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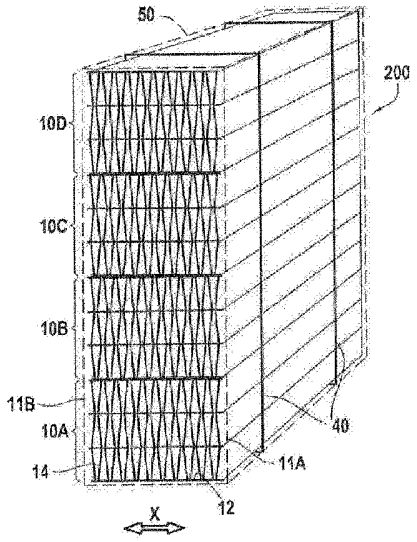
(54) **Multilayer insulating product packet, method and equipment for packaging such a packet.**

(57) The multilayer insulating product packet (200) comprises at least one multilayer insulating product plate (10) which comprises at least one first film (12) and at least one central element (14), which is connected against said at least one first film and which comprises corrugations spreading according to a direction of propagation (X) with a pitch (P) and amplitude (A) crest to crest; and stress packaging means (40, 50) holding said at least one crest in a stressed state. In the stressed state, the plate (10) is held compressed according to the direction of propagation of the corrugations (X) such that the pitch is less and the amplitude greater in the stressed state than in the unstressed state of said at least one plate.



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Title: Multilayer insulating product packet, method and equipment for packaging such a packet

The present invention relates to a multilayer insulating product packet, comprising at least one multilayer insulating product plate which comprises at least one first film, and at least one central element, which is connected against said at least one first film and which comprises corrugations spreading according to a direction of propagation with a pitch and with amplitude crest to crest.

A multilayer insulating product of this type is known from French patent application No. 2 982 193.

This product is satisfactory, in particular with respect to its thermal insulation properties, its mechanical resistance and its lightness.

Another important parameter in the field of multilayer insulation is that of its bulk during transport and storage.

In conventional terms, to the extent where multilayer insulating products are traditionally made in the form of continuous strips, they are packaged by being wound onto rollers.

Figures 10 and 11 illustrate the traditional packaging method. Figure 10 in fact shows a multilayer insulating product strip 1, comprising a first film 2, a second film 2' and a central element 4 which is sandwiched between the two films. The strip 1 is conveyed in the forward direction S in the packaging device presented in figure 10. This device comprises a compression station 20 in which the thickness of the insulating product, measured perpendicularly to the plane of the strip 1, moves from a value E0 in the area 21 located upstream of the compression station 20 to a value E1 in the area 22 located downstream of the compression station. For this, the strip is compressed between compression cylinders 19. This thickness E1 is retained during winding of the strip according to a roller 26, in a winding area 23, due to the presence, in the area 22 located between the compression

station 20 and the roller 23, of guides 24 enabling a flattened and compressed configuration, that is, in a stressed state, of the strip 1. Therefore, in the compression station, the central element 4 is crushed on itself. Once a roller of preferred diameter is produced, the strip 1 is kept in the compressed state, for example by packaging of the roller in a plastic film. The strip is thus transported and stored in the wound and stressed state. To utilise the strip, as shown in figure 11, the strip is unwound from the roller 26 in an unwinding station 28 and reconstitutes to a thickness E0' close to its original thickness E0.

The inventors realised that in the particular case of a multilayer insulating product of the type comprising a film and a central element having corrugations (as described in French patent No. 2 982 193), compression of the strip by flattening perpendicular to its plane and its winding on a roller risks causing deterioration, in particular delamination of the corrugated central element, with the film(s) to which it is connected. In fact, in this case, compression of the strip which is made by reduction according to its thickness tends to crush the corrugations, in turn degrading their bond with the film(s) (by shearing and delamination) and also impairs their capacity to regain their initial form when the strip is unwound. This problem is significant in the event where the direction of propagation of the corrugations is perpendicular to the forward direction S of the strip, since the flattening is done according to the contact line of the strip with the compression cylinders, this line being parallel to the direction of propagation of the corrugations, that is, perpendicular to the lines formed by the crests of the corrugations and compression and shearing operate perpendicularly to the corrugations. In other terms, the crest lines are crushed or “broken” by the compression cylinders. Now, from the manufacturing viewpoint, when the product is produced in a continuous strip it is interesting that the direction of propagation of the corrugations is according to the width of the strip. In fact, the fact of making the strip by positioning the central element such that the direction of propagation of the

corrugations is oriented according to the width of the strip enables welding of the crests of the corrugations onto the film (or onto two films, when two films are provided), according to the length of the strip, according to the natural forward direction of the strip.

The aim of the invention therefore is to propose a multilayer insulating product packet of the type having a corrugated central element, packaged so as to eliminate this risk, or at least attenuate it significantly.

Therefore, the invention relates to a multilayer insulating product packet, comprising:

- at least one multilayer insulating product plate which comprises at least one first film, and at least one central element, which is connected against said at least one first film and which comprises corrugations spreading according to a direction of propagation with a pitch and with amplitude crest to crest; and
- stress packaging means holding said at least one plate in a stressed state.

According to an aspect of the invention, in the stressed state, said at least one plate is held compressed according to the direction of propagation of the corrugations such that the pitch is less and the amplitude larger in the stressed state than in an unstressed state of said at least one plate.

In other terms, when the insulating product plate is obtained from a strip in which the direction of propagation of the corrugations is oriented according to the width of the strip, the product is compressed according to its width and rather than according to its thickness. This compression therefore brings together the segments of the corrugations which extend between two consecutive crests, without crushing the corrugations, or crushing or “breaking" the crest lines.

Therefore, with the invention, the reduction in volume of the insulating product plate is obtained by compression made according to the direction of propagation of the corrugations of the central element rather

than by a decrease in its thickness. The inventors have noted that compression made according to the direction of propagation of the corrugations does not alter or almost does not alter the bond between the central element and the film(s), and at the same time enables low–volume packaging of the product, preventing its deterioration and when the packet is undone allowing the plate to regain its original thickness to produce the preferred thermal insulation performance.

The above shows the packaging of at least one insulating product plate. As indicated, this plate is classically formed from a strip of multilayer insulating product but as is evident hereinbelow this strip is sectioned into sections forming plates of length allowing their packaging according to the invention.

Optionally, the packaging means comprise an envelope or banding which at least partially encloses said at least one plate by holding it in the stressed state.

The envelope can for example be a film fully enclosing the plate, at least on its faces parallel to the film and its sides perpendicular to the direction of propagation of the corrugations. The envelope can also be formed by a box, cardboard for example, a kit or the like. The banding can be done for example by means of ties of strap type, string or the like, or else by means of one or more adhesive strips.

Optionally, the packaging means comprise a rod or a wire passing through said at least one plate according to the direction of propagation of the corrugations and held at its two ends against the sides of the plate which extend transversally to the direction of propagation of the corrugations.

Therefore, the rod or the wire is poked through the plate, and therefore passes through the corrugations of the central element. The diameter of the rod or the wire can be extremely small such that the resulting boring does not affect or almost does not affect the insulating properties of the plate. The rod or the wire is held by its two ends against

the sides of the plate, for example by means of pierced platelets, via which the rod or the wire passes, and a stop solidly connected to the rod or the wire to the side of the platelet opposite the insulating product plate. With respect to a wire, this stop can be made by a simple knot made in the film. With respect to a rod, this stop can be made for example by a staple, a pin, a bolt or the like.

Optionally, the packet comprises a plurality of plates each held in the stressed state by the packaging means, these plates having in particular parallel directions of propagation and being in particular superimposed perpendicularly to these parallel directions.

The different plates forming part of the same packet can have the same dimensions in their stressed state. They can for example be stacked or juxtaposed so that their respective directions of propagation are parallel to each other without joining, or else placed end–to–end to align their directions of propagation. In all cases, the result is a packet containing several plates in reduced bulk, which can be handled, transported and stored easily.

The invention also relates to a method for making a multilayer insulating product packet of the above type.

As indicated previously in relation to figures 10 and 11, the multilayer insulating product packaging methods of the type mentioned above, which are known, undergo the risk of harming insulating products having a central element corrugated, in particular by causing delamination of the central element with the film(s) to which it is connected. The aim of the invention is to propose a method substantially free of these disadvantages.

Therefore, the invention relates to a method for making a multilayer insulating product packet comprising at least one multilayer insulating product plate which comprises at least one first film, and at least one central element, which is connected against said at least one first film and which comprises corrugations spreading according to a direction of

propagation with a pitch and with amplitude crest to crest, the method comprising a packaging step, in which said at least one plate is packaged in a stressed state.

According to an aspect of the invention, from an unstressed state of said at least one plate, a compression step is conducted by compressing said at least one plate according to the direction of propagation of the corrugations to guide it into the stressed state in which the pitch is less and the amplitude greater than in the unstressed state.

Therefore, with this method, the plate is compressed so as to reduce the pitch of the corrugations, and the inventors noted that compression in this direction does not affect or almost does not affect the bond between the central element and the film(s).

Optionally, during the compression step, said at least one plate is compressed by bringing its sides together to each other transversal to the direction of propagation of the corrugations.

This bring together is achieved in particular by compression walls, cooperating with the sides of the plate perpendicular to its width.

Optionally, during the compression step, said at least one plate is compressed via aspiration in the cells formed in the hollows of the corrugations of the central element.

Optionally, during the compression step, said at least one plate is compressed according to the direction of propagation of the corrugations, and pressure allowing controlled spacing of said parallel outer faces is exerted on its outer faces parallel to the film.

Because of this, the preferred compression is achieved by holding the faces of the plate which are parallel to the film in the preferred bulk. In reaction to compression according to the direction of propagation of the corrugations, this in particular prevents the plate from warping by forming one or more waves rising perpendicularly to the direction of propagation of the corrugations by escaping compression and exiting from the bulk provided for its packaging.

