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(54) **Apparatus and method of processing corrugated cardboard blanks for making cardboard boxes**

(57) The corrugated cardboard comprises two outer layers of flat material and at least one inner layer of corrugated material forming inner flutes between said two outer layers. Each of said corrugated cardboard blanks (P) comprises at least one through hole (A) which leaves exposed in the edge thereof openings in communication with said inner flutes. The method comprises the steps of injecting an amount of glue into said inner flutes of the

corrugated cardboard blank (P) through the openings exposed in the edge of the hole (A), and then pressing the outer layers of the corrugated cardboard blank (P) against one another in a region (B) around the hole (A) with a pressure sufficient to flatten the corrugated inner layer. The apparatus comprises glue injection means in connection with a nozzle and pressure means for implementing the method.

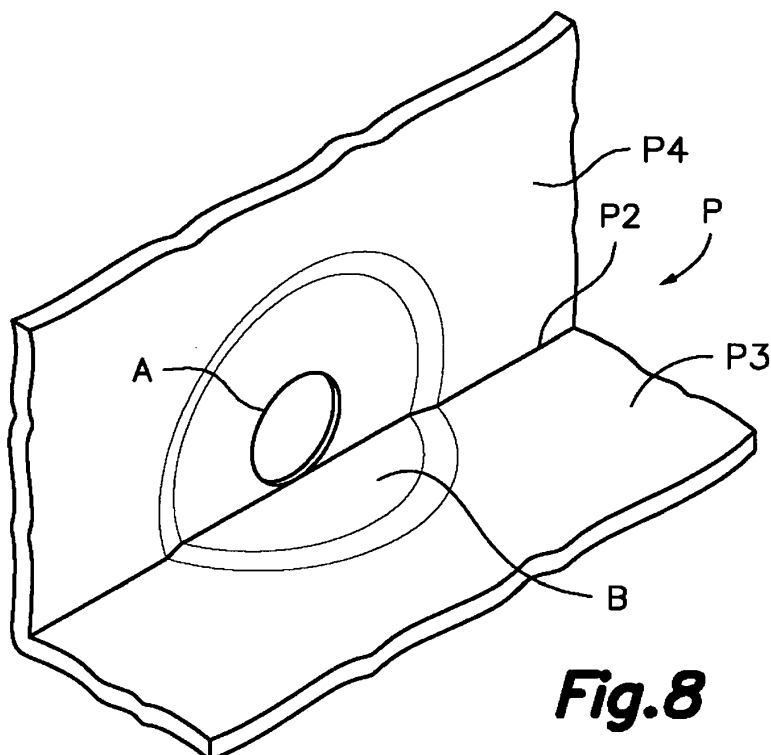


Fig. 8

Description

Field of the Art

[0001] The present invention relates to an apparatus and to a method for processing corrugated cardboard blanks for making cardboard boxes, including a sealing unit, and a method for sealing edges of holes in said corrugated cardboard blanks for the purpose of preventing the access of liquids and dirt to the inner structures of the corrugated cardboard exposed in the edges of the holes. Optionally, the apparatus of the present invention furthermore comprises a box forming unit for the formation of the corrugated cardboard boxes from the corrugated cardboard blanks with the holes sealed. The invention is generally useful in the field of corrugated cardboard blanks and boxes, and more particularly corrugated cardboard blanks resistant to liquids and corrugated cardboard boxes for containing products susceptible of exuding or producing liquids, such as fish and other marine products, or vegetable products.

Background of the Invention

[0002] Corrugated cardboard is a material in the form of a lamina formed by two outer layers of flat material and at least one inner layer of corrugated material which forms a structure defining inner flutes between said two outer layers. Corrugated cardboard presents excellent qualities of heat insulation and resistance in relation to weight which make it very suitable as a packaging material. Furthermore, corrugated cardboard can be easily recycled and is environmentally friendly. Corrugated cardboard boxes for containing any type of product, which are obtained by folding from a flat corrugated cardboard blank, are well known and widely used. Subjecting corrugated cardboard to a treatment to make it resistant to liquids is known, and the use of treated corrugated cardboard boxes, optionally provided with drain holes, for containing products susceptible of exuding or producing liquids, such as fish and other marine products, or vegetable products, is recently becoming widespread. However, when the corrugated cardboard is cut, for example to form a blank, the mentioned inner structure and openings in communication with said flutes are exposed in the cut edges of the corrugated cardboard blank and in the edges of the drain holes, and there is the risk that the liquids can penetrate the inner structure of the corrugated cardboard through said openings exposed in the cut edges and edges of the holes.

[0003] Patents JP-A-2005014989 and US-A-3937390 describe respective treated corrugated cardboard boxes provided for containing fish and provided with drain holes in a bottom wall or in side walls next to the bottom. However, they neither describe nor suggest a solution to the problem of the access of liquids to the inner structure of the corrugated cardboard through the openings exposed in the edges of the drain holes.

[0004] Patent EP-A-0636555 discloses a treated corrugated cardboard box for containing fish, which is provided with several drain holes in a bottom wall, and wherein the edge of each drain hole is coated by a complement of a plastic material. The complement is formed by an inner part and an outer part, coupled by snap-fitting. The inner part has a sleeve fittingly inserted in the hole and a crown extending over the inner surface of the bottom wall in a region around the hole. The outer part projects externally from the bottom wall and has a plurality of radial conduits in communication with the central conduit of the sleeve and with the exterior. A drawback of this complement is that the mentioned crown of the inner part, which is arranged in the region around the hole, forms a protrusion preventing an efficient and complete draining of the liquids towards the central conduit of the sleeve. Another drawback is of an economic nature, since the provision and installation of an inner part and another outer part for each hole is expensive and complex. Furthermore, the plastic parts attached to the box complicate or prevent the recycling of the corrugated cardboard.

[0005] Patent GB-A-2344786 describes a process for closing the linear edges of a corrugated cardboard blank by means of a tape. The tape is folded in a U shape, with a central portion applied to the linear edge of the blank and side portions applied and adhered to regions of the outer faces of the blank adjacent to the linear edge. However, this document does not describe how to close curved edges or the edge of a round hole with a tape folded in a U-shape, since this is geometrically impossible unless cuts or folds are made in the tape which can compromise the tightness.

[0006] Patents US-A-3635451 and US-A-3711352 describe corrugated cardboard blanks with at least one linear edge closed by means of operations performed in the material itself and with the cooperation of an adhesive, said operations being non-viable in practice to close the edge of a hole.

[0007] Patent US-A-5162061 discloses a device for introducing a liquid into the inner flutes of a corrugated cardboard blank through the openings of said flutes exposed in a cut edge of the blank by means of a continuous process. The blank is moved in a vertical position below a liquid application nozzle to receive the liquid through the openings exposed in the upper edge. The liquid impregnates the layers of the corrugated cardboard, and the excess liquid is drained through the openings of the flutes exposed in the lower edge. The object of this device is to impregnate the corrugated cardboard to improve its performance without deteriorating its outer appearance, but it does not serve to seal the cut edges of the corrugated cardboard blank.

[0008] Documents US-A-2798416, US-A-3978774, ES-A-8700148, ES-A-235835-U and ES-A-255122-U describe different examples of automatic machines for forming cardboard boxes from conventional flat corrugated cardboard blanks, which are provided with cuts and

flaps in corner regions which will form the corners of the box. These known machines generally comprise a mold with four corner assemblies delimiting a molding cavity and a plunger operated to move vertically downwards for pressing a bottom portion of the blank into the molding cavity and forming the cardboard box in cooperation with openings in communication with corner assemblies of the mold. However, this type of known machine is not capable of forming cardboard boxes from flat cardboard blanks without cuts in the corner regions due to the difficulty of folding in a controlled manner quadrangular corner portions of the blank by a diagonal fold by means of the simple downward pressure exerted by the plunger.

Disclosure of the Invention

[0009] The present invention provides an apparatus for processing corrugated cardboard blanks resistant to liquids, without cuts in the corner regions and with drain holes, for forming cardboard boxes suitable for products susceptible of exuding or producing liquids. The present invention also provides a sealing method for sealing the edges of the drain holes in said corrugated cardboard blanks.

[0010] The corrugated cardboard of which the blanks are made comprises two outer layers of flat material and at least one inner layer of corrugated material forming inner flutes between said two outer layers, and wherein each of said corrugated cardboard blanks comprises at least one through hole which leaves exposed in the edge thereof openings in communication with said inner flutes. The sealing method of the present invention comprises the steps of injecting an amount of glue into said inner flutes of the corrugated cardboard blank through the mentioned openings in the edge of the hole, and then pressing the outer layers of the corrugated cardboard blank against one another in a region around said hole with a pressure sufficient to flatten said corrugated inner layer. The apparatus of the present invention comprises a sealing unit implementing this method for sealing holes in the corrugated cardboard blanks, and optionally a box forming unit for the formation of the corrugated cardboard boxes from the blanks with the holes sealed.

[0011] The sealing unit comprises glue injection means in connection with a nozzle, which is adapted to be positioned and inserted in said hole of the corrugated cardboard blank for injecting an amount of glue into the inner flutes of the corrugated cardboard through the openings in the edge of the hole, and pressure means configured to press the outer layers of the corrugated cardboard blank against one another in said region around the hole with a pressure sufficient to flatten said corrugated inner layer.

[0012] Depending on the type of glue used, such glue must be applied in hot conditions to confer a suitable fluidity to it, and the adhesive strength of the glue is not manifested until it has partially cooled. When a glue of this type is used, the method of the present invention

comprises carrying out the mentioned step of pressing in two stages. A first stage comprises applying a first pressure to the region around the hole of the corrugated cardboard blank while the glue is substantially at said application temperature for the purpose of flattening the inner flutes and spreading said amount of glue between the two outer layers in said region, and a second stage comprises applying a second pressure to the region around the hole of the corrugated cardboard blank when the temperature of the glue has decreased substantially below said application temperature and maintaining said second pressure for a time sufficient for the at least partial solidification of the glue. The mentioned first and second stages of applying pressure are separated by a period during which the pressure is released.

[0013] Accordingly, for the application of the previous variant of the method, the apparatus of the present invention furthermore comprises heating means for heating said amount of glue to be injected to an application temperature, and said pressure means comprise spreading pressure means for applying a first pressure to the region around the hole of the corrugated cardboard blank while the glue is substantially at said application temperature for the purpose of flattening the inner flutes and spreading the amount of glue between the two outer layers in said region, and consolidation pressure means for applying a second pressure to the region around the hole of the corrugated cardboard blank when the temperature of the glue has decreased substantially below said application temperature and for maintaining said second pressure for a time sufficient for the at least partial solidification of the glue.

[0014] In one embodiment, the mentioned injection means, said heating means and said spreading pressure means are integrated in at least one injection and spreading unit installed in an injection and spreading station, and said consolidation pressure means are integrated in at least one consolidation unit installed in a consolidation station. In this case, the apparatus comprises conveying means for intermittently moving successive corrugated cardboard blanks first from a blank feeding device to said injection and spreading station, then from the injection and spreading station to said consolidation station, and finally from the consolidation station to a blank outlet to direct the blanks towards a storage station, towards a box forming unit integrated in the same apparatus as the sealing unit to form cardboard boxes from said blanks, or towards an independent box forming machine.

