat-shrink film which projects at the top beyond the top edge of the goods stack, and heat-sealing of the cover sheet film to the heat-shrink film sub-region of the heat-shrink film wrapper, the cover sheet film can also be at least partly shrunk in the region that is not in contact with the heat-shrink film sub-region applied as a consequence of shrinking.

[0023] Alternatively, the heat-shrink film can also be embodied as a heat-shrink film hood pulled over the goods stack. The heat-shrink film hood can project at the bottom

with respect to the underside of the, in particular palletized, goods stack. It is useful in such a case if the, in particular palletized, goods stack is lifted in the context of shrinking so that the downwardly projecting margin of the heat-shrink film hood can be shrunk for formation of a bottom shrink.

[0024] At least during shrinking of the first of the four lateral surface sub-regions, the goods stack can be at least partly, preferably completely, covered at the top by a planar thermal conduction and/or thermal reflection device arranged above the goods stack at a distance from the cover surface and oriented parallel thereto. The thermal conduction and/or thermal reflection device can be embodied, for example, as a heat accumulation panel. If good reflection is desired, a thermal conduction and/or thermal reflection device embodied, for example, as a mirror panel can be provided. The hot air that rises in the context of shrinkage of the first of the four lateral surface sub-regions is directed into the gap between the cover surface of the goods stack and the thermal conduction and/or thermal reflection device, flows through the gap, and in that context preheats at least that heat-shrink film sub-region of the heat-shrink film which projects at the top beyond the top edge of the goods stack.

[0025] At least during shrinking of the cover surface, the goods stack can be at least partly, preferably completely, covered at the top by a planar thermal conduction and/or thermal reflection device arranged above the goods stack at a distance from the cover surface and oriented parallel thereto. The thermal conduction and/or thermal reflection device can be embodied, for example, as a heat accumulation panel. If good reflection is desired, a thermal conduction and/or thermal reflection device embodied, for example, as a mirror panel can be provided. The hot air used in the context of shrinkage of the cover surface can flow into the gap between the cover surface of the goods stack and the thermal conduction and/or thermal reflection device and, as a result of accumulation of the hot air and/or reflection of heat toward the goods stack, preheats at least that heat-shrink film sub-region of the heat-shrink film which projects at the top beyond the top edge of the goods stack and is not yet shrunk.

[0026] It is of course also possible for the heat-shrink film to be preheated in the region of the first lateral surface sub-region, preferably from top to bottom, prior to shrinking. A procedure of this kind is useful in particular when the oppositely located lateral surface sub-region of the goods stack, shrinkage of which has just been completed, has been preheated from top to bottom and then shrunk in the opposite direction from bottom to top, since then the heat-shrink film of the next goods stack awaiting shrinking can be preheated in the region of the first lateral surface sub-region, for example from top to bottom, prior to shrinking.

[0027] The invention also relates to an apparatus for shrinking a heat-shrink film applied around an, in particular palletized, goods stack that comprises a bottom surface, a cover surface, and a circumferential lateral surface that is made up of four lateral surface sub-regions, having at least one heating device for shrinking the heat-shrink film by heating, the heat-shrink film covering the lateral surface of the goods stack at least in its top region, preferably the entire height of the lateral surface, and the heat-shrink film projecting at the top, at least with a heat-shrink film sub-region, beyond the top edge of the goods stack for formation of a top shrink. The heat-shrink film sub-region thus forms a circumferential protrusion. The heat-shrink film can of course also project at the bottom, at least with a heat-shrink film sub-region, beyond the bottom edge of the goods stack or beyond the bottom edge of a pallet on which the goods stack is placed, for formation of a bottom shrink.