Optionally, during the packaging step, said at least one plate is enclosed at least partially by an envelope or banding.

Optionally, during the packaging step, a rod or a wire is passed through said at least one plate according to the direction of propagation of the corrugations and the rod or the wire is held at its two ends against the sides of the plate which extend transversally to the direction of propagation of the corrugations.

Optionally, during the packaging step, several plates are packaged, which are in particular arranged so as to have parallel directions of propagation and be superimposed perpendicularly to these parallel directions.

The invention also relates to equipment for producing a multilayer insulating product packet of the type mentioned above.

As indicated previously in relation to figures 10 and 11, known packaging equipment, when used for packaging an insulating product having a corrugated central element, undergo the risk of causing deterioration of the product, in particular delamination of the central element with the film(s) to which it is connected. The invention aims to propose equipment for packaging substantially free of these disadvantages.

Therefore, the invention relates to equipment for making a multilayer insulating product packet comprising at least one multilayer insulating product plate which comprises at least one first film and at least one central element, which is connected against said at least one first film and which comprises corrugations spreading according to a direction of propagation with a pitch and with amplitude crest to crest, the equipment comprising means for forming a packet in which said at least one plate is packaged in a stressed state.

According to an aspect of the invention, the equipment comprises a compression device configured to compress said at least one plate from an unstressed state of said at least one plate, according to the direction of propagation of the corrugations to guide said at least one plate into the

stressed state in which the pitch is less and the amplitude greater than in the unstressed state.

The equipment according to the invention therefore produces a packet in which the plate is compressed according to the direction of propagation of the corrugations, which, as indicated previously, avoids or at the very least limits the risks of deterioration of the product.

Optionally, the compression device comprises means to compress said at least one plate by bringing its sides together to each other transversal to the direction of propagation of the corrugations.

Optionally, the compression device comprises means for undertaking aspiration in the cells formed in the hollows of the corrugations of the central element.

Optionally, the compression device comprises means for exerting pressure on the outer faces of the plate parallel to the film, said pressure allowing controlled spacing of said parallel outer faces.

The fact of exerting pressure for controlled spacing of the parallel outer faces prevents, during compression according to the direction of propagation of the corrugations, the plate from warping in its entirety and does not exit from the bulk provided for its packaging.

Optionally, the means for exerting pressure on the parallel outer faces comprise a planar support for the first outer face and at least one support surface, arranged supported on the second outer face.

Optionally, the means to compress said at least one plate comprise a compression wall capable of being shifted according to the direction of propagation of the corrugations and the equipment comprises means for spacing at least one part of the support surface from the support while the compression wall is shifted to compress said at least one plate.

Optionally, with the planar support being horizontal and the support surface being formed at the lower surface of a support strip arranged above the support with a space for insertion of said at least one plate between the support and the support strip, the equipment comprises

at least one weight roller arranged on the support strip, a lifting roller on which the support strip passes and means for spacing the lifting roller of the support while the compression wall is shifted to compress said at least one plate.

The invention will be more clearly understood and its advantages will emerge from the following detailed description of embodiments shown by way of non–limiting examples.

The description refers to the appended drawings, in which:

- figure 1 is a view in partial perspective of a multilayer insulating product plate before its packaging;

- figure 2 is an enlarged view of the detail II of figure 1;

- figure 3 shows a variant embodiment for a superimposed multilayer insulating product plate, before its packaging;

- figure 4A shows a packet according to the invention;

- figure 4B shows a packet according to the invention, according to a variant;

- figures 5A to 5C show different possible arrangements of packets according to the invention;

- figures 6A and 6B show, in a plan view, the equipment serving as packaging of the insulating product;

- figure 7 shows a possibility for the compression device in which a plate is arranged before being compressed;

- figure 8 is a view similar to figure 7, showing the situation after compression of the plate;

- figure 9 is a view similar to figure 7 showing that the device can be used for compression of several plates;

- figures 10 and 11 illustrate the prior art.

The multilayer insulating product plate 10 shown in figure 1 comprises a first film 12, a central element 14, and a second film 12'. The central element is sandwiched between the films 12 and 12'. It comprises corrugations which spread according to a direction of propagation X which

in this case is the direction of the width l of the plate. Therefore, the respectively upper and lower crests of the corrugations are respectively connected to the first film 12 and to the second film 12' and extend according to lines perpendicular to the width l of the plate, that is, according to the direction L of the length of the plate, transversal to the direction X of propagation of the corrugations.

Therefore, in this case the bond lines of the crests of the corrugations with the films form an angle of 90 degrees with the direction of propagation of the corrugations X. But it should be noted that they can be inclined by a different angle relative to the direction X, in particular by being inclined by 90°±15°, or 90°±5° relative to the direction X. In this case, the direction of propagation X of the corrugations must be understood as being the direction of propagation of the wave formed by the profile of the corrugations, that is, their corrugation section in a plane perpendicular to the direction of the width l of the plate.

Figures 1 and 2 in particular show that the crests 14a, 14b of the corrugations delimit a continuous and rectilinear plane outer face, corresponding respectively to the plane of the film 12 and to that of the film 12'. This planarity of the outer face is verified in the unstressed state. Hereinbelow, reference is made to the “plane of the film” by considering that it is defined by this planar outer face.

For example, as described in French application No. 2 982 193, the two films 12 and 12’ are metallized plastic films which, as evident in figure 2, can comprise a layer of plastic 12a coated with a metallic layer 12B.

In the example shown, the profile of the corrugations of the central element 14 is a zigzag, that is, the crests are substantially pointed and the sections extending between two crests are substantially planar. This is best seen in figure 2, which shows crests 14a connected to the upper film 12 and crests 14b connected to the lower film 12', according to bond lines, in particular done by welding, whereof the width W (this width being measured according to the direction of propagation of the corrugations X) is

minimal. The thickness e of the central element, measured over a section 14c extending between a crest 14a and the adjacent crest 14b is for example comprised between 1 mm and 1 cm. Cells 16 are formed in the hollows of the corrugations, that is, in the triangles formed in section by the crests 14a, 14b and 14a which follow each other. The pitch P of the corrugations of the central element 14 is measured between two consecutive upper crests 14a, or else between two consecutive lower crests 14b. It is preferably comprised between 15 and 100 mm. The amplitude A of the corrugations is their height, measured perpendicularly to the plane of the sheet 12, that is, according to the thickness of the plate.

As is seen in figure 3, the insulating product plate 10 can comprise several layers, each comprising a film of the type of film 12, and a central element of the type of the element 14. In other terms, the lower film 12' of the first layer comprising the film 12 and the central element 14 can form the upper film of the following layer, comprising the central element 14' formed between this film 12' and a film 12", and so on. The directions of propagation of the corrugations of the different central elements are parallel.

Figure 4A shows a multilayer insulating product packet 200 according to the invention. This figure illustrates several similar multilayer insulating product plates 10A, 10B, 10C and 10D which are held in a stressed state in which their opposite sides 11A and 11B transversal to the direction of propagation X of their corrugations are brought together such that the pitch of their corrugations is reduced, while the amplitude crest to crest is increased relative to the values of this pitch and this amplitude in the unstressed state. Of course, each of the insulating product plates shown in figure 4A can conform to the product according to figure 1 or to the product according to figure 3, that is, comprise one or more layers of central elements. In this case the choice was made to show plates each having three layers of corrugated central elements.

From the pitch P and the amplitude A presented by the central element of the insulating product in the unstressed state, this pitch P and this amplitude A move respectively to pitch P' and amplitude A', as shown in dashed lines in figure 2. It should be noted that for the sake of simplification the part in dashed lines in figure 2, which illustrates the stressed state of the insulating product, represents the upper film 12 as being planar. Of course, due to the compression in the direction of propagation of the corrugations X, this film (as also for film 12') has slight corrugations in the stressed state.

For example, the ratio between the pitch P' in the stressed state and the pitch P in the unstressed state is comprised between 0.02 and 0.6, in particular between 0.05 and 0.4, more particularly between 0.15 and 0.35. For example, the ratio between the amplitude A' in the stressed state and the amplitude A in the unstressed state is comprised between 1.2 and 4.5, in particular between 1.4 and 2.2.

In reference again to figure 4A, it is evident that the packet 200 comprises stress packaging means which hold the insulating product plates 10A to 10D in their stressed state. In this case, these packaging means are formed by banding, two banding straps 40 or the like being shown. These can be straps, adhesive strips, strings or the like. As indicated previously, the packaging means can also comprise an envelope which encloses at least partially the plate(s) in the stressed state. Therefore, figure 4A shows in dashed lines an envelope 50, for example formed by the walls of a box, kit or the like in which the insulating product plates are arranged. Such an envelope can of course coexist with the abovementioned banding. It can also be provided that the envelope only is present, in particular when it has the form of a supple film wound about the plates. For clarity of the drawing, the envelope is shown with a small space relative to the insulating products it contains, which is not necessarily the case in reality, above all when banding is absent.

Figure 4B shows a packet 210 comprising the same plates 10A to 10D, held in the stressed state by another type of packaging means. In this case, these packaging means comprise rods, wires or the like 60, which pass through the plates on either side according to the directions of propagation X of the corrugations of their respective central elements (these directions being parallel), and which are held at the two ends against the sides of the insulating product plates. In this case, to achieve this the packaging means comprise rigid or semi–rigid platelets 62, arranged on either side of the plates, against their sides 11A and 11B perpendicular to the directions of propagation of the corrugations, and relative to which the ends of the rods or wires 60 are held by stops 64 such that, in this case, bulges are formed at these ends. Of course, these packaging means can coexist with those mentioned previously, in particular with the envelope 50.

It is noted that with the invention it is possible to significantly reduce the dimension of the insulating product plate in the direction of propagation of the corrugations X, and also show the ratio between the pitch P' and P, but by relatively slightly increasing the height of this plate, and also show the ratio between the amplitudes A' and A.