[0015] If, as is usual, each of the corrugated cardboard blanks has several holes which must be sealed, in the injection and spreading station there are installed several of said injection and spreading units, one for each hole of the corrugated cardboard blank, positioned to perform in unison an injection and spreading operation in relation to all the holes of each corrugated cardboard blank while same is maintained by the conveying means temporarily stopped in a work position, and in the consolidation station there are installed several of said consolidation units,

one for each hole of the corrugated cardboard blank, which are positioned to perform in unison a consolidation operation in relation to all the holes of each corrugated cardboard blank while same is maintained by the conveying means temporarily stopped in a work position. Preferably, for an optimization of the times, the apparatus is synchronized such that the injection and spreading units act on a corrugated cardboard blank in the injection and spreading station at the same time as the consolidation units act on another corrugated cardboard blank in the consolidation station, in which the injection and spreading operation has already been performed previously in the injection and spreading station, and so on.

[0016] The flat corrugated cardboard blanks for forming boxes for products susceptible of exuding or producing liquids do not have cuts in the corner regions. Each of these blanks has formed therein two longitudinal fold lines and two transverse fold lines, which are intersecting, defining a central bottom portion, two front and rear portions, two side portions and four substantially quadrangular corner portions. Each corner portion furthermore has a diagonal fold line between a free vertex of the corner portion and the corresponding vertex of the bottom portion. The drain holes are preferably formed in the front and rear portions adjacent to the corresponding transverse fold lines.

[0017] Throughout this description, the terms "longitudinal", "transverse", "front", "rear", "side" and derivatives are used with reference to the direction in which a feeding device makes the blanks advance through the apparatus, regardless of which longitudinal or transverse dimension of the blank or of the box or lid obtained is the longest.

[0018] The box forming unit comprises a mold with at least four corner assemblies defining a cavity and an upper mouth for said cavity, a blank feeding device capable of placing said flat blanks one by one in an initial position on said mouth of the cavity, and a plunger operated to move vertically downwards and provided with one or more lower pressure surfaces for pressing said bottom portion of the blank and inserting it into the cavity and thus cause an upward folding of the front, rear and side portions of the blank in cooperation with elements of said corner assemblies of the mold. The mold furthermore comprises pushing elements arranged in said corner assemblies in positions selected to be below said corner portions of the blank when the blank is in said initial position. The mentioned pushing elements are operated to push the corner portions upwards for the purpose of starting a folding thereof through said diagonal fold lines before the action of said plunger. Upper stops arranged to support the blank from the upper side while it is pushed by said pushing elements from the lower side are also arranged in the mold.

[0019] The mentioned upper stops preferably include front and rear upper stops located for the purpose of being respectively above said front and rear portions of the blank, in positions adjacent to said longitudinal fold lines, when the blank is in the initial position for the purpose of

supporting from the upper side the front and rear portions of the blank while the corner portions are pushed by the pushing elements, and thus favoring a folding of the portions of the longitudinal fold lines between the front and rear portions of the blank and the corner portions at the same time as the folding of the diagonal fold lines is performed.

[0020] The plunger includes, in addition to the mentioned lower pressure surfaces, side stops arranged to press the corner portions folded through the diagonal fold lines against the side portions of the blank and against side plates of the corner assemblies of the mold when the blank is inserted in the cavity of the mold by the plunger. As is conventional, the box forming unit includes an adhesive applying device arranged to apply adhesive to selected areas of the blank before the blank is placed in the initial position, more specifically, during the path of the blank pushed by the feeding device from a stack of blanks to the mouth of the mold. The mentioned areas where the adhesive is applied encompass areas suitable for adhering the corner portions folded through the diagonal fold lines to the side portions of the blank in cooperation with the pressure exerted by said side stops.

Brief Description of the Drawings

[0021] The previous and other features and advantages will be more fully understood from the following detailed description of an embodiment with reference to the attached drawings, in which:

*Figure 1 is a schematic perspective view of an apparatus for processing corrugated cardboard blanks for making cardboard boxes according to an embodiment of the present invention;

Figure 2 is a sectioned side view of an injection and spreading unit forming part of the apparatus of Figure 1 in an inactive position in relation to a corrugated cardboard blank;

Figure 3 is a sectioned side view of the injection and spreading unit in a first active position in relation to the corrugated cardboard blank;

Figure 4 is a sectioned side view of the injection and spreading unit in a second active position in relation to the corrugated cardboard blank;

Figure 5 is a sectioned side view of a consolidation unit forming part of the apparatus of Figure 1 in an inactive position in relation to the corrugated cardboard blank;

Figure 6 is a sectioned side view of the consolidation unit in an active position in relation to the corrugated cardboard blank;

Figure 7 is a sectioned partial perspective view of a corrugated cardboard blank with a hole sealed by means of the apparatus and/or the method of the present invention; and

Figure 8 is a partial perspective view of a cardboard box obtained by folding a corrugated cardboard

blank with a hole sealed by means of the apparatus and/or the method of the present invention.

Figure 9 is a plan view of a basic flat cardboard blank, from which the box forming unit of the apparatus of the present invention can form a basic cardboard box;

Figure 10 is a plan view of another flat cardboard blank provided with appendages, from which the box forming unit of the apparatus of the present invention can form a cardboard box with partial covers or roofs; Figure 11 is a partial perspective view showing an intermediate step of folding of the blank of Figure 9 to be performed by the box forming unit of the apparatus of the present invention for the formation of a corner of a basic box;

Figure 12 is a partial perspective view of the inner side of the corner of the basic box of Figure 11 finished;

Figure 13 is a perspective view of a cardboard box with partial covers or roofs formed from the blank of Figure 10;

Figure 14 is a partial perspective view of the box forming unit, which shows the action of several elements of the mold for performing an initial step of folding of corner portions of the blank; and

Figure 15 is a partial perspective view of the box forming unit, which shows the action of a plunger in cooperation with the mold for performing a subsequent step of folding of the corner portions of the blank;

Detailed Description of Exemplary Embodiments

[0022] The apparatus for processing corrugated cardboard blanks for making cardboard boxes comprises a sealing unit for sealing edges of holes formed in said corrugated cardboard blanks for the purpose of preventing the access of liquids and dirt to the inner structures of the corrugated cardboard exposed in the edges of the holes, and optionally a box forming unit for the formation of the corrugated cardboard boxes from the corrugated cardboard blanks with the holes sealed.

[0023] Figure 1 shows the mentioned sealing unit according to an embodiment of the apparatus of the present invention. The sealing unit comprises an injection and spreading station 100 in which there is arranged a number of injection and spreading units 10 (described in detail below in relation to Figures 2, 3 and 4), and a consolidation station 500 in which there is arranged a number of consolidation units 50 (described in detail below in relation to Figures 5 and 6). The apparatus furthermore includes conveying means configured to intermittently move successive corrugated cardboard blanks P first from a blank feeding device (not shown) to said injection and spreading station 100, then from the injection and spreading station 100 to said consolidation station 500, and finally from the consolidation station 500 to a blank outlet (not shown), from where the blanks are directed

to a storage station, to a box forming unit, or to a box forming machine for forming cardboard boxes from said blanks. The mentioned conveying means can be of any conventional type of those used in the field of handling corrugated cardboard blanks, for example in cardboard box forming folding machines. The conveying means are configured to transport and support the corrugated cardboard blanks P between lower runners 2 and upper runners 3 along a path T in an imaginary plane through the injection and spreading station 100 and consolidation station 500.

[0024] The corrugated cardboard comprises, as is known, two outer layers of flat material and at least one inner layer of corrugated material forming inner flutes between said two outer layers. Each of the corrugated cardboard blanks P handled by the conveying means comprises several through holes A which leaved exposed in the edges thereof openings in communication with said inner flutes. The apparatus and the method of the present invention serve to seal the edges of the holes in the corrugated cardboard blanks. In the example shown in Figure 1, the corrugated cardboard blanks P are flat blanks with several fold lines P2 provided for the subsequent formation of cardboard boxes by the folding thereof. The boxes are configured to contain products susceptible of exuding or producing liquids, such as fish and other marine products, or vegetable products, and each corrugated cardboard blank P has four holes which will be drain holes in the corresponding box. Accordingly, to seal the edges of the four holes, in the injection and spreading station 100 there are installed four of said injection and spreading units 10 positioned to act in unison in relation to the four holes A of each corrugated cardboard blank P while same is maintained stopped by the conveying means in a work position, whereas in the consolidation station 500 there are installed four of said consolidation units 50 positioned to act in unison in relation to the four holes A of each corrugated cardboard blank P while same is maintained stopped by the conveying means in a work position.

[0025] With reference now to Figures 3, 4 and 5, each injection and spreading unit 10 comprises a first die 11 and a first punch 15. The mentioned first die 11 includes a first die body 18 to which a nozzle 12 is fixed, which has a peripheral surface sized to be fittingly inserted in the hole A of the corrugated cardboard blank P and a frustoconical end for providing a centering of the hole A of the corrugated cardboard blank P. In said peripheral surface of the nozzle 12 there is formed an annular groove 22 in which a plurality of radial injection outlets 14 open, said radial injection outlets 14 being communicated with a main passage of the nozzle 12 and with the exterior. A glue injecting device 24, of the conventional type, is in connection with said main passage of the nozzle 12 through at least one conduit 20 formed through said first die body 18 for supplying amounts of glue to be injected from the nozzle 12. The first die body 18 defines a first spreading pressure surface 13 arranged around

the nozzle 12 for making contact with the region B around the hole A on a first side (lower side in the figures) of the corrugated cardboard blank P. The annular groove 22 of the nozzle 12 is positioned in relation to the first spreading pressure surface 13 in a manner suitable to be substantially facing said openings of the inner flutes exposed in the edge of the hole A when said first spreading pressure surface 13 is in contact with said first side of the corrugated cardboard blank P, as shown in Figure 3. In a particular embodiment, not shown, the mentioned annular groove is incomplete and comprises, for example, two annular channel portions suitable for covering two facing sectors of the edge of the hole A, where the mentioned inner flutes are exposed.

[0026] Inside a housing in the first die body 18 there is housed a heating device 19, such as an electric resistor, arranged to heat the glue in said conduit 20 and in the main passage and injection outlets 14 of the nozzle 12. To that end, the first die body 18 is of a metal material with a high heat transfer coefficient, such as an alloy of iron, aluminium or copper, and the same can be said of the nozzle 12.

[0027] The injection and spreading unit 10 likewise comprises a first punch 15 facing the first die 11. Said first punch 15 includes a first punch body 21 having an opening 16 capable of fittingly housing at least one part of the nozzle 12 and defining a second spreading pressure surface 17 arranged around said opening 16 for making contact with the region B around the hole A on a second side (upper side in the figures) of the corrugated cardboard blank P. The mentioned first punch body 21 is a hollow body of a material with a low coefficient of friction, such as, for example, Teflon, to prevent the adhesion of remains of glue, and is fixed on a core 25 of a metal material. The core 25 has an axial cavity 28 communicated with the opening 16 of the first punch body 21, and the core 25 and the first punch body 21 have respective facing side openings 26, 27 for facilitating the removal and cleaning of any remains of glue accumulated in said axial cavity 28 (Figure 2). First driving means are arranged to move said first die 11 and/or said first punch 15 towards one another to insert the nozzle 12 in the hole A of the corrugated cardboard blank P in order to be able to inject an amount of glue through the openings of the inner flutes exposed in the edge of the hole A, and press the region B around the hole A on both sides of the corrugated cardboard blank P by means of said first and second spreading pressure surfaces 13, 17 after the glue has been injected, applying a pressure sufficient to flatten the inner flutes of the corrugated cardboard blank P. Said first driving means comprise a first linear actuator 23, such as a pneumatic linear actuator (shown in Figure 1), which is connected to the first die 11, and a second actuator 26, such as a pneumatic linear actuator (Figures 2 to 4), which is connected to the first punch 15.