[0028] A goods stack usually has a cuboidal conformation. A pallet usually has a rectangular contour made up of two oppositely located long sides and two oppositely located short sides. A heat-shrink film in the form of a heat-shrink film wrapper is usually applied around a goods stack, the heat-shrink film wrapper projecting at the top, with a circumferential heat-shrink film sub-region, beyond the top edge of the goods stack for formation of a top shrink. In addition, a cover sheet film is located on the cover surface of the goods stack. The heat-shrink film sub-region is firstly folded over so that it rests in substantially planar fashion on the cover film. This can be accomplished in a separate machine. In addition, the heat-shrink film sub-region can have been fastened, for example in the region of at least one corner, by spot heat-sealing, so that the as-yet unshrunk heat-shrink film wrapper does not slip downward when the goods stack is transported. Local heat-sealing of this kind in the region of the top side in order to prevent downward slippage can also be accomplished by way of a horizontally oriented and vertically movable heat-sealing bar. The four lateral surface sub-regions of the heat-shrink film wrapper are then shrunk by the fact that the goods stack is moved through two vertically oriented heating devices.

[0029] It is disadvantageous in this context that as shrinking and subsequent cooling occur, the heat-shrink film wrapper contracts not only in a longitudinal direction but also in a transverse direction. This results in formation of a half-moon in particular in the region of the long sides of a goods stack, since the heat-shrink film wrapper pulls upward here because of the transverse shrinkage.

[0030] The object of the invention is to eliminate the aforesaid disadvantages and to describe an apparatus with which half-moon formation in the context of shrinkage can be avoided so that the goods stack is effectively protected by the heat-shrink film and, if it is arranged on a pallet, is optimally secured on the pallet.

[0031] This object is achieved by the fact that the apparatus encompasses a conveying device for moving the goods stack in a conveying direction during shrinking; and that for heat impingement, at least one heating device is embodied in oblong fashion and is oriented above the conveying device horizontally and orthogonally to the conveying direction, and the lengthwise dimension of the heating device extends at least approximately over the width of the goods stack, the heating device being arranged vertically adjustably and mounted pivotably around an axis oriented parallel to its lengthwise dimension, and furthermore a control system being provided by means of which firstly the heat-shrink film is shrunk in the region of a first lateral surface sub-region of the four lateral surface sub-regions of the goods stack, the shrinkage direction being from bottom to top, then, the shrinkage direction being changed approximately 90°, that heat-shrink film sub-region of the heat-shrink film which projects at the top beyond the top edge of the goods stack is shrunk, beginning from the top edge of the first lateral surface sub-region along the cover surface to the top edge of that lateral surface sub-region which is located oppositely from the first lateral surface sub-region, and in a further step

[0032] either, the shrinkage direction being changed approximately a further 90°, the heat-shrink film is shrunk from top to bottom in the region of that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region,

[0033] or, the shrinkage direction being changed approximately a further 90°, the heat-shrink film is preheated from top to bottom in the region of that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region, and is then shrunk in the opposite direction from bottom to top.

[0034] The apparatus according to the present invention allows the heat-shrink film also to be tensioned in the two oppositely located lateral surface sub-regions that are oriented orthogonally to the first of the four lateral surface sub-regions and to the oppositely located lateral surface sub-region, with no pulling up in those two unshrunk lateral surface sub-regions. Formation of the undesired half-moons therefore does not occur. Tensioning also does not cause any creases, so that these two oppositely located lateral surface sub-regions can be optimally used, for example, for advertising purposes. The two oppositely located unshrunk lateral surface sub-regions are preferably the long sides in the context of a rectangular goods stack.

[0035] At least one heating device can comprise different mutually independently controllable heating regions. A configuration of this kind allows the heating output to be reduced or even shut off in certain regions.

[0036] At least one heating device can be embodied as a gas burner strip. With a configuration of this kind, a controllable device that, for example, modifies the gas delivery cross section can be provided for regulating the output of a heating region. Other types of heating devices are of course also conceivable.

[0037] That side of at least one heating device which faces toward the goods stack can be embodied to be flat. That side of the heating device which faces toward the goods stack thus forms a flat surface.

[0038] It is useful if at least one heating device protrudes beyond the width of the goods stack, so that the heating device projects beyond the goods stack at least on one side, preferably on both sides, of the goods stack. An arrangement of this kind additionally allows a narrow marginal region of the heat-shrink film on at least one of the two lateral surface sub-regions oriented parallel to the shrinkage direction during shrinking of the cover surface, which region adjoins the edge to the first lateral surface sub-region of the goods stack and/or adjoins the edge to the top side of the goods stack and/or adjoins the edge to that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region, additionally to be shrunk in the context of shrinkage.