For example, in the stressed state, the dimension of the plate according to the direction of propagation of the corrugations X (its width) is comprised between 100 and 700 mm. It can in particular be comprised between 150 and 400 mm and, in particular, be substantially equal to 200 mm.

For example, in the unstressed state, the dimension of said at least one plate according to the direction of propagation of the corrugations X is comprised between 1000 and 1500 mm, in particular being substantially equal to 1200 mm.

In particular, the insulating product packet according to the invention can comprise four similar plates, superimposed by their faces parallel to the film, each of these plates in the unstressed state having a length (measured parallel to the crest lines of the corrugations) of the order

of 1200 mm and a height, measured perpendicularly to the direction of propagation of the corrugations X and perpendicularly to the crest lines of the corrugations, of the order of 100 mm. An example of a packet, before stressing of the superimposed plates, can have a length of 1200 mm and a height of less than 400 mm. Once the plates are put in their stressed state, the same packet has for example a length of 200 mm and a height of 600 mm or fewer.

In figures 4A and 4B the plates are superimposed by their faces parallel to the films, that is, corresponding to the planes defined by the directions of propagation of the corrugations and the crest lines of the corrugations. In figure 5A, the packet is formed by plates 10A, 10B and 10C which are juxtaposed by their faces defined by the planes perpendicular to the directions of propagation of the corrugations. In figure 5B, the two above arrangements are combined, the plates 10A and 10C, as also the plates 10B and 10D being superimposed, and the two groups formed in this way being juxtaposed. In figure 5C, the plates 10A and 10B are arranged end to end and the plates 10C and 10D, also arranged end to end, are superimposed on the latter (they could obviously be juxtaposed on them). In general, any arrangement of a packet of several plates superimposed, juxtaposed or end to end is feasible.

By way of simplification, figures 5A to 5C show similar straps 40 enclosing the entire packet considered. However, packaging individual means (for example banding) for each plate can of course be provided, and overall packaging means for the packet (for example an envelope).

Figures 6A and 6B, which schematically show the equipment for executing the manufacturing method of a multilayer insulating product packet according to the invention, will now be described. According to this method, the multilayer insulating product is advanced gradually on a conveyor 100, in particular a belt conveyor. In this case, the forward direction F of the conveyor is perpendicular to the direction of propagation X of the corrugations of the central element(s) of the insulating product.

The upstream station 102 is a feed station, which feeds the conveyor with the strip of insulating product 1. The following station, according to the forward direction F of the conveyor, is a cutting station 104 in which the strip 1 is cut. Downstream of this station 104, the front end 1' of the strip 1 and the rear end 10' of the plate 10 which has just been cut can be seen.

The means for forming a packet with this plate are arranged downstream of the cutting station 104. This shows in particular a compression device 110 in which the plate 10 now exited from the cutting station is compressed according to the propagation direction X of the corrugations of the central element of the plate. The compression station in this case comprises means for compressing the plate by bringing together one of the other of its sides transversal to the direction of propagation of the corrugations X.

For example, these means comprise compression walls 112, moveable in a to–and–fro manner according to the direction X, which will be described in more detail hereinbelow.

Figure 6A shows the situation before the start of compression, the plate 10 being located in the compression device 110, from which the compression walls 112 have been spaced apart. In figure 6B, these walls 112 have been brought together and the plate 10 is therefore compressed.

As it leaves the compression device 110, the plate is held in the compressed state between guides 114, whereof the spacing corresponds to the spacing of the walls 112 on completion of compression of the plate, to be conveyed to a packaging station 116 in which the plate is packaged in the stressed state. For example, in this packaging station, banding or enveloping of the plate can be carried out to obtain the packet 200 or 210 shown in figures 4 and 5 (in this case the packet 200 is shown). As it leaves the packaging station 116, the produced packet 200 is conveyed to the exit of the conveyor, for example to means for paletting or introducing into cardboard cartons or the like, not shown here.

Figures 6A and 6B have just been described with reference made to the packaging of an insulating product plate. Of course, several plates can be packaged simultaneously. For this purpose, the feed device can simultaneously feed several superimposed or juxtaposed strips 1, which follow the previously disclosed processing. As they leave the cutting station, several plates can be superimposed in an elevator (not shown), which interrupts the conveyor and which, when carrying a sufficient number of plates, rests them on the conveyor upstream of the compression station 110.

In reference to figures 7 and 8, compression of an insulating product plate 10 is now described. Figure 7 shows this plate in the non–compressed state which it adopts when entering the compression device 110, whereof the compression walls 112 are then spaced apart. In figure 8, the compression walls 112 have been brought together according to the direction of propagation of the corrugations, in particular by being shifted respectively according to arrows f and f' to bring together the sides 11A and 11B of the plate 10. Of course, it could be arranged to move only one of the walls, the other staying fixed.

In what has just been described, the plate is compressed by bringing its sides together to each other perpendicular to its width, by mechanical stress exerted on these sides. By way of alternative or complement, other means of compression can be used. Therefore, in particular, aspiration can be executed in the cells 16 (see figure 2) formed in the hollows of the corrugations of the central element 14. Therefore, figures 6A and 6B show two vacuum boxes 110', which are located respectively in the downstream and upstream regions of the compression station 110, and which execute lateral aspiration tending to bring out the fluid contained by the cells (this fluid is in particular air, but it can also be another gas, for example). These vacuum boxes can be mobile in a to–and–fro manner to be spaced apart from the plane of the conveyor when it advances and be brought closer to execute aspiration. The equipment comprises means for exerting pressure on the outer faces 11 and 11' of the plate which are

parallel to the film 12, pressure allowing controlled spacing of its parallel outer faces. In this case, the plate is arranged on a planar support 113 against which rests the outer face 11'. A support surface 111 is arranged in support on the other outer face 11. In this case, the outer faces 11 and 11' are respectively the upper and lower faces of the plate 10, the planar support being horizontal and the plate being placed thereon. The support surface 111 is in this case formed on the lower surface of a support strip 115 arranged above the support 113 by delimiting relative to the latter a space which enables insertion of the insulating product plate 10 between the support and the support strip. In the situation shown in figure 7, the height of this space corresponds to the thickness E of the plate in the unstressed state (see also figure 1). The equipment comprises means for spacing at least one part of the support surface 111 relative to the support while the compression wall is shifted to compress the plate 10. In this case, the equipment comprises weight rollers which are arranged on the support strip. These weight rollers in this case comprise two lateral rollers 120, respectively arranged against the inner faces of the walls 112, each roller being connected to the relevant wall by a tilting rod 122. Therefore, the roller accompanies the shifts of the wall according to arrow f or f', and is capable of spacing apart from the support 113. In the middle part, the support strip 115 moves to a lifting roller 124, on either side of which are arranged two other weight rollers 126. Via a return system, the lifting roller 124 is connected to displacement of one of the compression walls 112 to space apart from the support 113 while this compression wall moves by compressing the plate 10. In this case, the lifting roller 124 is carried by a belt 128 which, via return pulleys 130 is connected to one of the walls 112. It could be possible for it to be connected to both walls, if they are both mobile, or again for it to be connected to a winding pulley driven by a motor slaved to the system, that is, the exit of which considers the compression of the plate(s). The weight rollers 126 as such are stressed, while able to roll freely on the outer face of the strip 115, to remain in the middle region of the

latter. For example, each weight roller 126 is connected to the weight roller 120 located to the same side of the lifting roller by a spring (not shown) working in compression. The mass of the weight rollers is determined as a function of the weight to be brought to the upper surface of the plate 10. It can be relatively modest, for example a few kilos. Figure 8 shows that the walls 112 have come together, the weight rollers 120 and 126 have accompanied this displacement and remained pressed onto the upper surface of the support strip 115, and the lifting roller 124 has moved up.

Figure 9 shows the same equipment as in figure 7, but several similar plates 10 are arranged on the support 113, under the support surface 111 and between the compression walls 112.

The compression device operates in the same way as that which has just been described, and therefore simultaneously compresses several similar plates 10 arranged above each other, that is, superimposed by their face parallel to the film, perpendicular to the direction of propagation of the corrugations.

Of course, even if figures 7 to 9 show compression of one or more plates having a single central element 14, the invention operates in the same way to compress one or more plates of the type shown in figure 3.

CONCLUSIES

1. Meerlaags isolerend product-pakket (200, 210), omvattende:

- ten minste een meerlaagse isolerend product-plaat (10) die is voorzien van ten minste een eerste film (12) en ten minste een centraal element (14) dat is verbonden met de ten minste ene eerste film (12) en dat voorzien is van plooiingen die zich uitstrekken in een voortplantingsrichting (X) met een golflengte (P) en amplitude (A2) van top naar top; en

- spannende verpakkingsmiddelen (40, 50, 60) die de ten minste ene plaat in een gespannen toestand houden,

gekenmerkt doordat, in de gespannen toestand, genoemde ten minste ene plaat (10) samengedrukt wordt gehouden in de voortplantingsrichting (X) van de plooiingen zodanig dat in de gespannen toestand de golflengte (P') kleiner en de amplitude (A') groter is dan in een ongespannen toestand van genoemde ten minste ene plaat.

2. Pakket (200, 210) volgens conclusie 1, waarbij de verhouding tussen de golflengte (P') in de gespannen toestand en de golflengte (P) in de ongespannen toestand is gelegen tussen 0,02 en 0,6, in het bijzonder tussen 0,05 en 0,4, meer in het bijzonder tussen 0,15 en 0,35.

3. Pakket (200, 210) volgens conclusie 1 of 2, waarbij de verhouding tussen de amplitude (A') in de gespannen toestand en de amplitude (A) in de ongespannen toestand is gelegen tussen 1,2 en 4,5, in het bijzonder tussen 1,4 en 2,2.

4. Pakket (200, 210) volgens een van de conclusies 1-3, waarbij, in de gespannen toestand, de grootte van de ten minste ene plaat (10) in de voortplantingsrichting (X) van de plooiingen is gelegen tussen 100 en 700 mm, in het bijzonder tussen 150 en 400 mm, en in het bijzonder in hoofdzaak gelijk is aan 200 mm.