[0028] The operation of the injection and spreading unit 10 is as follows. The conveying means move a corrugated cardboard blank P to the injection and spreading

station 100 and stop it in a position in which each hole A of the corrugated cardboard blank P is aligned with the corresponding injection and spreading unit 10. The corrugated cardboard blank P is arranged at a constant height determined by the lower runners 2 and upper runners 3 between the first die 11 and the first punch 15, which are both in respective inactive positions (Figure 2). The heating device 19 housed in the first die body 18 is activated to heat the first die body 18 including the conduit 20, the first spreading pressure surface 13 and the nozzle 12, whereby the amount of glue to be injected is heated to a suitable application temperature for conferring sufficient fluidity to it.

[0029] Said first actuator 23 is then operated to move the first die 11 from its inactive position (Figure 2), in which the first spreading pressure surface 13 is separated from the first side of the corrugated cardboard blank P and the nozzle 12 is outside the hole A, to a work position (Figure 3), in which the first spreading pressure surface 13 is in contact with the first side of the corrugated cardboard blank P and the nozzle 12 is inserted in the hole A. In this work position the annular groove 22 and the plurality of injection outlets 14 of the nozzle 12 are facing the edge of the hole A of the corrugated cardboard blank P. Then, the glue injecting device 24 is activated to inject the amount of glue at the application temperature into the inner flutes of the corrugated cardboard blank P through the openings exposed in the edge of the hole A by means of the nozzle 12.

[0030] Next, the second actuator 23 is operated to move the first punch 15 from its inactive position (Figures 2 and 3), in which the second spreading pressure surface 17 is separated from the second side of the corrugated cardboard blank P, to a work position (Figure 4), in which the second spreading pressure surface 17 is pressed against the region B around the hole A on the second side of the corrugated cardboard blank P while the region B around the hole A on the first side of the corrugated cardboard blank P is supported by the first spreading pressure surface 13 of the first die 11, which acts like a dolly. The applied pressure is sufficient to flatten the inner flutes of the corrugated cardboard blank P, and this causes a spreading of the amount of glue substantially at the application temperature in the region B. After this, the first die 11 and the first punch 15 are again taken to their respective inactive positions, releasing the pressure, and the conveying means move the corrugated cardboard blank P to the consolidation station 500.

[0031] Upon releasing the pressure, the glue is still hot enough to have a low adhesive strength, and this, in some cases depending on the characteristics of the corrugated cardboard, can allow a partial recovery of the region B to its original state. In the time elapsing during the path of the corrugated cardboard blank P from the injection and spreading station 100 to the consolidation station 500, the spread glue cools to a temperature substantially below the application temperature and acquires adhesive strength.

[0032] In relation now to Figures 5 and 6, the consolidation units 50 are described below. Each consolidation unit 50 comprises a second die 51 including a second die body 57 with an opening 52 adapted to the dimensions of the hole A of the corrugated cardboard blank P and a first consolidation pressure surface 53 arranged around said opening 52 for making contact with the region B around the hole A on the first side of the corrugated cardboard blank P. The consolidation unit furthermore comprises a second punch 54 including a second punch body 58 defining a stump 55 sized to be fittingly inserted through the hole A of the corrugated cardboard blank P and in the opening 52 of said second die 51, and a second consolidation pressure surface 56 arranged around said stump 55 for making contact with the region B around the hole A on the second side of the corrugated cardboard blank P. Second driving means are arranged to move said second die 51 and/or said second punch 54 towards one another to press the region B around the hole A on both sides of the corrugated cardboard blank P by means of said first and second consolidation pressure surfaces 53, 56 applying a pressure sufficient to flatten the inner flutes of the corrugated cardboard blank P. These second driving means comprise an actuator 62, such as a pneumatic linear actuator, connected to the second punch 54, whereas the second die 51 is static and are fixed to a structure of the apparatus.

[0033] The mentioned second punch body 58 is a hollow body of a material with a low coefficient of friction, such as Teflon, fixed to a second core 64, which is of a metal material. The mentioned stump 55 formed in the second punch body 58 is sized to slide fittingly inside the hole A of the corrugated cardboard blank P for the purpose of sweeping any excess of glue adhered to its inner edge. The end of the stump 55 is frustoconical to provide a centering of the hole A of the corrugated cardboard blank P. The second die body 57 is in the form of a plate of a material with a low coefficient of friction, such as Teflon, and is fixed to a first core 59 of a metal material by means of a retaining ring 63 coupled in a threaded manner to the mentioned first core 59. Between the second die body 57 and the first core 59 there is arranged a steel sheet 60 provided with a hole 61 aligned with said opening 52 of the second die body 57 and sized to slide fittingly along said stump 55 of the second punch 54 when the latter is inserted in the opening 52 of the second die body 57 for the purpose of retaining any remains of glue adhered thereto. The second die body 57 has a cavity 65 in communication with the hole 61 of said steel sheet 60 and the opening 52 of the second die body 57, and furthermore has side openings 66 for facilitating the removal and cleaning of any remains of glue accumulated in said cavity 65.

[0034] The operation of the consolidation unit 50 is as follows. The conveying means move the corrugated cardboard blank P coming from the injection and spreading station 100 to the consolidation station 500 and stop it in a position in which each hole A of the corrugated card-

board blank P is aligned with the corresponding consolidation unit 10. The corrugated cardboard blank P is arranged at a constant height determined by the lower runners 2 and upper runners 3 between the second die 51 and the second punch 54, which is in an inactive position (Figure 5). The second die 51, the position of which is fixed, is located such that the first consolidation pressure surface 53 of the second die 51 is very close to the surface of a first side (lower side) of the corrugated cardboard blank P. It should be recalled that the region B around the hole A of the corrugated cardboard blank P has been previously pressed in the injection and spreading unit 10 and during the path between the injection and spreading station 100 and the consolidation station 500 the injected and spread glue has cooled to said temperature substantially below the application temperature.

[0035] The actuator 62 is then operated to move the second punch 54 from the inactive position (Figure 5), in which the second consolidation pressure surface 56 is separated from the second side of the corrugated cardboard blank P and the stump 55 is outside the hole A of the corrugated cardboard blank P, to a work position (Figure 6), in which the second consolidation pressure surface 56 is in contact with the second side of the corrugated cardboard blank P and the stump 55 is inserted in the hole A and in the opening 52 of the second die 51 while the first side of the corrugated cardboard blank P is supported by the first consolidation pressure surface 53 of the second die 51, which acts as a dolly. The pressure applied by the first and second consolidation pressure surfaces 53, 56 to the region B around the hole A of the corrugated cardboard blank P is sufficient to again flatten the inner flutes of the corrugated cardboard, and is maintained for a time sufficient to allow the at least partial solidification of the glue, which is at an increasingly lower temperature in relation to said application temperature and has an increasing adhesive strength. Then, the pressure is released and the conveying means move the corrugated cardboard blank P towards the mentioned blank outlet (not shown) for a storage station or a machine for assembling boxes from said blanks.

[0036] Figure 7 shows the result obtained by the apparatus and/or the method of the present invention. The corrugated cardboard blank P has a hole A and a flattened region B around the hole A, which is depressed in relation to the surface of the outer layer on a side of the corrugated cardboard blank P. The gaps between the two outer layers and the corrugated inner layer in the flattened region B are full of solidified glue, which seals the edge of the hole A against the penetration of liquids, dust and other detritus into the inner flutes of the corrugated cardboard through the openings of said flutes which would otherwise be exposed in the edge of the hole A. Alternatively, and depending on the configuration of the second die 51 and of the second punch 54, the depressed area in the region B around the hole A could be formed on the opposite side of the corrugated cardboard blank P, or distributed on both sides.

[0037] Figure 8 shows a detail of a cardboard box obtained by folding a corrugated cardboard blank P provided with several fold lines P2 and several holes A sealed by means of the apparatus and/or the method of the present invention. The box is made of an impregnated, treated or coated corrugated cardboard to make it at least externally resistant to liquids, and is provided for containing, for example, products susceptible of exuding or producing liquids, such as fish and other marine products, or vegetable products. Figure 8 shows a side wall P4 and a bottom wall P3 of the box, connected by one of said fold lines P2. The hole A is formed in said side wall P4 with its edge very close to the fold line P2, although alternatively the hole A could be partially extended in the bottom wall P3, and the depressed area in the region B around hole A is located on the inner side of the box, such that a part of the depressed area is arranged in the side wall P4 and another part in the bottom wall P3. The part of the depressed area located in the bottom wall P3 contributes to directing the liquids existing in the bottom of the box towards the drain hole A, the edge of which is sealed to prevent the penetration of liquids into the inner flutes of the corrugated cardboard through the openings of said flutes which would otherwise be exposed in the edge of the hole A.

[0038] A person skilled in the art will be able to make modifications and variations from the embodiment shown and described without departing from the scope of the present invention as it is defined in the attached claims. For example, if glue capable of solidifying quickly is used, the consolidation units 50 could be omitted and the consolidation pressure could be applied by the injection and spreading units 10 themselves. If the glue does not need to be heated, the heating means 19 could be omitted. The transport of the corrugated cardboard blanks P between the injection and spreading station 100 and the consolidation station 500 could be performed manually and the conveying means could be omitted. The holes A in the corrugated cardboard blank P, although shown round in the figures, could have any other shape, and in any case the nozzle 12 and the first spreading pressure surface 13 in the first die 11, the opening 16 and the second spreading pressure surface 17 in the first punch 15, the opening 52 and first consolidation pressure surface 53 in the second die 51, and the stump 55 and second consolidation pressure surface 56 in the second punch 54 will be formed according to the shape of the hole A in the corrugated cardboard blank P.

[0039] In relation to Figures 9 and 10, examples of flat corrugated cardboard blanks P are described below, which blanks are designed without cuts in the corner regions to form, from a folding and adhesion of parts thereof, cardboard boxes relatively resistant to water or to moisture. The box forming unit of the apparatus of the present invention is configured to form cardboard boxes from flat cardboard blanks of the type of those shown in Figures 9 and 10.

[0040] Figure 9 shows a basic blank P, which is suit-

able for the formation of boxes of a basic type. The mentioned blank P is formed by a substantially rectangular flat piece of corrugated cardboard in which there are formed two longitudinal fold lines P1 and two transverse fold lines P2, which are intersecting, defining in a central region a bottom portion P3, and in a peripheral region opposite front and rear portions P4, opposite side portions P5, and four substantially quadrangular corner portions P6. In each corner portion P6 there is formed a diagonal fold line P7 extending from a corner of the bottom portion P3 to an outer corner of the rectangular flat piece dividing the corner portion into two triangular halves. In the front and rear portions P4 there are formed holes A, each of which is surrounded by a region B sealed as has been described above in relation to the sealing unit and the sealing method.