[0039] At least one region, projecting laterally with respect to the goods stack, of at least one heating device can be arranged pointing toward the goods stack at an angle. A configuration in which the heating device is U-shaped is, for example, conceivable. The two projecting regions are oriented parallel to the conveying direction. By means of each projecting region, in the context of shrinkage a narrow marginal region of the heat-shrink film on at least one of the two lateral surface sub-regions oriented parallel to the shrinkage direction during shrinking of the cover surface, which region adjoins the edge to the first lateral surface sub-region of the goods stack and/or adjoins the edge to the top side of the goods stack and/or adjoins the edge to that lateral surface sub-region of the goods stack which is located oppositely from the first lateral surface sub-region, is shrunk in the context of shrinkage.

[0040] It is useful if at least one region projecting laterally with respect to the goods stack comprises at least one device for modifying the discharge direction of the hot air. The discharge direction can thereby be adjusted. It is entirely possible, for example, for at least one projecting region to be pivotable by means of a drive system or, for example, for the heating regions that are arranged in the projecting region to be pivotable.

[0041] It is useful if at least one planar thermal conduction and/or thermal reflection device is provided, which device: at least partly, preferably completely, covers the goods stack at the top at least during shrinking of the first of the four lateral surface sub-regions; is arranged above the goods stack at a distance forming a gap with respect to the cover surface; and is oriented parallel to the latter. The thermal conduction and/or thermal reflection device can be embodied, for example, as a heat accumulation panel. If good reflection is desired, a thermal conduction and/or thermal reflection device embodied, for example, as a mirror panel can be provided. The hot air that rises in the context of shrinkage of the first of the four lateral surface sub-regions can flow into the gap between the cover surface of the goods stack and the thermal conduction and/or thermal reflection device, where it preheats at least that heat-shrink film sub-region of the heat-shrink film which projects at the top beyond the top edge of the goods stack.

[0042] At least one thermal conduction and/or thermal reflection device can be arranged vertically adjustably, and can thus be adapted to goods stacks of different heights.

[0043] At least one thermal conduction and/or thermal reflection device can completely cover the cover surface of the goods stack, or can be embodied to be even bigger with an overhang. In the case of an overhang, the thermal conduction and/or thermal reflection device projects on at least one side of the goods stack.

[0044] At least one thermal conduction and/or thermal reflection device can be equipped laterally, on its two lateral edges oriented parallel to the conveying direction, with a respective downward-pointing angled piece. If the bottom edge of each angled piece is lower down than the cover surface, the spacing between the two angled pieces is greater than the width of the goods stack. Lateral outflow of the hot air is decreased by the angled pieces.

[0045] At least one thermal conduction and/or thermal reflection device can be equipped, on its lateral edge oriented oppositely to the conveying direction, with a downward-pointing end-face angled piece. If two lateral angled pieces are provided, the end-face angled piece preferably has a lesser height than the two lateral angled pieces. The result is to produce, in the region of the end-face angled piece, a larger clearance through which the hot air can flow out. It is furthermore useful if the bottom edge of the end-face angled piece is above the cover surface, so that the goods stack can be passed through beneath the end-face angled piece without colliding.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046] Exemplifying embodiments of the invention, depicted in the drawings, will be explained below. In the drawings:

[0047] FIG. **1** is a side view of an apparatus according to the present invention;

[0048] FIG. **2** is a side view of a thermal conduction and/or thermal reflection device according to the present invention; and

[0049] FIGS. **3** to **9** illustrate execution of the method according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0050] In all the Figures, matching reference characters are used for identical or similar components.

[0051] FIG. **1** is a side view of an apparatus according to the present invention for shrinking. It comprises a conveying device **1** that is, for example, a conveyor belt. Placed on conveying device **1** is a goods stack **2** that can be displaced in conveying direction **3** by means of conveying device **1**.

[0052] The rectangularly configured goods stack **2** has a cover surface, a lateral surface that is made up of four lateral surface sub-regions, and a bottom surface. Goods stack **2** has two oppositely located long sides that are oriented parallel to conveying device **3**, and two oppositely located short sides. In the exemplifying embodiment depicted, goods stack **2** is not placed on a pallet. The shape of goods stack **2** is cuboidal.