5. Pakket (200, 210) volgens een van de conclusies 1-4, waarbij in de ongespannen toestand, de grootte van de ten minste ene plaat (10) in de voortplantingsrichting (X) van de plooiingen is gelegen tussen 1000 en 1500 mm, en in het bijzonder in hoofdzaak gelijk is aan 1200 mm.

6. Pakket (200, 210) volgens een van de conclusies 1-5, waarbij het profiel van de plooiingen van het centrale element (14) een zigzag is.

7. Pakket (200, 210) volgens conclusie 6, waarbij de plooiingen van het centrale element (14) toppen (14a, 14b) hebben die een vlak buitenvlak definiëren dat continue en rechtlijnig is.

8. Pakket (200) volgens een van de conclusies 1-7, waarbij de spannende verpakkingsmiddelen een omhulsel (50) of band (40) omvatten welke ten minste gedeeltelijk genoemde ten minste ene plaat (10) omsluit en in de gespannen toestand houdt.

9. Pakket (210) volgens een van de conclusies 1-8, waarbij de verpakkingsmiddelen een stang of draad (60) omvat die zich in de voortplantingsrichting van de plooiingen door genoemde ten minste ene plaat (10) heen uitstrekt en die aan zijn beide einden (64) wordt gehouden aan zich dwars op de voortplantingsrichting van de plooiingen uitstrekkende zijden van de plaat.

10. Pakket (200, 210) volgens een van de conclusies 1-9, omvattende een meervoudig aantal platen (10A, 10B, 10C, 10D) die elk in de gespannen toestand wordt gehouden door de verpakkingsmiddelen (40, 50, 60), in het bijzonder waarbij genoemde platen parallelle voortplantingsrichtingen (X) hebben, en in het bijzonder waarbij genoemde platen boven elkaar zijn gelegen in een richting dwars op genoemde parallelle richtingen.

11. Werkwijze voor de vervaardiging van een meerlaags isolerend product-pakket (200, 210) dat ten minste een meerlaagse isolerend product-plaat (10) omvat die voorzien is van ten minste een eerste film (12) en ten minste een centraal element (14) dat verbonden is met de ten minste ene eerste film (12) en dat plooiingen omvat die zich uitstrekken in een

voortplantingsrichting (X) met een golflengte (P) en amplitude (A) van top tot top, waarbij de werkwijze een verpakkingsstap omvat, waarbij genoemde ten minste ene plaat in een gespannen toestand wordt verpakt,

gekenmerkt doordat, vanaf een ongespannen toestand van genoemde ten minste ene plaat (10), een samendrukstap wordt uitgevoerd door genoemde ten minste ene plaat samen te drukken in de voortplantingsrichting (X) van de plooiingen om het in een gespannen toestand te brengen waarin de golflengte (P') kleiner en de amplitude (A') groter is dan in de ongespannen toestand.

12. Werkwijze volgens conclusie 11, waarbij tijdens de samendrukstap genoemde ten minste ene plaat (10) wordt samengedrukt door het naar elkaar toe brengen van zijn zijden (11A, 11B) die dwars staan op de voortplantingsrichting (X) van de plooiingen.

13. Werkwijze volgens conclusie 11 of 12, waarbij tijdens de samendrukstap genoemde ten minste ene plaat (10) wordt samengedrukt met behulp van wegzuiging uit de cellen (16) die zijn gevormd in de holten van de plooiingen van het centrale element (14).

14. Werkwijze volgens een van de conclusies 11-13, waarbij tijdens de samendrukstap genoemde ten minste ene plaat (10) wordt samengedrukt in de voortplantingsrichting (X) van de plooiingen en waarbij op zijn parallel aan de film (12) liggende buitenvlakken (11, 11') druk wordt uitgeoefend die gecontroleerde op onderlinge afstand plaatsing van genoemde parallelle buitenvlakken toestaat.

15. Werkwijze volgens een van de conclusies 11-14, waarbij tijdens de verpakkingsstap genoemde ten minste ene plaat (10) ten minste gedeeltelijk wordt omsloten door een omhulsel (50) of band (40).

16. Werkwijze volgens een van de conclusies 11-15, waarbij tijdens de verpakkingsstap een staaf of een draad (60) in de voortplantingsrichting (X) van de plooiingen door genoemde ten minste ene plaat (10) heen wordt gevoerd en waarbij de staaf of draad aan zijn beide einden (64) wordt

vastgehouden aan de zijden van de plaat die zich dwars op de voortplantingsrichting van de plooiingen uitstrekken.

17. Werkwijze volgens een van de conclusies 11-16, waarbij tijdens de verpakkingsstap meerdere platen (10A, 10B, 10C, 10D) worden verpakt, die in het bijzonder zo zijn gerangschikt dat zij parallelle voortplantingsrichtingen (X) hebben en dwars op genoemde richtingen boven elkaar zijn gelegen.

18. Inrichting voor het verpakken van een meerlaags isolerend product-pakket (200, 210) met ten minste een meerlaagse isolerend product-plaat (10) die is voorzien van ten minste een eerste film (12) en ten minste een centraal element (14) dat met de ten minste ene eerste film (12) verbonden is en plooiingen omvat die zich uitstrekken in een voortplantingsrichting (X) met een golflengte (P) en amplitude (A) van top naar top, waarbij de inrichting middelen omvat voor het vormen van een pakket waarin genoemde ten minste ene plaat in een gespannen toestand is verpakt,

gekenmerkt doordat het een samendrukapparaat (110) omvat dat is ingericht voor het samendrukken van genoemde ten minste ene plaat in de voortplantingsrichting (X) van de plooiingen vanuit een ongespannen toestand van de ten minste ene plaat (10) om het in de gespannen toestand te brengen waarin de golflengte (P) kleiner en de amplitude (A'2) groter is dan in de ongespannen toestand.

19. Inrichting volgens conclusie 18, waarbij het samendrukapparaat (110) middelen (112) omvat om genoemde ten minste ene plaat (10) samen te drukken door zijn zijden (11A, 11B) die dwars op de voortplantingsrichting (X) van de plooiingen staan naar elkaar toe te brengen.

20. Inrichting volgens conclusie 18 of 19, waarvan het samendrukapparaat (110) middelen (110') omvat voor het uitvoeren van

wegzuiging uit de cellen (16) die zijn gevormd in de holten van de plooiingen van het centrale element (14).

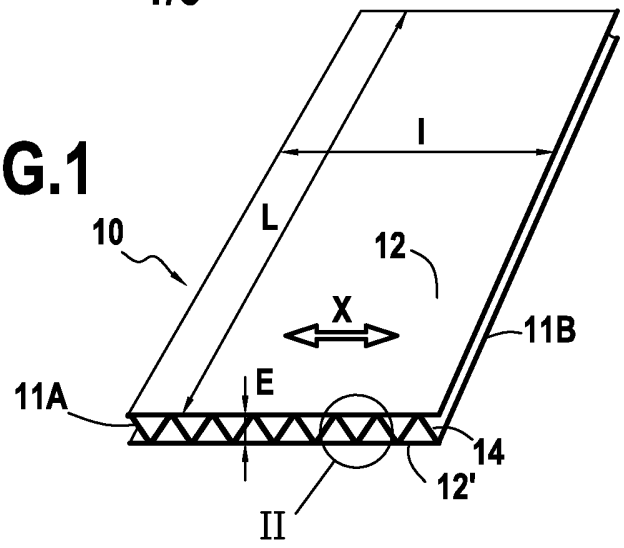
21. Inrichting volgens één van de conclusies 18-20, waarbij het samendrukapparaat (110) middelen (111, 113) omvat voor het op de parallel aan de film (12) gelegen buitenvlakken (11, 11') van de plaat (10) uitoefenen van druk die gecontroleerde op onderlinge afstand plaatsing van genoemde parallelle buitenvlakken toestaat.

22. Inrichting volgens conclusie 21, waarbij de middelen voor het uitoefenen van druk op de parallelle buitenvlakken een vlakke steun (113) voor het eerste buitenvlak (11) omvatten en verder ten minste een steunvlak (111) omvatten dat is ingericht voor het steunen van het tweede buitenvlak (11).

23. Inrichting volgens conclusie 22, waarbij de middelen voor het genoemde ten minste ene plaat (10) samendrukken een samendrukwand (112) omvatten die kan worden verplaatst in de voortplantingsrichting (X) van de plooiingen en waarbij de inrichting middelen (124) omvat voor het ten minste een deel van het steunvlak (111) op afstand plaatsen ten opzichte van de steun (113) terwijl de samendrukwand (112) wordt verschoven om genoemde ten minste ene plaat (10) samen te drukken.

24. Inrichting volgens conclusie 23, waarbij de vlakke steun (113) horizontaal is en het steunvlak (111) gevormd is aan een onderzijde van een steunstrook (115) die is aangebracht boven de steun (113) met een ruimte voor het tussen de steun (113) en de steunstrook (115) inbrengen van genoemde ten minste ene plaat (10), waarbij de inrichting is voorzien van ten minste een rolgewicht (120, 126) dat is gelegen op de steunstrook (115), een hijsrol (124) waarover de steunstrook beweegt en middelen (128, 130) voor het de hijsrol op afstand plaatsen van de steun terwijl de samendrukwand wordt verschoven om genoemde ten minste ene plaat samen te drukken.