[0041] Figures 11 and 12 show the formation of the corners of the box or lid from this basic blank P. Each corner portion P6 is initially folded through its corresponding diagonal fold line P7 forming a point towards the inside of the box or lid at the same time as the front, rear and side portions P4, P5 are folded upwards (Figure 11). Finally, when the front, rear and side portions P4, P5 are completely upright, the mentioned point formed by the folded corner portion P6 is placed against and adhered to the corresponding side portion P5 (Figure 12). A blank similar to the blank P shown in Figure 9 although without the holes A and surrounding regions B would be useful for forming corrugated cardboard lids using the box forming unit of the apparatus of the present invention or a box forming machine with similar features.

[0042] Figure 10 shows a more complex blank P, suitable for the formation of boxes provided with partial covers or roofs, such as the one shown in Figure 13. This complex blank P is similar to the basic blank P described above in relation to Figure 9, with the difference that the side portions P5 have appendages P8 and additional fold lines P9 between the side portions P5 and the appendages P8. The corners of the box are formed by folding the corner portions P6 through the diagonal fold lines P7, in a manner similar to that shown in Figures 11 and 12. The appendages P8 can be folded through the additional fold lines P9 to form with them partial covers or roofs along the sides of the cardboard box, as shown in Figure 13. The transverse fold lines P2 define flaps P10 at the ends of the appendages P8, and said flaps P10 are folded and adhered to the corresponding front and rear portions P4 to fix the appendages P8.

[0043] With reference to Figures 14 and 15, a cardboard box forming unit is described below which can optionally be arranged after the sealing unit in the apparatus for processing corrugated cardboard blanks according to an embodiment of the present invention, or can alternatively be integrated in an independent apparatus. The box forming unit comprises, as is conventional, a mold with four corner assemblies 1 provided with different elements defining a molding cavity with an upper mouth. A blank feeding device (not shown) individually places

blanks P (in the example shown, complex blanks P such as the one shown in Figure 10) in an initial position on said mouth of the molding cavity. An adhesive applying device (not shown) applies adhesive to selected areas of the blank P before the latter is placed in said initial position.

[0044] The box forming unit furthermore comprises a plunger 4 operated to move vertically downwards. The plunger 4 comprises a structure 36, 37 connected to a vertical rod 39 connected in turn to driving means, and in said structure 36, 37 there are provided side pressure parts 10 providing lower pressure surfaces arranged to press the bottom portion P3 of the blank P and insert it into the molding cavity, which causes an upward folding of the front, rear and side portions P4, P5 of the blank P in cooperation with elements of the corner assemblies 1 of the mold (Figure 15).

[0045] In the corner assemblies 1 of the mold there are arranged pushing elements 5 located below the corner portions P6 of the blank P when the blank P is in the initial position (Figure 14). Each of the pushing elements 5 is connected to a respective actuator 5a which can be activated to move the pushing element 5 upwards in interference with the blank P. The pushing elements 5 preferably have an elongated shape and are substantially aligned with the diagonal fold lines P7 although other configurations are also possible. In the example shown, the actuators 5a are pneumatic cylinders, although they could alternatively be other driving means.

[0046] The corner assemblies 1 furthermore include front and rear upper stops 6, 7 located above the front and rear portions P4 of the blank P, in positions adjacent to the longitudinal fold lines P1 when the blank P is in the initial position, for the purpose of supporting from the upper side the front and rear portions P4 of the blank P and thus favoring the folding of the front and rear portions P4 in the longitudinal fold lines P1 and the folding of the corner portions P6 through the diagonal fold lines P7 when the corner portions P6 are pushed upwards by the pushing elements 5 (Figure 14) just before the plunger 4 pushes the blank P downwards.

[0047] The mold furthermore comprises side upper stops 11 located above the side portions P5 of the blank P, or the appendages P8 if the blank is the complex blank P shown in Figure 10, preferably in positions adjacent to the additional fold lines P9 existing between the side portions P5 and the appendages P8 (Figure 14), when the blank P is in the initial position for the purpose of supporting the side portions P5 or the appendages P8 of the blank P from the upper side while the corner portions P6 are pushed by said pushing elements 5 from the lower side.

[0048] The structure 36, 37 of the plunger 4 furthermore has side stops 8 arranged at a higher level with respect to the side pressure parts 10 to press the corner portions P6 which are being folded through the diagonal fold lines P7 against the side portions P5 of the blank P and against side plates 9 located in the corner assemblies

1 of the mold while the blank P is inserted in the molding cavity 2 of the mold by the plunger 4. When the plunger 4 has reached its lower position, a folding device (not shown) is operated to make folding members rotate and thus fold the appendages P8 of the side portions P5 to form the partial covers or roofs of the box as has been described above in relation to Figure 13. Likewise, other elements (not shown) of the mold are operated to press the flaps P10 at the ends of the appendages P8 against the front and rear portions P4 of the blank P and thus assure their mutual adhesion, while the plunger 4 is still inside the box.

[0049] Both the side stops 8 and the side pressure parts 10 of the plunger 4 are assembled in the structure 36, 37 such that they can pivot about respective shafts 45, 43. Limiting members are arranged to limit the upward pivoting of the side stops 8 and of the side pressure parts 10 to respective horizontal positions, and elastic elements are arranged to push the side stops 8 and the side pressure parts 10 towards their horizontal positions.

[0050] Thus, when the plunger is lowered towards its lower position the side stops 8 and the side pressure parts 10 are maintained in their horizontal positions to press against the bottom portion P3 of the blank P, and when the plunger is withdrawn towards its upper position, the side stops 8 and the side pressure parts 10 pivot in contact with the partial covers or roofs P8 of the box, which allows extracting the plunger 4 from the cardboard box housed in the molding cavity avoiding the partial covers or roofs P8. The mentioned elastic elements return the side stops 8 and the side pressure parts 10 to their horizontal positions once they have come out of the box. Alternatively, the side stops 8 and the side pressure parts 10 can be installed in a retractable manner and operated by corresponding driving means in the structure 36, 37 of the plunger 4 with an equivalent result.

[0051] An additional object of the present invention is a die-cut corrugated cardboard blank with the features of the basic blank P shown in Figure 9 or of the complex blank P shown in Figure 10, but with the holes A simply die-cut without sealing, this corrugated cardboard blank being adapted to be treated by means of the sealing unit and/or the box forming unit of the apparatus for processing corrugated cardboard blanks of the present invention.

[0052] Modifications and variations based on the embodiments shown and described will occur to a person skilled in the art without departing from the scope of the present invention as it is defined in the attached claims.

Claims

1. An apparatus for processing corrugated cardboard blanks for making cardboard boxes, said corrugated cardboard comprising two outer layers of flat material and at least one inner layer of corrugated material forming inner flutes between said two outer layers, and wherein each of said corrugated cardboard

blanks (P) comprises at least one through hole (A) which leaves exposed in the edge thereof openings in communication with said inner flutes, said apparatus comprising a sealing unit including:

glue injection means in connection with a nozzle (12) adapted to be positioned and inserted in said hole (A) of the corrugated cardboard blank (P) for injecting an amount of glue into said inner flutes through said openings exposed in said edge of the hole (A); and

pressure means configured to press the outer layers of the corrugated cardboard blank (P) against one another in a region (B) around said hole (A) with a pressure sufficient to flatten said corrugated inner layer.

2. The apparatus according to claim 1, **characterized in that** it furthermore comprises heating means for heating said amount of glue to be injected to an application temperature, and **in that** said pressure means comprise spreading pressure means for applying a first pressure to the region (B) around the hole (A) of the corrugated cardboard blank (P) while the glue is substantially at said application temperature for the purpose of flattening the inner flutes and spreading the amount of glue between the two outer layers in said region (B), and consolidation pressure means for applying a second pressure to the region (B) around the hole (A) of the corrugated cardboard blank (P) when the temperature of the glue has decreased substantially below said application temperature and for maintaining said second pressure for a time sufficient for the at least partial solidification of the glue.

3. The apparatus according to claim 2, **characterized in that** said injection means, said heating means and said spreading pressure means are integrated in at least one injection and spreading unit (10) installed in an injection and spreading station (100), and said consolidation pressure means are integrated in at least one consolidation unit (50) installed in a consolidation station (500).

4. The apparatus according to claim 3, **characterized in that** said injection and spreading unit (10) comprises:

a first die (11) including a first die body (18) to which said nozzle (12) is fixed and defining a first spreading pressure surface (13) arranged around said nozzle (12) for making contact with the region (B) around the hole (A) on a first side of the corrugated cardboard blank (P);

a glue injecting device (24) in connection with the nozzle (12) through at least one conduit (20) through said first die body (18) for supplying the

amounts of glue to be injected from the nozzle (12);

at least one heating device (19) arranged to heat the first die body (18);

a first punch (15) including a first punch body (21) with an opening (16) capable of at least partly housing the nozzle (12) and a second spreading pressure surface (17) arranged around said opening (16) for making contact with the region (B) around the hole (A) on a second side of the corrugated cardboard blank (P); and

first driving means for moving said first die (11) and/or said first punch (15) towards one another until pressing the region (B) around the hole (A) on both sides of the corrugated cardboard blank (P) by means of said first and second spreading pressure surfaces (13, 17) after the glue has been injected.

5. The apparatus according to claim 4, **characterized in that** the nozzle (12) is sized to be fittingly arranged in the hole (A), said nozzle (12) having an annular groove (22) and a plurality of injection outlets (14) opening in said annular groove (22), the annular groove (22) being positioned to be substantially facing said openings of the inner flutes exposed in the edge of the hole (A), when said first spreading pressure surface (13) is in contact with said first side of the corrugated cardboard blank (P).

6. The apparatus according to claim 4, **characterized in that** said first die body (18) is of a material with a high heat transfer coefficient selected from a group comprising alloys of iron, aluminium and copper, among others, and said first punch body (21) is a hollow body of a material with a low coefficient of friction selected from a group comprising Teflon, among others, fixed to a core (25) of a metal material.

7. The apparatus according to claim 4, **characterized in that** support means are provided to support the corrugated cardboard blanks (P) in a work position in the injection and spreading station (100), and said first driving means comprise at least one first actuator for moving the first die (11) between an inactive position, in which the first spreading pressure surface (13) is separated from the first side of the corrugated cardboard blank (P) and the nozzle (12) is outside the hole (A), and a work position, in which the first spreading pressure surface (13) is in contact with the first side of the corrugated cardboard blank (P) and the nozzle (12) is inserted in the hole (A).

8. The apparatus according to claim 7, **characterized in that** said first driving means comprise at least one second actuator (23) for moving the first punch (15) between an inactive position, in which the second spreading pressure surface (17) is separated from

the second side of the corrugated cardboard blank (P), and a work position, in which the second spreading pressure surface (17) is pressed against the second side of the corrugated cardboard blank (P) while the first side of the corrugated cardboard blank (P) is supported by the first spreading pressure surface (13) of the first die (11).