[0053] As is evident from FIG. **1**, the apparatus for impingement of heat onto a heat-shrink film **4** (not depicted in FIG. **1**) that is applied around goods stack **2** comprises a heating device **5** that is embodied in oblong fashion and is oriented horizontally above conveying device **1** and orthogonally to conveying direction **3**. The width of the heating region of heating device **5** is at least as great as the width of goods stack **2** in the region of the two short sides, so that the lengthwise dimension of heating device **5** extends at least over the width of goods stack **2**. Heating device **5** is arranged vertically adjustably by way of an apparatus (not depicted), and is furthermore mounted pivotably around an axis **6** oriented parallel to its lengthwise dimension.

[0054] Also provided is a thermal conduction and/or thermal reflection device **7** that is likewise vertically adjustable and is configured, in the exemplifying embodiment depicted, as a heat accumulation panel. The heat accumulation panel is equipped laterally, on both lateral edges oriented parallel to conveying direction **3**, with a respective downward-pointing angled piece **8**. The spacing of the two angled pieces **8** is selected so that it is greater than the width of goods stack **2**, so that goods stack **2** can thus be moved through between the two angled pieces **8**. If goods stacks **2** of differing widths are to be shrunk, it is useful if the spacing of the two oppositely located angled pieces **8** is adjustable. With a configuration of this kind, preferably each angled piece **8** is displaceable horizontally and approximately orthogonally to conveying direction **3**.

[0055] At its lateral edge pointing oppositely to conveying direction **3**, thermal conduction and/or thermal reflection device **7** comprises an end-face angled piece **9**, which likewise points downward but whose height is selected so that goods stack **2** can be moved through below end-face angled piece **9** without colliding. For vertical adjustment, thermal conduction and/or thermal reflection device **7** comprises two carriages **10** that are arranged vertically displaceably on two support poles (not depicted). Thermal conduction and/or thermal reflection device **7** is fastened via a retaining frame **11** onto carriages **10**.

[0056] For better illustration of the method sequence, thermal conduction and/or thermal reflection device **7** is depicted only in very highly simplified fashion in FIGS. **3** to **9**. Angled pieces **8** and carriages **10**, for example, are not depicted. The apparatus comprises a suitable control system for carrying out the method described below.

[0057] FIG. **3** depicts the beginning of the shrinking process. Heat-shrink film **4**, which is embodied in the exemplifying embodiment depicted as a heat-shrink film wrapper, has already been applied around goods stack **2** in an upstream apparatus. In the exemplifying embodiment depicted, heat-shrink film **4** covers the lateral surface of goods stack **2** over the entire height of the lateral surface. Heat-shrink film **4** projects at the top, with a circumferential heat-shrink film sub-region **4***a*, beyond the top edge of goods stack **2** for later formation of a top shrink. In addition, in this exemplifying embodiment a cover sheet film has been applied onto the cover surface of goods stack **2**. Heat-shrink film sub-region **4***a* projecting at the top has already been folded over and rests on the cover sheet film.

[0058] As depicted in FIG. **3**, at the beginning of the shrinking process heating device **5** is in its lowest position. Heating device **5** is activated so that hot air is blown onto the first of the four lateral surface sub-regions of goods stack **2**. In the exemplifying embodiment depicted, this first lateral surface sub-region is the front side pointing in conveying direction **3**. As is evident from FIG. **3**, hot air is preferably blown onto goods stack **2** substantially horizontally or with a slightly obliquely downward orientation.

[0059] At this point in time, thermal conduction and/or thermal reflection device **7** is located above goods stack **2** and thus covers it completely. The hot air that rises as the first lateral surface sub-region is shrunk flows into the gap between the cover surface of goods stack **2** and thermal conduction and/or thermal reflection device **7**, and enables preheating here of heat-shrink film sub-region **4***a* that projects at the top and of the cover sheet film. Heating device **5** is then moved upward in the direction of arrow **12** (shrinkage direction) until it has reached the position depicted in FIG. **4**.