FIG.1



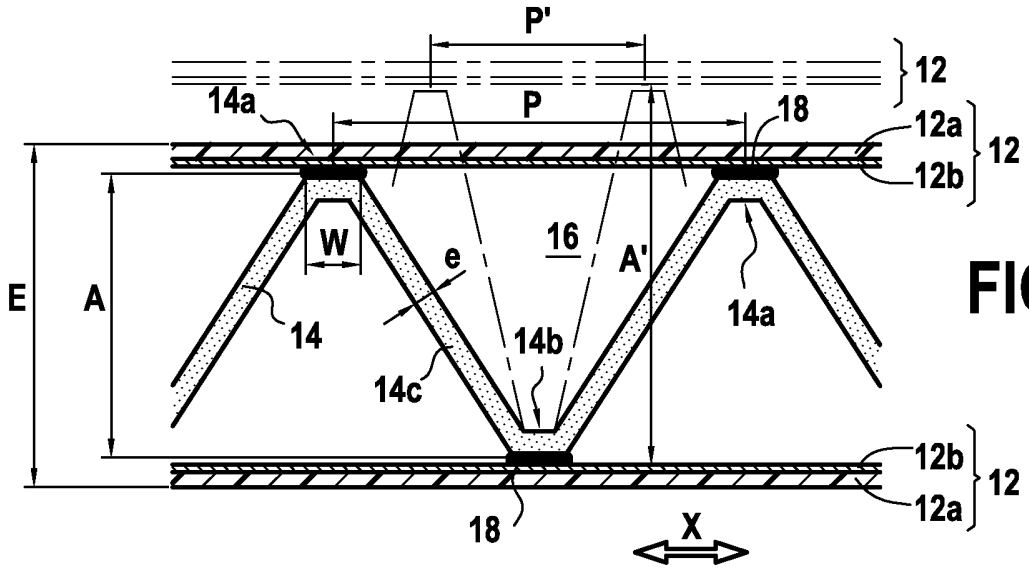
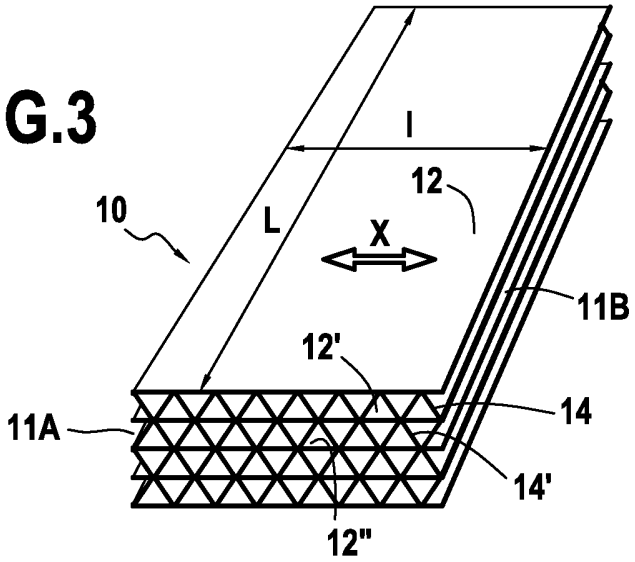