9. The apparatus according to claim 3, **characterized in that** said consolidation unit (50) comprises:

a second die (51) including a second die body (57) defining an opening (52) adapted to be arranged aligned with the hole (A) of the corrugated cardboard blank (P) and a first consolidation pressure surface (53) arranged around said opening (52) for making contact with the region (B) around the hole (A) on the first side of the corrugated cardboard blank (P);

a second punch (54) including a second punch body (58) defining a stump (55) sized to be inserted through the hole (A) of the corrugated cardboard blank (P) and in the opening (52) of said second die (51), and a second consolidation pressure surface (56) arranged around said stump (55) for making contact with the region (B) around the hole (A) on the second side of the corrugated cardboard blank (P); and second driving means for moving said second die (51) and/or said second punch (54) towards one another to press the region (B) around the hole (A) on both sides of the corrugated cardboard blank (P) by means of said first and second consolidation pressure surfaces (53, 56) after the region (B) around the hole (A) of the corrugated cardboard blank (P) has been pressed in the injection and spreading unit (10) and the glue has cooled to said temperature substantially below the application temperature.

10. The apparatus according to claim 9, **characterized in that** said second die body (57) is a blank of a material with a low coefficient of friction selected from a group comprising Teflon, among others, fixed to a first core (59) of a metal material, and said second punch body (58) is a hollow body of a material with a low coefficient of friction selected from a group comprising Teflon, among others, fixed to a second core (64) of a metal material.

11. The apparatus according to claim 10, **characterized in that** said stump (55) of the second punch (54) is sized to slide fittingly inside the hole (A) of the corrugated cardboard blank (P) to sweep any excess of glue adhered to its inner edge, and the second die (51) furthermore includes a steel sheet (60) arranged between said second die body (57) and said first core (59) and provided with a hole (61) aligned with

said opening (52) of the second die body (57) and sized to slide fittingly along said stump (55) of the second punch (54) for the purpose of retaining any remains of glue adhered thereto.

12. The apparatus according to claim 9, **characterized in that** support means are provided to support the corrugated cardboard blanks (P) in a work position in the consolidation station (500), and said second driving means comprise at least one actuator (62) for moving the second punch (54) between an inactive position, in which the second consolidation pressure surface (56) is separated from the second side of the corrugated cardboard blank (P), and a work position, in which the second consolidation pressure surface (56) is in contact with the second side of the corrugated cardboard blank (P) and the stump (55) is inserted in the hole (A) and in the opening (52) of the second die (51) while the first side of the corrugated cardboard blank (P) is supported by the first consolidation pressure surface (53) of the second die (51).

13. The apparatus according to any one of the previous claims, **characterized in that** it furthermore comprises a box forming unit for forming boxes from corrugated cardboard blanks (P), each of which comprises at least one hole (A) with a flattened and sealed region (B) around said hole (A), intersecting longitudinal and transverse fold lines (P1, P2) defining a bottom portion (P3), four front, rear and side portions (P4, P5) and four substantially quadrangular corner portions (P6), each corner portion having a diagonal fold line (P7), wherein said box forming unit comprises:

a mold with four corner assemblies (1) defining a molding cavity with an upper mouth;
a blank feeding device capable of placing said corrugated cardboard blanks (P) one by one in an initial position on said mouth of the molding cavity; and

a plunger (4) operated to move vertically downwards and provided with one or more lower pressure surfaces for pressing said bottom portion (P3) of the corrugated cardboard blank (P) and inserting it into the molding cavity and thus cause an upward folding of said front, rear and side portions (P4, P5) of the corrugated cardboard blank (P) in cooperation with elements of said corner assemblies (1) of the mold, wherein the mold furthermore comprises:

pushing elements (5) arranged in said corner assemblies (1) below said corner portions (P6) of the corrugated cardboard blank (P) when the corrugated cardboard blank (P) is in said initial position and operated by

driving means to push the corner portions (P6) upwards for the purpose of starting a folding thereof through said diagonal fold lines (P7) before the action of said plunger (4); and
 upper stops (6, 7, 11) arranged to support the corrugated cardboard blank (P) from the upper side while it is pushed by said pushing elements (5) from the lower side.

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14. A method for processing corrugated cardboard blanks for making cardboard boxes, said corrugated cardboard comprising two outer layers of flat material and at least one inner layer of corrugated material forming inner flutes between said two outer layers, and wherein each of said corrugated cardboard blanks (P) comprises at least one through hole (A) which leaves exposed in the edge thereof openings in communication with said inner flutes, the method comprising the steps of:

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injecting an amount of glue into said inner flutes of the corrugated cardboard blank (P) through said openings exposed in said edge of the hole (A); and
 pressing the outer layers of the corrugated cardboard blank (P) against one another in a region (B) around said hole (A) with a pressure sufficient to flatten said corrugated inner layer.

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15. The method according to claim 14, **characterized in that** it further comprises heating said amount of glue to be injected to an application temperature, and **in that** it comprises carrying out said step of pressing in first and second stages, wherein:

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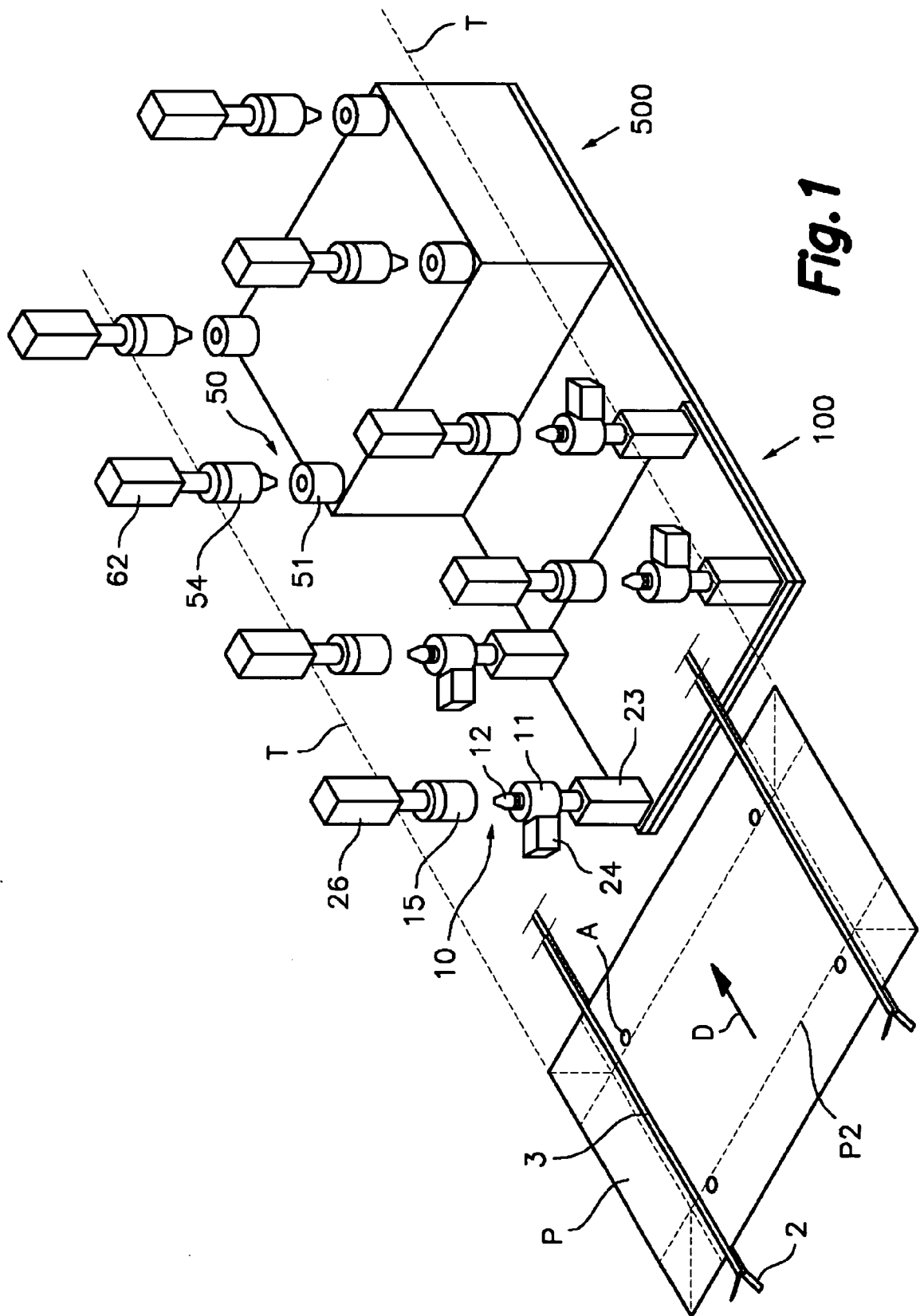
said first stage comprises applying a first pressure to the region (B) around the hole (A) of the corrugated cardboard blank (P) while the glue is substantially at said application temperature for the purpose of flattening the inner flutes and spreading said amount of glue between the two outer layers in said region (B); and
 said second stage comprises applying a second pressure to the region (B) around the hole (A) of the corrugated cardboard blank (P) when the temperature of the glue has decreased substantially below said application temperature and maintaining said second pressure for a time sufficient for the at least partial solidification of the glue,
 said first and second stages of applying pressure being separated by a period during which the pressure is released.

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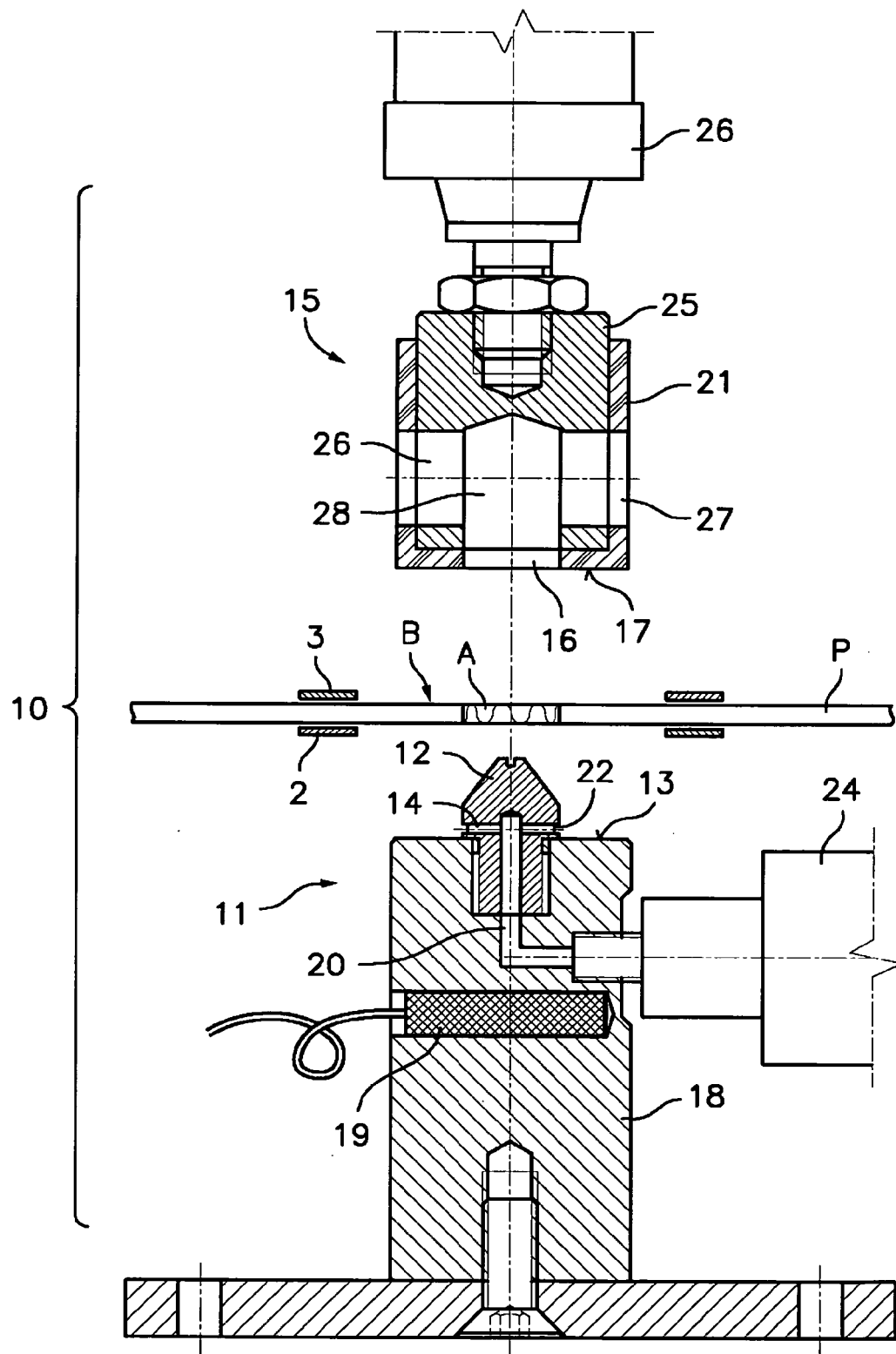