[0060] Goods stack **2** is then displaced by conveying device **1** in conveying direction **3**. In order to shrink heat-shrink film sub-region **4***a* that projects at the top, and optionally also the cover sheet film, heating device **5** is pivoted around its lengthwise dimension until hot air is being blown approximately vertically downward, and in this manner that heat-shrink film sub-region **4***a* of heat-shrink film **4** which projects at the top beyond the top edge of goods stack **2**, and optionally also the cover sheet film, are shrunk along the cover surface starting from the top edge of the first lateral surface sub-region to the top edge of that lateral surface sub-region which is located oppositely from the first lateral surface sub-region. Shrinkage direction **12** is parallel to the cover surface. For shrinking, goods stack **2** is moved continuously in conveying direction **3** until goods stack **2** has reached the position in FIG. **8**. As a result of the displacement of goods stack **2**, the proportion of the cover surface of goods stack **2** covered by thermal conduction and/or thermal reflection device **7** becomes increasingly small until, as is evident e.g. from FIG. **7**, no further coverage at all is provided by thermal conduction and/or thermal reflection device **7**.

[0061] As depicted in FIG. **8**, shrinkage direction **12** changes again after the shrinking of heat-shrink film sub-

region **4***a* of heat-shrink film **4** which projects at the top, and optionally also of the cover sheet film, since heating device **5** is now lowered vertically in order to shrink that lateral surface sub-region which is located oppositely from the first lateral surface sub-region. For this, heating device **5** is again pivoted around its lengthwise dimension so that heat-shrink film **4** can now be shrunk from top to bottom in the region of that lateral surface sub-region which is located oppositely from the first lateral surface sub-region. The shrinking process is completed in FIG. **9**. As is evident from FIGS. **8** and **9**, hot air is preferably blown onto goods stack **2** substantially horizontally or with a slightly obliquely downward orientation.

[0062] If heating device **5** projects beyond the width of goods stack **2**, heating device **5** preferably projects beyond goods stack **2** on both sides of goods stack **2**. By means of each projecting region, a narrow marginal region **13** of heat-shrink film **4** on the respective lateral surface sub-region oriented parallel to conveying direction **3** or parallel to shrinkage direction **12** during shrinking of the cover surface, which region adjoins the edge to the first lateral surface sub-region of goods stack **2** and/or adjoins the edge to the top side of goods stack **2** and/or adjoins the edge to that lateral surface sub-region of goods stack **2** which is located oppositely from the first lateral surface sub-region, can additionally be shrunk.

[0063] When the lateral surface sub-region oriented parallel to conveying direction **3** or parallel to shrinkage direction **12** during shrinking of the cover surface is shrunk in the three marginal regions **13** (vertically oriented lateral edge to the first lateral surface sub-region, and horizontally oriented top edge to the top side of goods stack **2**, and vertically oriented lateral edge to that lateral surface sub-region which is located oppositely from the first lateral surface sub-region), the shrunken region of this lateral surface sub-region oriented parallel to conveying direction **3** or parallel to shrinkage direction **12** during shrinking of the cover surface is in the shape of an upside-down "U." This U-shaped marginal region **13** is depicted with hatching exclusively in FIG. **9**. The remaining area of this lateral surface sub-region remains unshrunk.

[0064] After completion of the shrinking process in FIG. **9**, heating device **5** is pivoted approximately 180° around its lengthwise direction and the next, as-yet unshrunk, goods stack **2** is transported in by conveying device **1** for shrinking.

I claim:

1. A method for shrinking a heat-shrink film (**4**) applied around an, in particular palletized, goods stack (**2**) that comprises a bottom surface, a cover surface, and a circumferential lateral surface that is made up of four lateral surface sub-regions, with at least one heating device (**5**) for shrinking the heat-shrink film (**4**) by heating, the heat-shrink film (**4**) covering the lateral surface of the goods stack (**2**) at least in its top region, preferably the entire height of the lateral surface, and the heat-shrink film (**4**) projecting at the top, at least with a heat-shrink film sub-region (**4***a*), beyond the top edge of the goods stack (**2**) for formation of a top shrink,