FIG.2

FIG.3



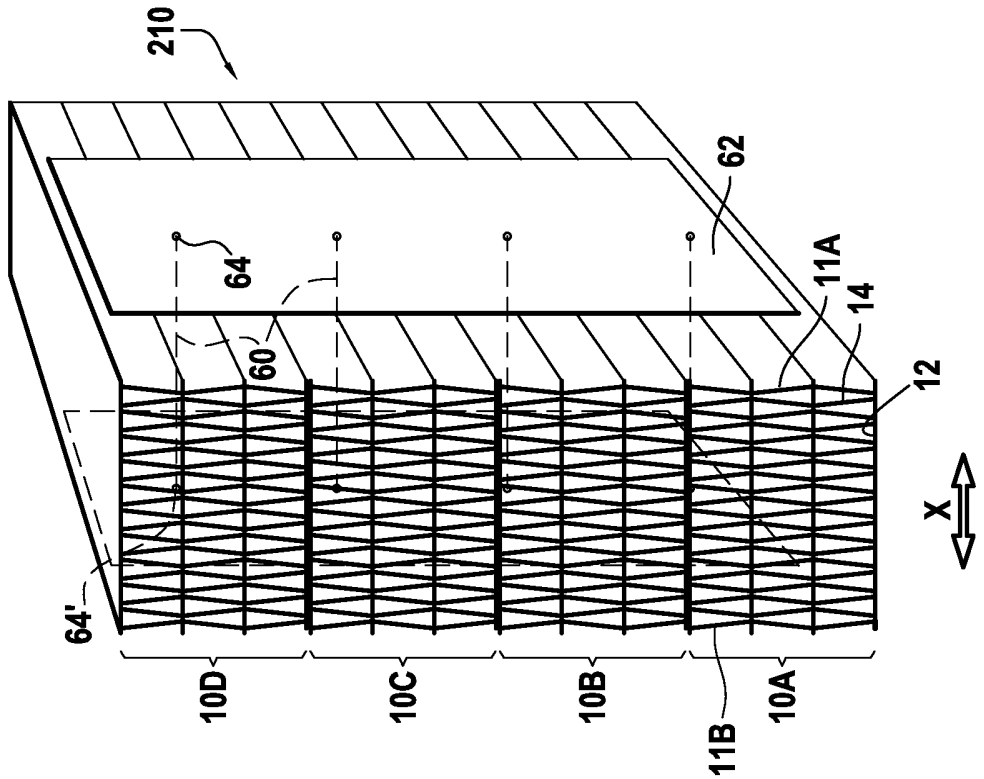

210
62
64
60
11A
14
12
64'
X
10D
10C
10B
11B
10A

FIG.4B

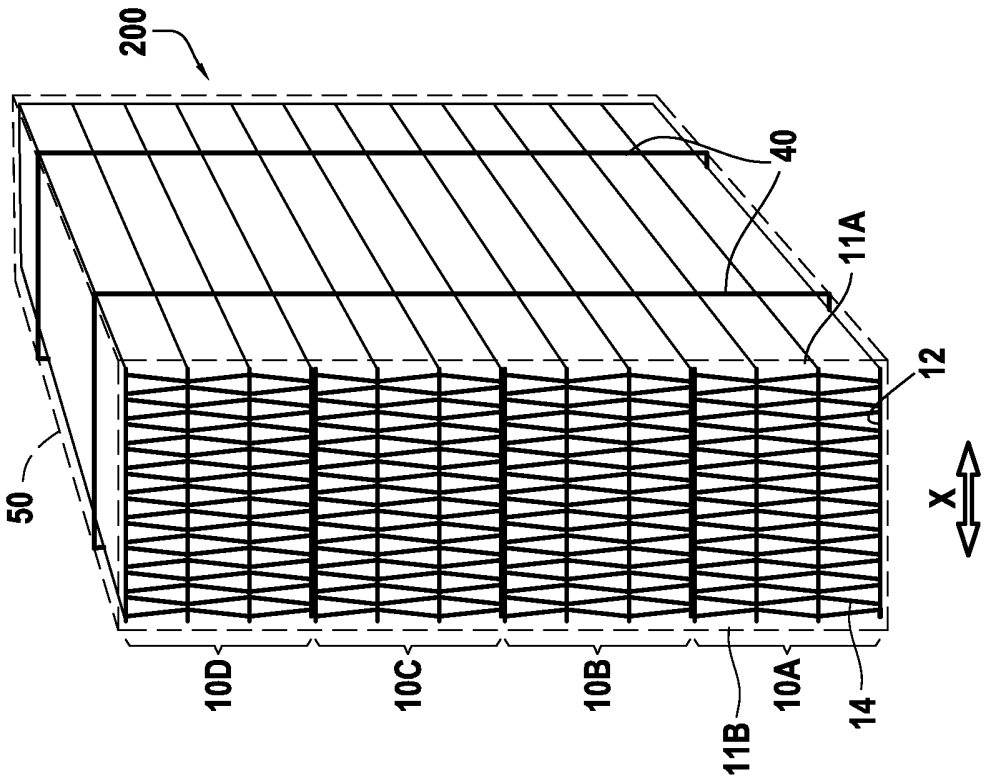

200
40
11A
12
50
X
10D
10C
10B
11B
10A
14

FIG.4A

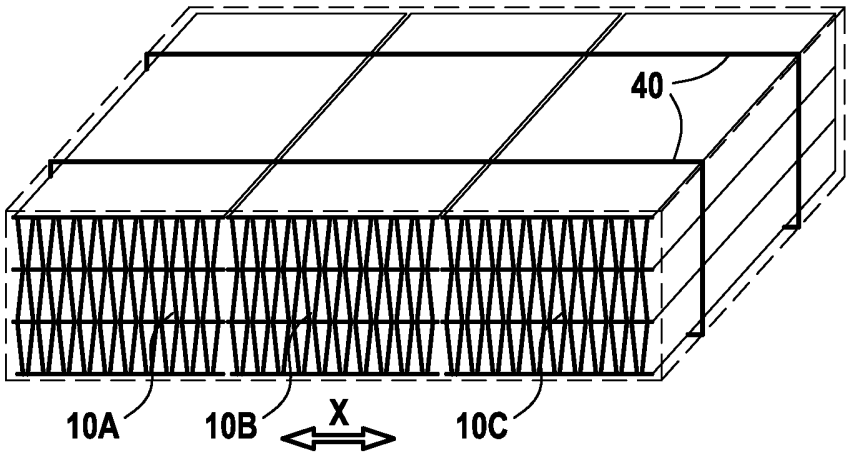


FIG.5A

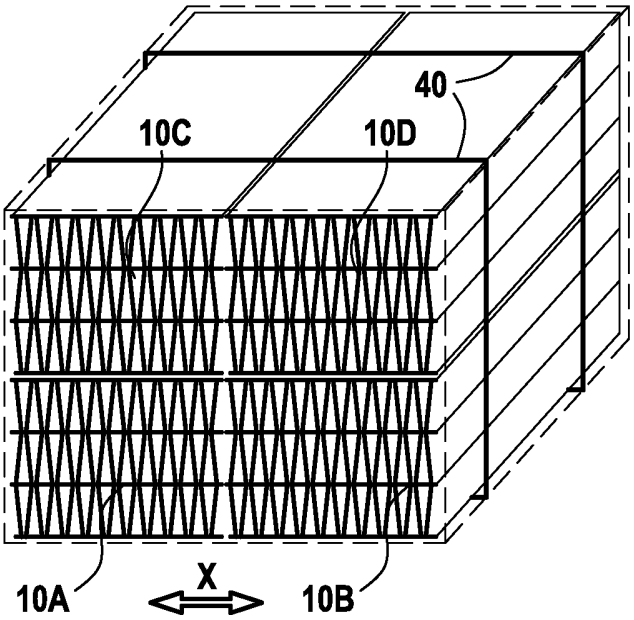


FIG.5B

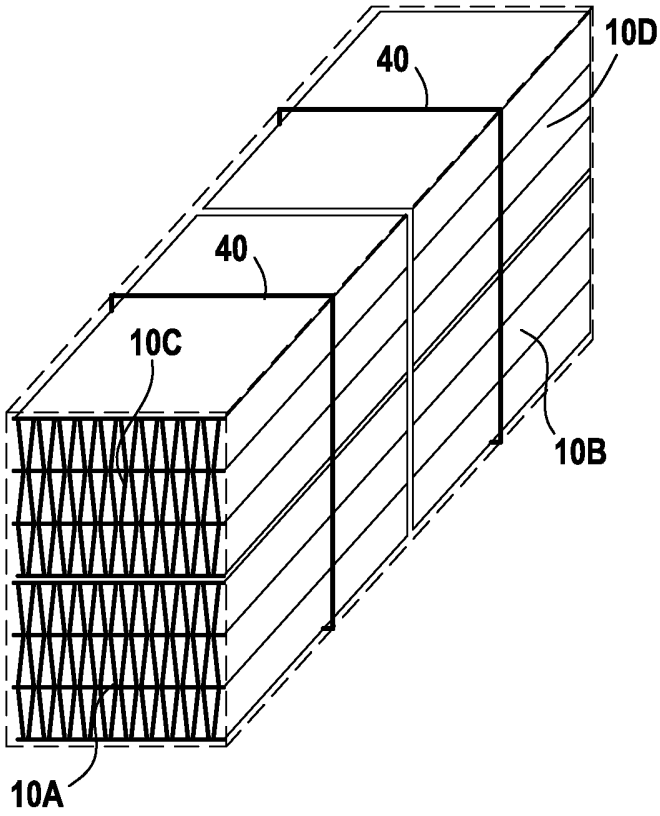


FIG.5C

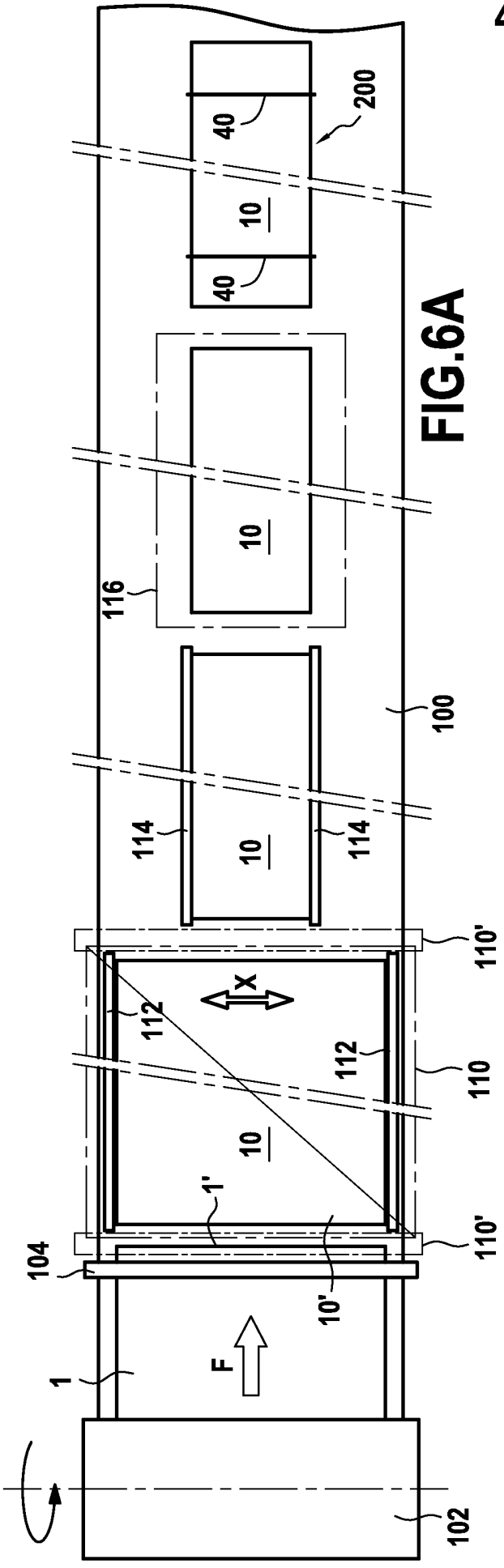

200
40
10
40
10
116
100
114
10
114
110'
X
112
112
110
10
1'
110'
104
10'
1
F
102

FIG.6A

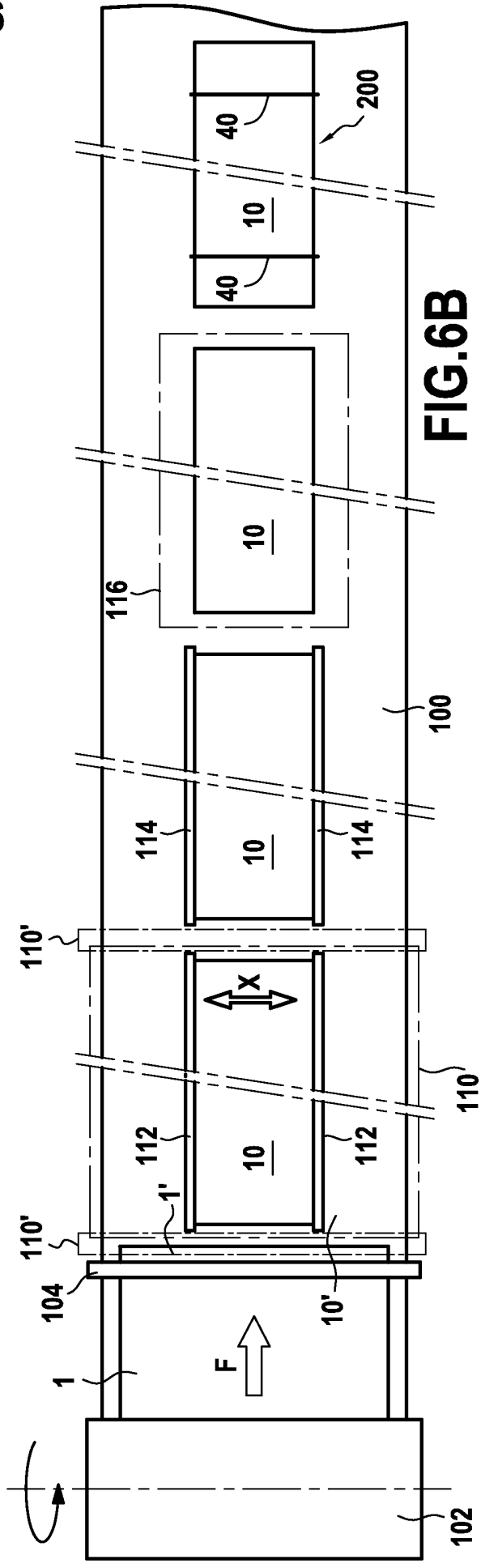

200
40
10
40
10
116
100
114
10
114
110'
X
112
112
110
10
1'
110'
104
10'
1
F
102

FIG.6B

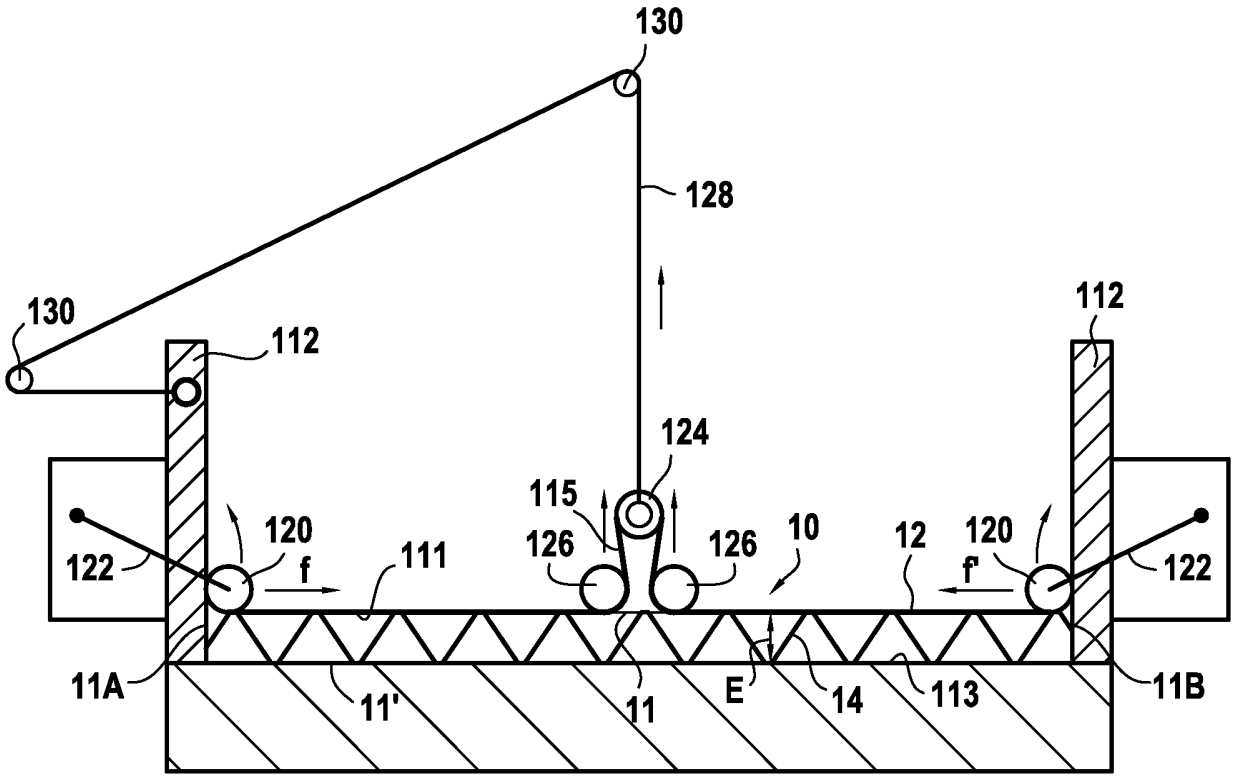

130
128
130
112
112
124
115
120
122
f
111
126
126
10
12
120
f'
122
11A
11'
11
E
14
113
11B