Fig.2

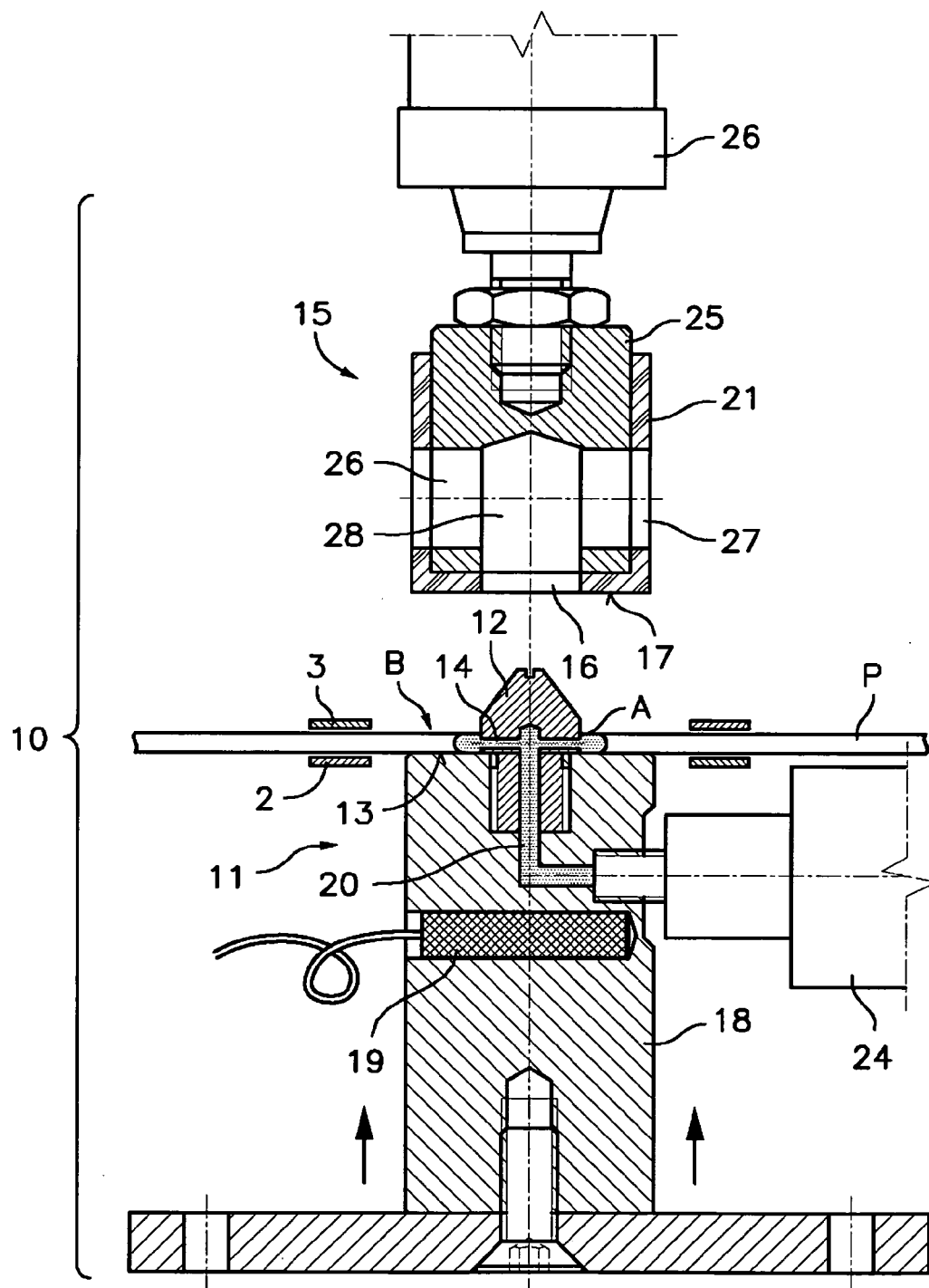


Fig.3

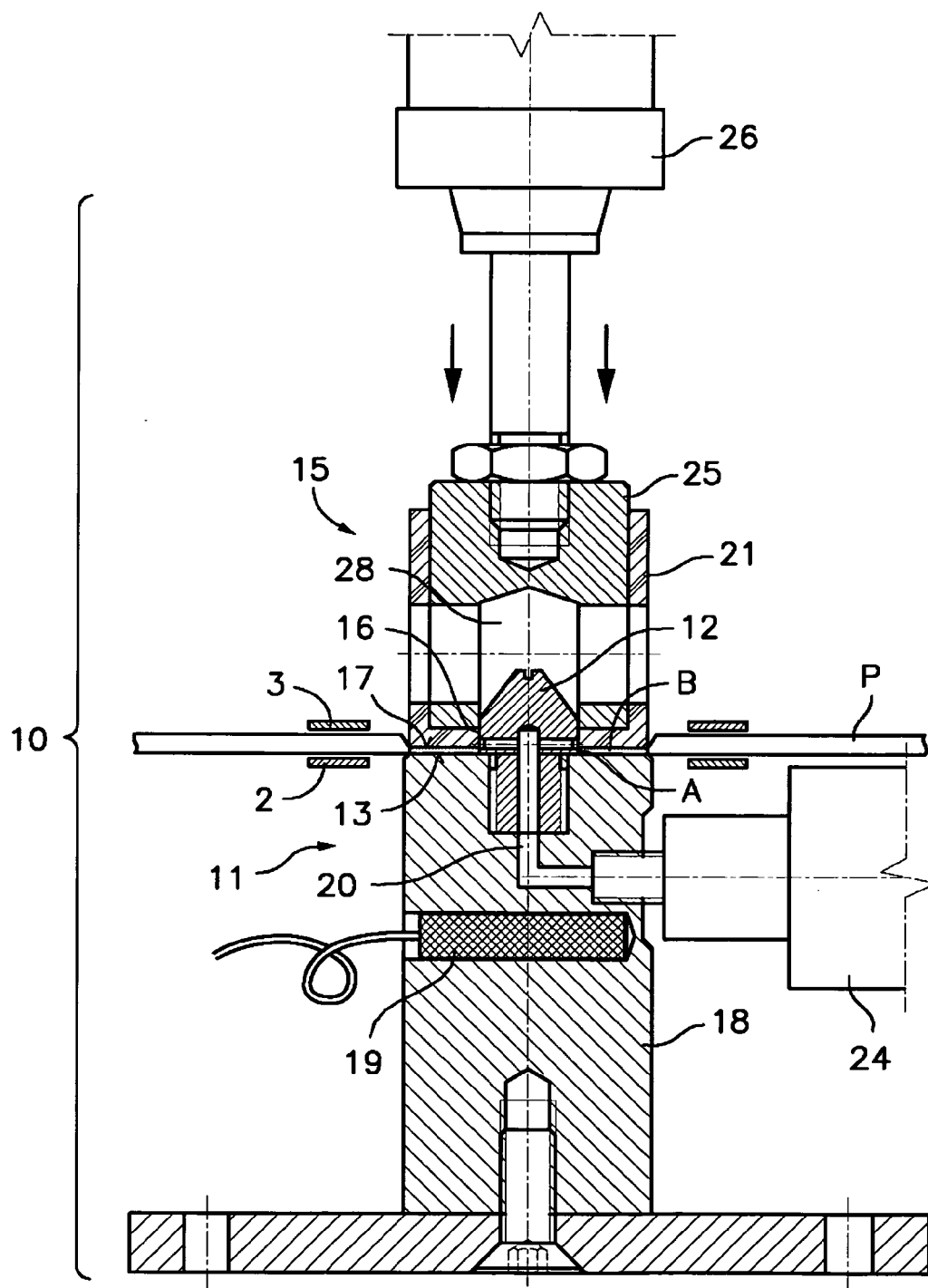


Fig. 4

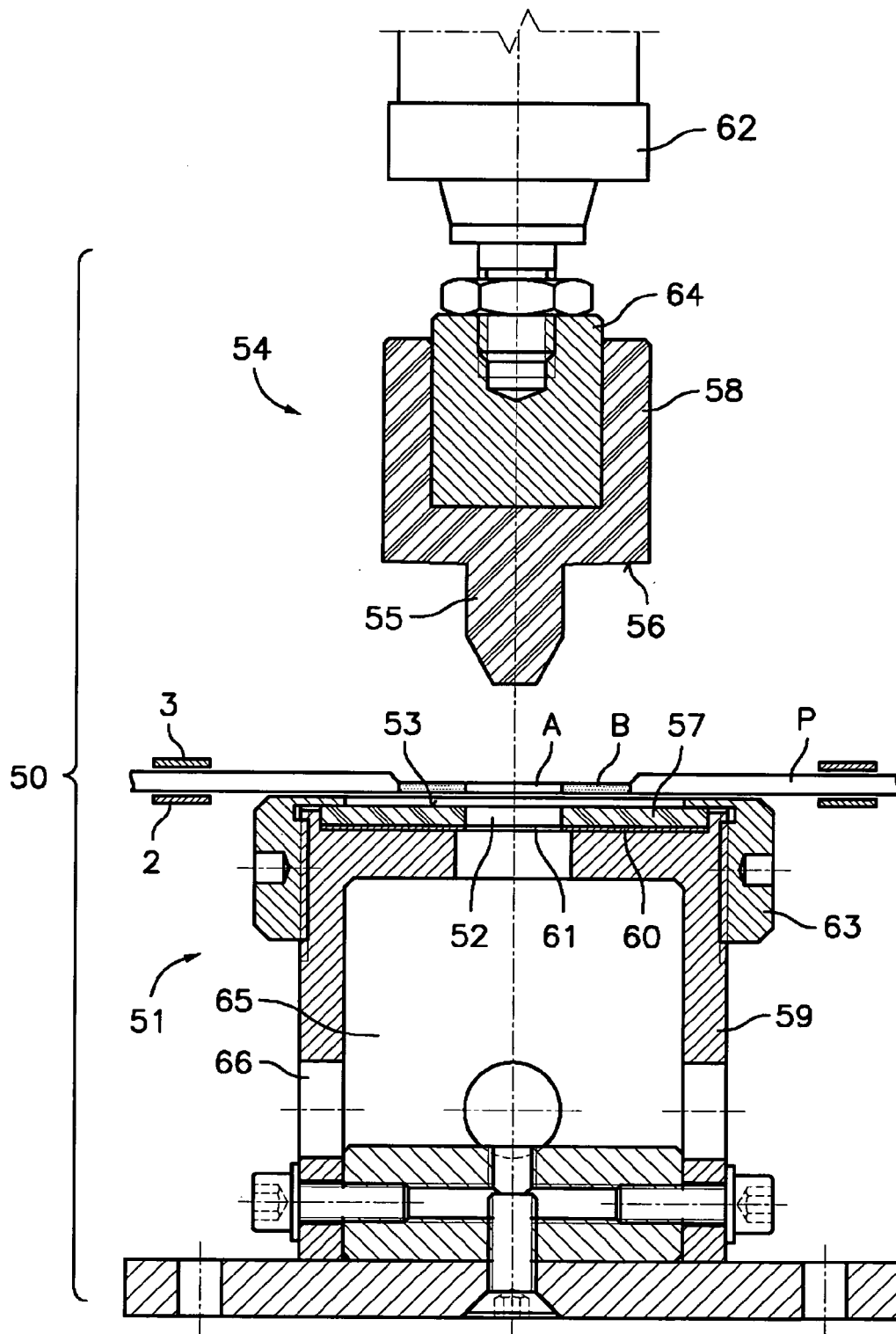


Fig.5

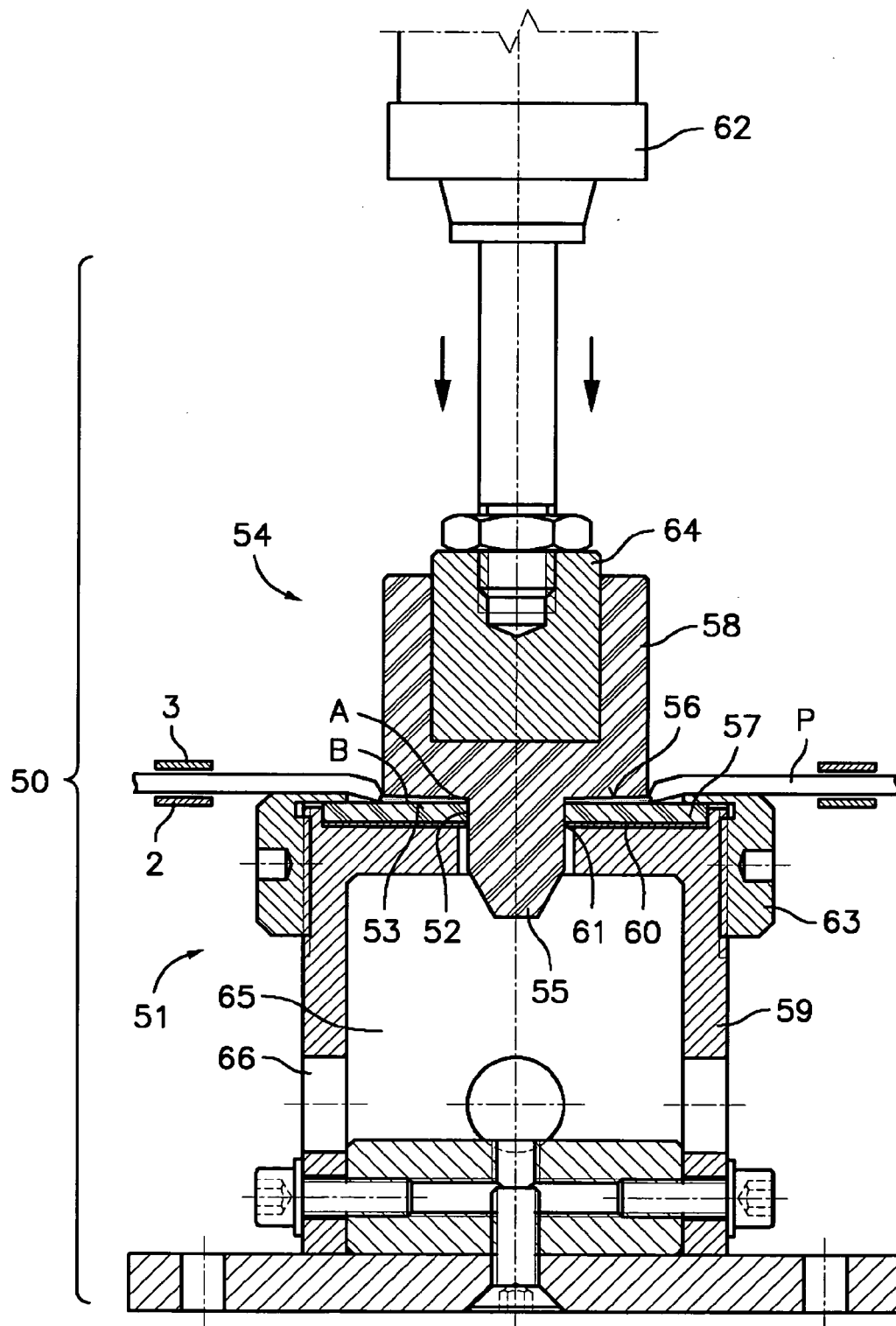


Fig. 6

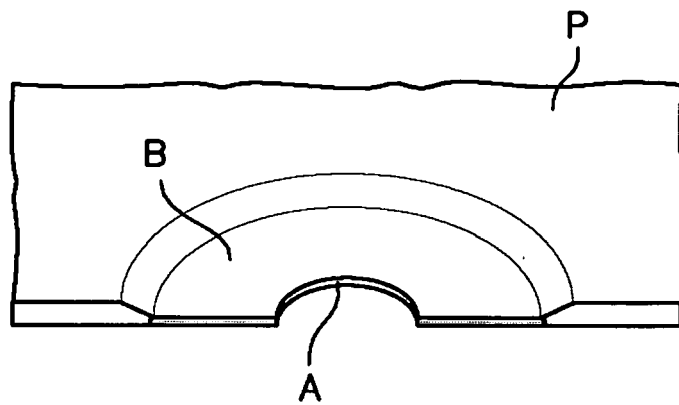