wherein firstly the heat-shrink film (**4**) is shrunk in the region of a first lateral surface sub-region of the four lateral surface sub-regions of the goods stack (**2**), the shrinkage direction (**12**) being from bottom to top; then, the shrinkage direction (**12**) being changed approximately 90°, that heat-shrink film sub-region (**4***a*) of the heat-shrink film (**4**) which projects at the top beyond the top edge of the goods stack (**2**) is shrunk, beginning from the top edge of the first lateral surface sub-region along the cover surface; and in a further step either, the shrinkage direction (**12**) being changed approximately a further 90°, the heat-shrink film (**4**) is shrunk from top to bottom in the region of that lateral surface sub-region of the goods stack (**2**) which is located oppositely from the first lateral surface sub-region,

or, the shrinkage direction (**12**) being changed approximately a further 90°, the heat-shrink film (**4**) is preheated from top to bottom in the region of that lateral surface sub-region of the goods stack (**2**) which is located oppositely from the first lateral surface sub-region, and is then shrunk in the opposite direction from bottom to top.

2. The method according to claim **1**, wherein the goods stack (**2**) is stationary during shrinking; and at least one, preferably vertically adjustable, heating device (**5**) is guided along the goods stack (**2**).

3. The method according to claim **1**, wherein in the context of shrinkage, the goods stack (**2**) is moved in a conveying direction (**3**) by means of a conveying device (**1**) whose conveying speed is preferably regulatable, the first of the four lateral surface sub-regions of the goods stack (**2**) facing in the conveying direction (**3**); and at least one heating device (**5**) is arranged pivotably around an axis (**6**) oriented parallel to its lengthwise dimension but in stationary fashion in relation to the conveying direction (**3**).

4. The method according to claim **1**, wherein in the context of the relative displacement between the goods stack (**2**) and at least one, preferably vertically adjustable, heating device (**5**) in the context of shrinkage, a narrow marginal region (**13**) of the heat-shrink film (**4**) on at least one of the two lateral surface sub-regions oriented parallel to the shrinkage direction (**12**) during shrinking of the cover surface, which region adjoins the edge to the first lateral surface sub-region of the goods stack (**2**) and/or adjoins the edge to the top side of the goods stack (**2**) and/or adjoins the edge to that lateral surface sub-region of the goods stack (**2**) which is located oppositely from the first lateral surface sub-region, is additionally shrunk.

5. The method according to claim **1**, wherein the heat-shrink film (**4**) is embodied as a heat-shrink film wrapper.

6. The method according to claim **5**, wherein a cover sheet film, preferably projecting beyond at least one lateral edge of the cover surface of the goods stack (**2**), is arranged on the top side of the goods stack (**2**), which film is heat-sealed to that heat-shrink film sub-region (**4***a*) of the heat-shrink film (**4**), embodied as a heat-shrink film wrapper, which projects beyond the top edge of the goods stack (**2**).

7. The method according to claim **6**, wherein simultaneously with or after shrinking of that heat-shrink film sub-region (**4***a*) of the heat-shrink film (**4**) which projects at the top beyond the top edge of the goods stack (**2**), the cover sheet film is also at least partly shrunk in the region that is not in contact with the heat-shrink film sub-region (**4***a*) applied as a consequence of shrinking.

8. The method according to claim **1**, wherein the heat-shrink film (**4**) is embodied as a heat-shrink film hood pulled over the goods stack (**2**).

9. The method according to claim **1**, wherein at least during shrinking of the first of the four lateral surface sub-regions, the goods stack (**2**) is at least partly, preferably completely, covered at the top by a planar thermal conduc-

tion and/or thermal reflection device (**7**) arranged above the goods stack (**2**) at a distance from the cover surface and oriented parallel thereto.

10. The method according to claim **1**, wherein at least during shrinking of the cover surface, the goods stack (**2**) is at least partly, preferably completely, covered at the top by a planar thermal conduction and/or thermal reflection device (**7**) arranged above the goods stack (**2**) at a distance from the cover surface and oriented parallel thereto.

11. The method according to claim **1**, wherein the heat-shrink film (**4**) is preheated in the region of the first lateral surface sub-region, preferably from top to bottom, prior to shrinking.