FIG.7

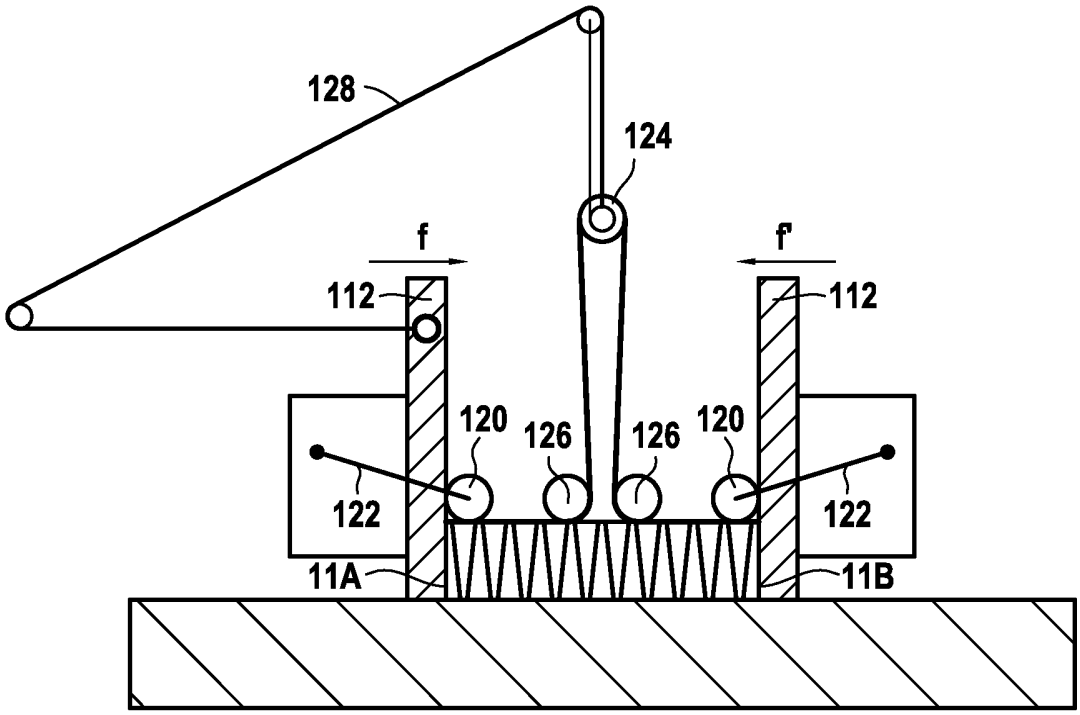

128
124
f
f'
112
112
120
126
126
120
122
122
11A
11B

FIG.8

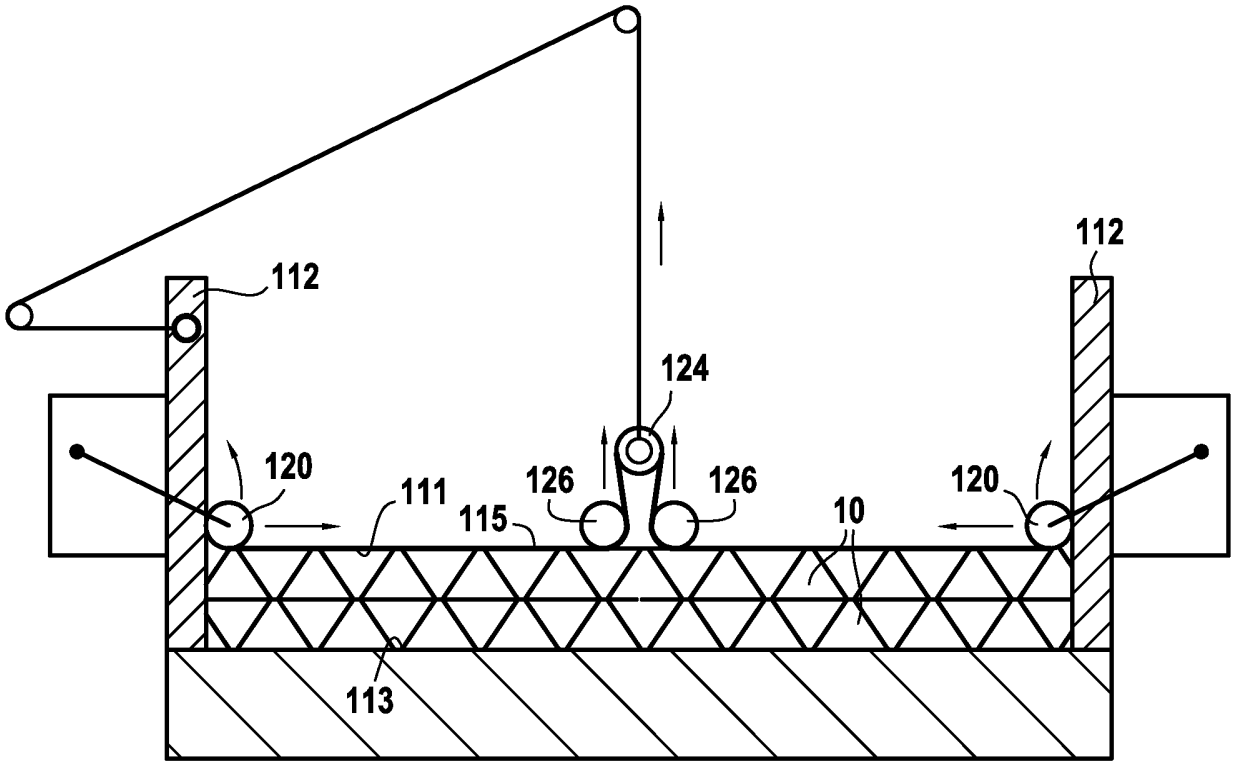


FIG.9

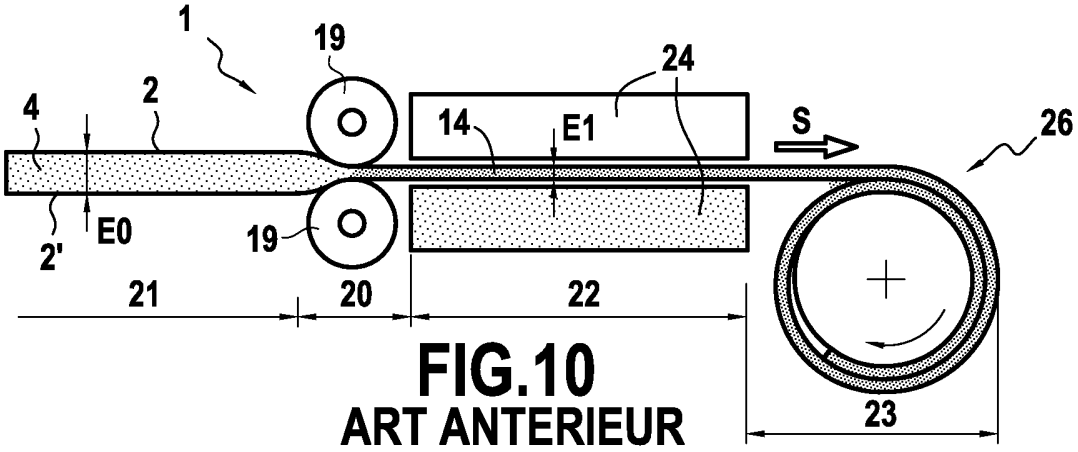


FIG.10
ART ANTERIEUR

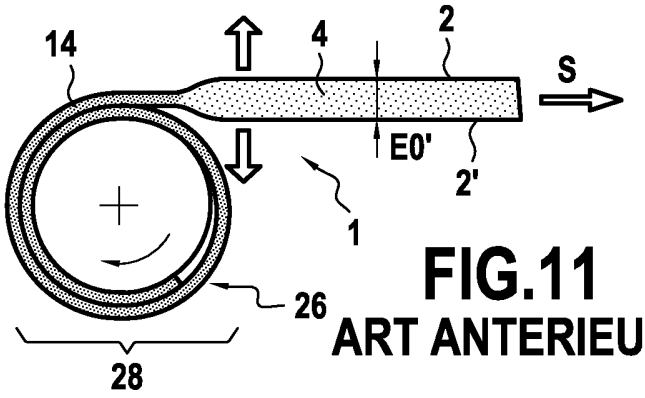


FIG.11
ART ANTERIEUR

A B R E G E

**Paquet de produit isolant multicouche,
procédé et équipement pour confectionner un tel paquet.**

Le paquet (200) de produit isolant multicouche comprend au moins une plaque de produit isolant multicouche (10) qui comprend au moins un premier film (12) et au moins un élément central (14), qui est relié contre ledit au moins un premier film et qui comporte des ondulations se propageant selon une direction de propagation (X) avec un pas (P) et une amplitude (A) crête à crête ; et des moyens (40, 50) de conditionnement contraint maintenant ladite au moins une crête dans un état contraint. Dans l'état contraint, la plaque (10) est maintenue comprimée selon la direction de propagation des ondulations (X) de telle sorte que le pas est plus faible et l'amplitude plus grande dans l'état contraint que dans l'état non contraint de ladite au moins une plaque.