Fig.7

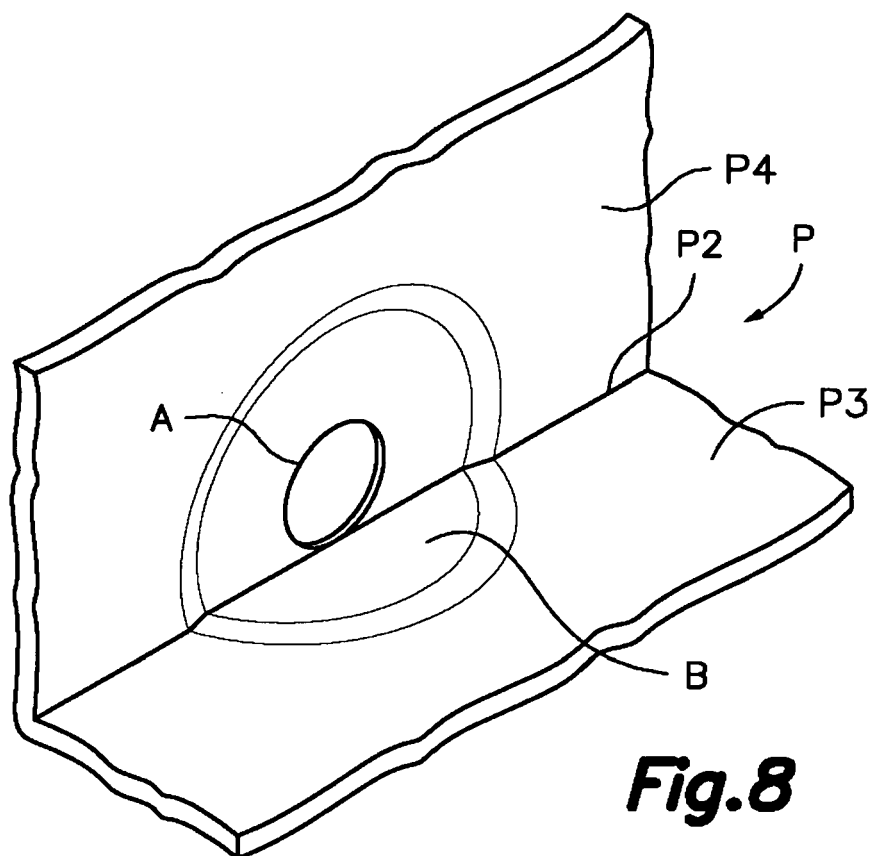
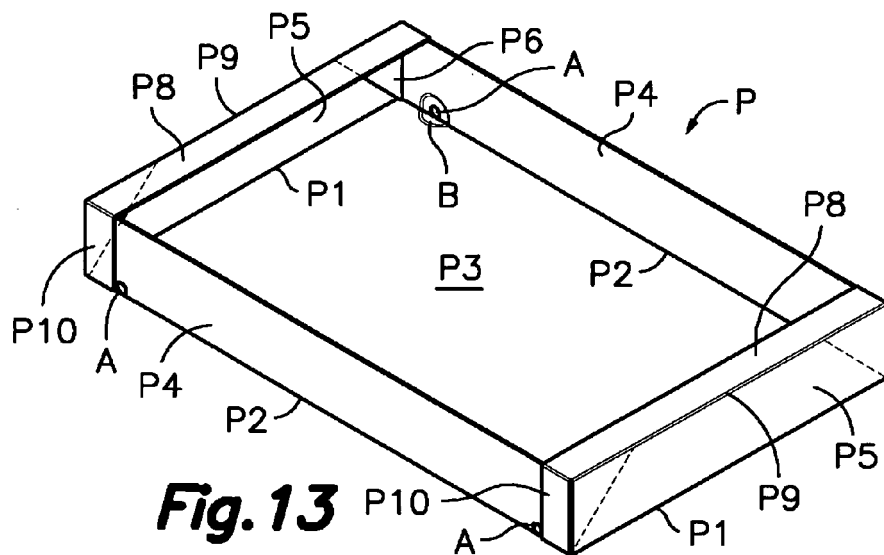
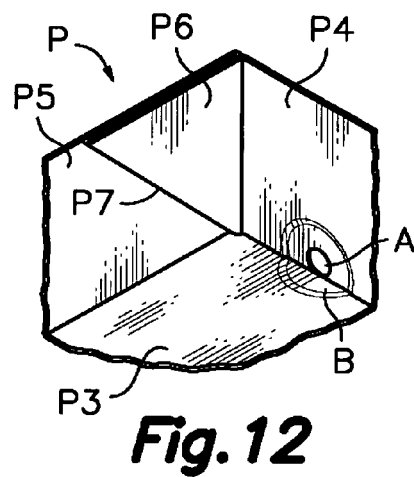
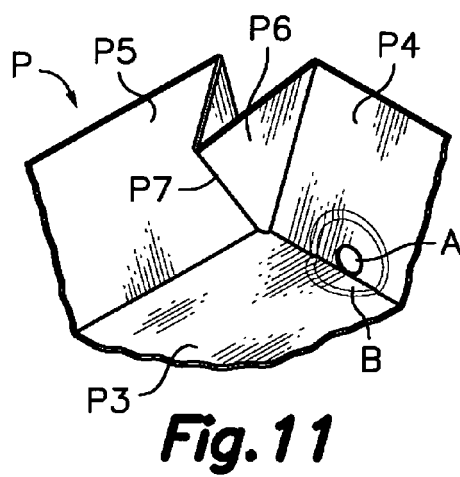
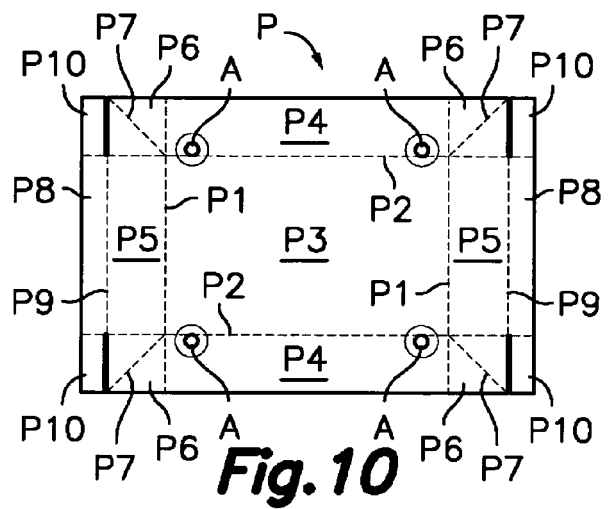
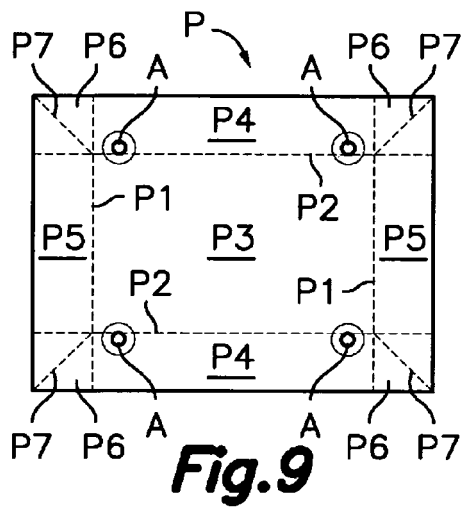