12. An apparatus for shrinking a heat-shrink film (**4**) applied around an, in particular palletized, goods stack (**2**) that comprises a bottom surface, a cover surface, and a circumferential lateral surface that is made up of four lateral surface sub-regions, having at least one heating device (**5**) for shrinking the heat-shrink film (**4**) by heating, the heat-shrink film (**4**) covering the lateral surface of the goods stack (**2**) at least in its top region, preferably the entire height of the lateral surface, and the heat-shrink film (**4**) projecting at the top, at least with a heat-shrink film sub-region (**4***a*), beyond the top edge of the goods stack (**2**) for formation of a top shrink,

wherein the apparatus encompasses a conveying device (**1**) for moving the goods stack (**2**) in a conveying direction (**3**) during shrinking; and for heat impingement, at least one heating device (**5**) is embodied in oblong fashion and is oriented above the conveying device (**1**) horizontally and orthogonally to the conveying direction (**3**), and the lengthwise dimension of the heating device (**5**) extends at least approximately over the width of the goods stack (**2**), the heating device (**5**) being arranged vertically adjustably and mounted pivotably around an axis (**6**) oriented parallel to its lengthwise dimension, and furthermore a control system being provided by means of which firstly the heat-shrink film (**4**) is shrunk in the region of a first lateral surface sub-region of the four lateral surface sub-regions of the goods stack (**2**), the shrinkage direction (**12**) being from bottom to top, then, the shrinkage direction (**12**) being changed approximately 90°, that heat-shrink film sub-region (**4***a*) of the heat-shrink film (**4**) which projects at the top beyond the top edge of the goods stack (**2**) is shrunk, beginning from the top edge of the first lateral surface sub-region along the cover surface, and in a further step

either, the shrinkage direction (**12**) being changed approximately a further 90°, the heat-shrink film (**4**) is shrunk from top to bottom in the region of that lateral surface sub-region of the goods stack (**2**) which is located oppositely from the first lateral surface sub-region,

or, the shrinkage direction (**12**) being changed approximately a further 90°, the heat-shrink film (**4**) is preheated from top to bottom in the region of that lateral surface sub-region of the goods stack (**2**) which is located oppositely from the first lateral surface sub-region, and is then shrunk in the opposite direction from bottom to top.

13. The apparatus according to claim **12**, wherein at least one heating device (**5**) comprises different mutually independently controllable heating regions.

14. The apparatus according to claim **12**, wherein at least one heating device (**5**) is embodied as a gas burner strip.

15. The apparatus according to claim **12**, wherein that side of at least one heating device (**5**) which faces toward the goods stack (**2**) is embodied to be flat.

16. The apparatus as recited in claim **12**, wherein at least one heating device (**5**) protrudes beyond the width of the goods stack (**2**), so that the heating device (**5**) projects beyond the goods stack (**2**) at least on one side, preferably on both sides, of the goods stack (**2**).

17. The apparatus according to claim **12**, wherein at least one region, projecting laterally with respect to the goods stack (**2**), of at least one heating device (**5**) is arranged pointing toward the goods stack (**2**) at an angle.

18. The apparatus according to claim **16**, wherein at least one region projecting laterally with respect to the goods stack (**2**) comprises at least one device for modifying the discharge direction of the hot air.

19. The apparatus according to claim **12**, wherein at least one planar thermal conduction and/or thermal reflection device (**7**) is provided, which device: at least partly, preferably completely, covers the goods stack (**2**) at the top at least during shrinking of the first of the four lateral surface sub-regions; is arranged above the goods stack (**2**) at a distance from the cover surface; and is oriented parallel to the latter.

20. The apparatus according to claim **19**, wherein at least one thermal conduction and/or thermal reflection device (**7**) is arranged vertically adjustably.

21. The apparatus according to claim **19**, wherein at least one thermal conduction and/or thermal reflection device (**7**) completely covers the cover surface of the goods stack (**2**), or is embodied to be even bigger with an overhang.

22. The apparatus according to claim **19**, wherein at least one thermal conduction and/or thermal reflection device (**7**) is equipped laterally, on its two lateral edges oriented parallel to the conveying direction (**3**), with a respective downward-pointing angled piece (**8**).

23. The apparatus according to claim **19**, wherein at least one thermal conduction and/or thermal reflection device (**7**) is equipped, on its lateral edge oriented oppositely to the conveying direction (**3**), with a downward-pointing end-face angled piece (**9**).

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