Figure 4A

Rijksdienst voor Ondernemend
Nederland

OCTROOIAANVRAAG NR.:
NO 139470
NL 2015397

ONDERZOEKSRAPPORT

BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK

RELEVANTE LITERATUUR

Categorie[1]	Literatuur met, voor zover nodig, aanduiding van speciaal van belang zijnde tekstgedeelten of figuren.	Van belang voor conclusie(s) nr:	Classificatie (IPC)
Y	FR 839 772 A (INT ALFOL MATSCHAPPIJ NV) 12 april 1939 (1939-04-12)	1-17	INV. B32B3/28
A	* bladzijde 1, regel 1 - regel 11 * * bladzijde 2, regel 91 - regel 97 * * figuren 1-4 *	18-24	E04B1/80 F16L59/07

X,D	FR 2 982 193 A1 (ORION FINANCEMENT [FR]) 10 mei 2013 (2013-05-10)	18-24	
Y	* bladzijde 1, regel 1 - regel 3 * * bladzijde 11, regel 14 - regel 16 * * figuur 2 *	1-17	

Onderzochte gebieden van de techniek:
B32B
B29D
E04B
F16L

Indien gewijzigde conclusies zijn ingediend, heeft dit rapport betrekking op de conclusies ingediend op:

Plaats van onderzoek:	Datum waarop het onderzoek werd voltooid:	Bevoegd ambtenaar:
München	10 augustus 2016	Bataille, Laurent

[1] CATEGORIE VAN DE VERMELDE LITERATUUR

X: de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur
Y: de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht
A: niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft
O: niet-schriftelijke stand van de techniek
P: tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur
T: na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding
E: eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven
D: in de octrooiaanvrage vermeld
L: om andere redenen vermelde literatuur
&: lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

AANHANGSEL BEHORENDE BIJ HET RAPPORT BETREFFENDE HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK, UITGEVOERD IN DE OCTROOIAANVRAGE NR.

NO 139470
NL 2015397

Het aanhangsel bevat een opgave van elders gepubliceerde octrooiaanvragen of octrooien (zogenaamde leden van dezelfde octrooifamilie), die overeenkomen met octrooischriften genoemd in het rapport.
De opgave is samengesteld aan de hand van gegevens uit het computerbestand van het Europees Octrooibureau per
De juistheid en volledigheid van deze opgave wordt noch door het Europees Octrooibureau, noch door het Bureau voor de Industriële eigendom gegarandeerd; de gegevens worden verstrekt voor informatiedoeleinden.

10-08-2016

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
FR 839772 A	12-04-1939	BE 424197 A	10-08-2016
		CH 203893 A	15-04-1939
		FR 839772 A	12-04-1939
		GB 504127 A	20-04-1939
		NL 46514 C	10-08-2016
		US 2101836 A	14-12-1937
FR 2982193 A1	10-05-2013	BE 1020843 A5	03-06-2014
		DE 202012104182 U1	13-12-2012
		FR 2982193 A1	10-05-2013
		FR 2982522 A1	17-05-2013
		GB 2496739 A	22-05-2013
		HK 1185313 A1	17-10-2014

EPO FORM P0469

Algemene informatie over dit aanhangsel is gepubliceerd in de 'Official Journal' van het Europees Octrooibureau nr 12/82 blz 448 ev

SCHRIFTELIJKE OPINIE

DOSSIER NUMMER	INDIENINGSDATUM	VOORRANGSDATUM	AANVRAAGNUMMER
NO139470	03.09.2015	03.09.2014	NL2015397

CLASSIFICATIE
INV. B32B3/28 E04B1/80 F16L59/07

AANVRAGER
Orion Financement

Deze schriftelijke opinie bevat een toelichting op de volgende onderdelen:

- ☒ Onderdeel I Basis van de schriftelijke opinie
- ☐ Onderdeel II Voorrang
- ☐ Onderdeel III Vaststelling nieuwheid, inventiviteit en industriële toepasbaarheid niet mogelijk
- ☐ Onderdeel IV De aanvraag heeft betrekking op meer dan één uitvinding
- ☒ Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid
- ☐ Onderdeel VI Andere geciteerde documenten
- ☐ Onderdeel VII Overige gebreken
- ☐ Onderdeel VIII Overige opmerkingen

DE BEVOEGDE AMBTENAAR
Bataille, Laurent

Aanvraag nr.:

SCHRIFTELIJKE OPINIE

NL2015397

Onderdeel I Basis van de Schriftelijke Opinie

1. Deze schriftelijke opinie is opgesteld op basis van de meest recente conclusies ingediend voor aanvang van het onderzoek.

2. Met betrekking tot **nucleotide en/of aminozuur sequenties** die genoemd worden in de aanvraag en relevant zijn voor de uitvinding zoals beschreven in de conclusies, is dit onderzoek gedaan op basis van:

   a. type materiaal:

   ☐ sequentie opsomming

   ☐ tabel met betrekking tot de sequentie lijst

   b. vorm van het materiaal:

   ☐ op papier

   ☐ in elektronische vorm

   c. moment van indiening/aanlevering:

   ☐ opgenomen in de aanvraag zoals ingediend

   ☐ samen met de aanvraag elektronisch ingediend

   ☐ later aangeleverd voor het onderzoek

3. ☐ In geval er meer dan één versie of kopie van een sequentie opsomming of tabel met betrekking op een sequentie is ingediend of aangeleverd, zijn de benodigde verklaringen ingediend dat de informatie in de latere of additionele kopieën identiek is aan de aanvraag zoals ingediend of niet meer informatie bevatten dan de aanvraag zoals oorspronkelijk werd ingediend.

4. Overige opmerkingen:

Aanvraag nr.:

SCHRIFTELIJKE OPINIE

NL2015397

Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid

1. Verklaring

Nieuwheid	Ja:	Conclusies	1-17, 20, 22-24
	Nee:	Conclusies	18, 19, 21
Inventiviteit	Ja:	Conclusies	
	Nee:	Conclusies	1-24
Industriële toepasbaarheid	Ja:	Conclusies	1-24
	Nee:	Conclusies	

2. Citaties en toelichting:

Zie aparte bladzijde

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1 FR 839 772 A (INT ALFOL MATSCHAPPIJ NV) 12 april 1939 (1939-04-12)

D2 FR 2 982 193 A1 (ORION FINANCEMENT [FR]) 10 mei 2013 (2013-05-10)

Independent claim 1

Document D1 is regarded as being the prior art closest to the subject-matter of claim 1 and discloses a multilayer insulating product packet comprising:

one multilayer insulating product plate which comprises one first film (4, 5) and one central element (13), which is connected against said first film and which comprises corrugations spreading according to a direction of propagation with a pitch and with amplitude crest to crest;

such that, in a folded state, said plate is held folded according to the direction of propagation of the corrugations such that the pitch is less and the amplitude larger in the folded state than in an unfolded state of said plate.

The subject-matter of claim 1 therefore differs from this known product in that it comprises stress packaging means holding said folded plate in a stressed state.

The problem to be solved by claim 1 may therefore be regarded as that of minimising the bulkiness of the packet in its folded state.

Starting from D1 which poses the problem of bulkiness of the packet (see page 2, lines 91-97), it would be obvious for a skilled person to use stress packaging means holding the plate in a stressed state as described in document D2 (see page 11, lines 14-16), thus arriving at the solution of claim 1.

The subject-matter of claim 1 does therefore not involve any inventive step. It is nevertheless considered industrially applicable.

Independent claim 11

Document D1, which is regarded as being the prior art closest to the subject-matter of claim 11, discloses a method for making a multilayer insulating product packet comprising one multilayer insulating product plate which comprises one first film, and one central element which is connected against said first film and which comprises corrugations spreading according to a direction of propagation with a pitch and with an amplitude crest to crest, the method comprising a packaging step in which said plate is packaged in a folded state,

such that, from an unfolded state of said plate, a folding step is conducted by folding said plate according to the direction of propagation of the corrugations to guide it into the folded state in which the pitch is less and the amplitude greater than in the unfolded state.

The methof of claim 11 consequently differs from that of D1 in that it comprises a compression step of said plate in its folded state.

The problem to be solved by claim 11 may therefore be regarded as that of minimising the bulkiness of the packet in its folded state.

For the reason exposed above regarding claim 1, the subject-matter of claim 11 does therefore not involve an inventive step. It is nevertheless considered industrially applicable.

Independent claim 18

Document D2 discloses (see page 1, lines 1-3; figure 2) an equipment for making a multilayer insulating product packet comprising one multilayer insulating product plate which comprises one first film and one central element which is connected against said first film and which comprises corrugations spreading according to a direction of propagation with a pitch and with amplitude crest to crest, the equipment comprising means for forming a packet in which said plate is packaged in a stressed state, the equipment being such that it comprises a compression device (see page 11, lines 14-16) configured to compress said plate from an unstressed state of said plate into the stressed state.

Because such equipment, intrinsically, is suitable for a use according to which the plate is compressed according to the direction of propagation of the corrugations to guide it into a stressed state in which the pitch is less and the amplitude greater than in the unstressed state, the subject-matter of claim 18 is not novel over D2. The subject-matter of claim 18 is nevertheless considered industrially applicable.

Dependent claims 2-10, 12-17 and 19-24

Dependent claims 2-10, 12-17 and 19-24 do not appear to contain any features which, in combination with the features of any claim to which they refer, meet the requirements of patentability in respect of novelty (claims 19, 21) or inventive step (claims 2-10, 12-17, 20, 22-24).