Fig.8



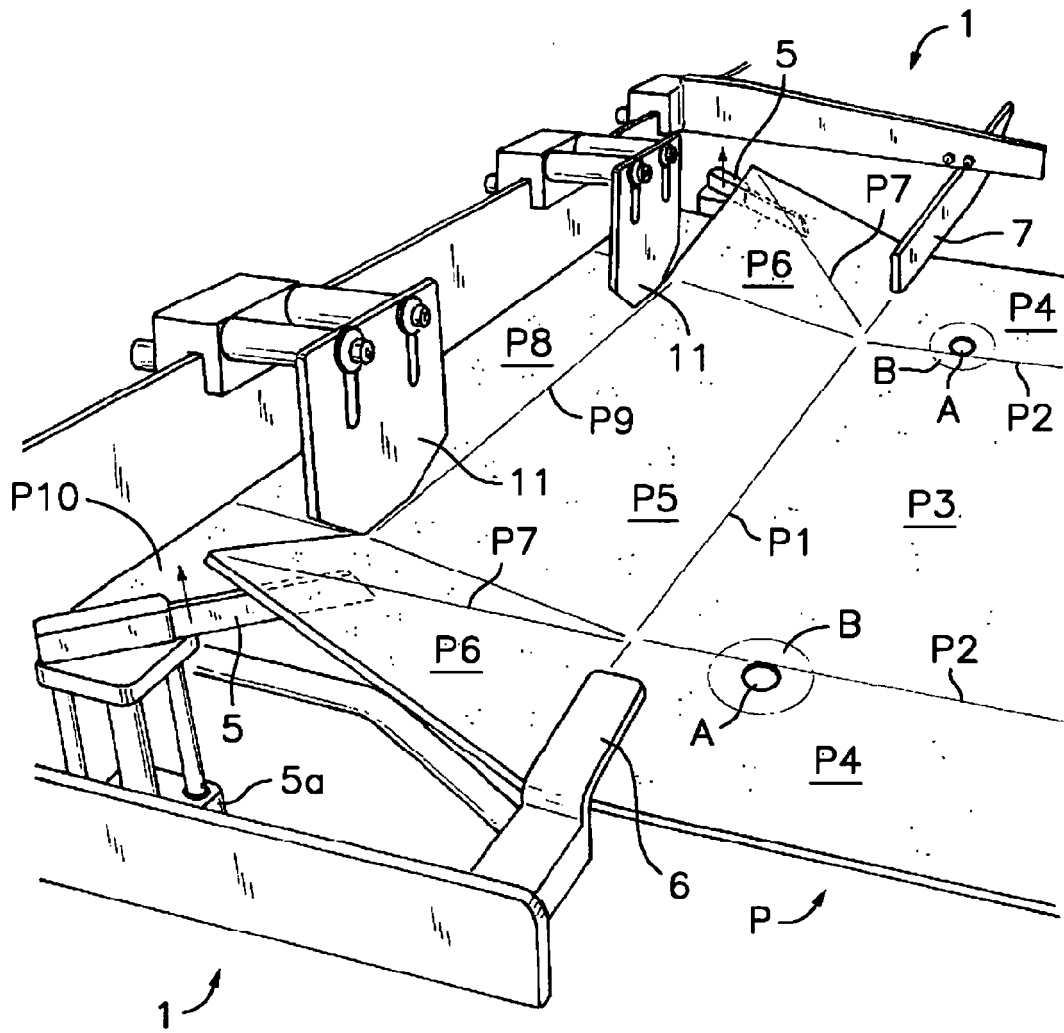


Fig. 14

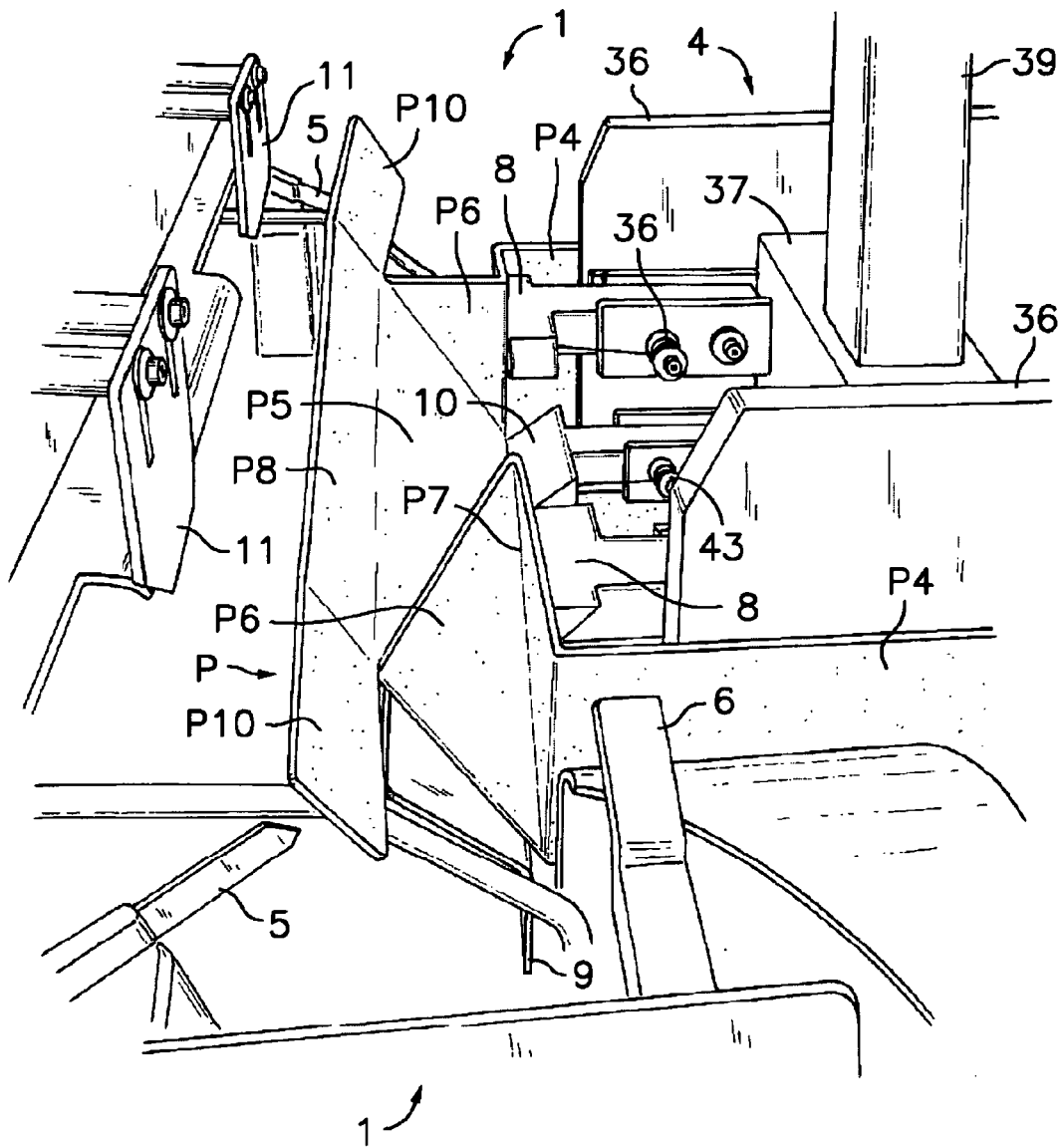


Fig. 15



EUROPEAN SEARCH REPORT

Application Number
EP 10 38 0021

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2010/004059 A1 (CARTONAJES INTERNATIONAL S L S [ES]; BOVEDA BERARD JESUS [ES]) 14 January 2010 (2010-01-14) * page 7, line 7 - page 9, line 2; claims 4,5-14; figures 1-4 *	1,2,14	INV. B31B3/52 B31B1/74 B65D81/26 B31B1/52 B31B3/00 B31B1/44
A	-----	3-12,15	
A	US 3 972 270 A (MARSHALL ELMER) 3 August 1976 (1976-08-03) * the whole document *	1-12,14, 15	
A	----- US 3 973 476 A (MARSHALL ELMER) 10 August 1976 (1976-08-10) * the whole document *	1-12,14, 15	

			TECHNICAL FIELDS SEARCHED (IPC)
			B31B B65D
1 The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 July 2010	Examiner Sundqvist, Stefan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)



Application Number

EP 10 38 0021

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-12, 14, 15

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 10 38 0021

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-12, 14, 15

Two step sealing of hole in corrugated cardboard blank.

2. claim: 13

Box erection from corrugated cardboard blank having sealed holes.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 38 0021

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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08-07-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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