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(54) **Title**: APPARATUS, METHOD AND DEVICE FOR WORKING BLANKS TO MAKE RIGID PACKETS FOR SMOKING ARTICLES

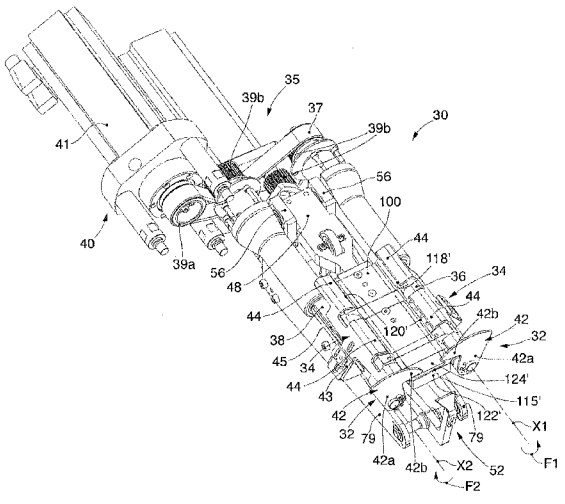

fig. 4

(57) **Abstract**: Apparatus for working blanks to make rigid packets with a hinged lid for smoking articles, starting from a substantially flat blank (100), wherein the apparatus comprises a wheel to transfer the blanks (12) provided with an entrance station (14) and an exit station (16), between which a predefined transfer path (P) develops, and with a flexing and bending station (18) provided in an intermediate position between the entrance station (14) and the exit station (16), and wherein the entrance station (14) is associated with a blank feeding store (22). In correspondence with the flexing and bending station (18) there is a device to work blanks comprising a structure in a single body provided with a pair of first flexing or pre-bending members (32), configured to flex a transverse bending line (115') between a first smaller upper panel (122') and a second smaller upper panel (124') of the blank (100) and to pre-bend the first smaller upper panel (122'), a pair of second flexing or pre-bending members (34), configured to flex longitudinal bending lines (120') of the blank (100) and to pre-bend at least the longitudinal lateral panels (1 18', 1 19') of the blank (100) associated with the longitudinal bending lines (120'), at least one complete bending member (52), configured to bend at 180° the first smaller upper panel (122') adjacent against the second smaller upper panel (124') of the blank (100) for gluing purposes.

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"APPARATUS, METHOD AND DEVICE FOR WORKING BLANKS TO MAKE RIGID PACKETS FOR SMOKING ARTICLES"

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FIELD OF THE INVENTION

Embodiments described here concern an apparatus, method and device for working blanks to make rigid packets with a hinged lid for smoking articles, such as for example, but not only, cigarettes.

BACKGROUND OF THE INVENTION

Packets of the rigid type for cigarettes are known, with a hinged closing lid. Such hinged lid rigid packets are easy and practical to use, as they protect the cigarettes inside them and are particularly appreciated by some types of smokers because of their great rigidity, which prevents damage to the cigarettes even when the packet is subjected to knocks or kept in a consumer's pocket or bag.

Traditional rigid packets for cigarettes with a hinged lid comprise a rigid external containing casing, also called bottom or cup-like container, and an upper lid hinged to the rigid casing by a hinge. When the lid is disposed to close the external containing casing, the packet is shaped like a rectangular parallelepiped, delimited laterally by two bigger lateral walls, front and rear, parallel and opposite to each other, and by two smaller lateral walls, also parallel and opposite each other and generally formed by double walls. Typically, the lid has a front wall which, when the lid is closed, is continuous with the bigger front lateral wall, and the front wall of the lid is usually a double wall. Between the bigger lateral walls and the smaller lateral walls four longitudinal edges are defined, which can be straight or "sharp" edges, beveled or rounded.

To make a rigid packet of this type, a conventional flat blank is usually used, i.e. a sheet of material, such as cardboard, millboard, paper or suchlike, suitably shaped and worked. The blank has a specific shape that, all in all, is like a rectangle and is passed through by pre-weakened longitudinal and transverse bending lines, along which the blank is bent, in a predefined sequence of operations, typically by automatic bending apparatuses, to make the packet. Typically, the blank is provided with lateral and longitudinal panels or wings, which are bent with respect to each other and glued together, overlapping, to define the double smaller lateral walls. Furthermore, there is a smaller transverse

panel at one end of the blank which is normally bent by 180° and glued onto a contiguous panel of the blank, to make the front wall of the lid in a double-wall configuration.

Applicant has observed that in finished rigid packets, the shape of the longitudinal and transverse edges does not always fully correspond to the desired shape, and that the smaller lateral walls and/or the walls of the lid are not always perfectly flat as desired, due to the residual elastic return of the blank which, after bending, can tend to return to its original flat configuration; these defects can occur more evidently when the edges are beveled or rounded. To reduce the residual elastic return, known making-up apparatuses are equipped with flexing units, which perform a pre-bending of the blanks in order to flex them along the longitudinal and/or transverse bending lines.

In particular, it is known to make apparatuses for the production of rigid packets that are configured to flex, or pre-bend, some panels or wings of the blank and to bend and glue other panels or wings. In particular, some known apparatuses comprise a transfer wheel, provided with an entrance station, to which the blanks are fed, and an exit station, from which the blanks are supplied at exit with the longitudinal panels or lateral wings pre-bent or flexed, and with the smaller transverse panel already bent by 180° and glued, to be sent to the subsequent completion working. The transfer wheel can rotate step-wise, i.e. intermittently, around an axis of rotation to move a plurality of blank holding heads along a predefined transfer path between the entrance station and the exit station. The holding heads are provided with suction-type retaining members, such as suckers, to retain and position the blank.

Between the entrance station and the exit station intermediate stations are provided, each configured to perform a specific working step that produces the blanks that are supplied at exit from the exit station, and each station corresponds to one step made by the transfer wheel along its intermittent path. For example, downstream of the entrance station, along the predefined transfer path between the entrance station and the exit station, at least the following can be provided:

- a station to flex or pre-bend the longitudinal panels or lateral wings, possibly equipped with a device to deliver one or more glues onto the longitudinal panels or lateral wings;

- a station to flex or pre-bend the smaller transverse panel, equipped with a device to deliver one or more glues onto the smaller transverse panel;
- another station to bend by 180° the smaller transverse panel on which there is the glue;
- a station to consolidate the gluing of the bent smaller transverse panel, after the pre-worked blank has been processed by the exit station and supplied to another apparatus downstream, which receives the groups of smoking articles, associating them with the pre-worked blank, performs still other operations of bending and gluing, and thus makes the final rigid packet.

Typically, the bending line of the smaller transverse panel as above can be obtained and defined by a screw-type bending member, provided to operate tangentially along the periphery of an angular segment of the transfer wheel so that, while the blank is turning, carried by the transfer wheel, it is subjected to the bending action of the screw-type bending member. In this context it is necessary to improve the bending line, since the screw-type bending member can cause crooked bending lines, imprecise and/or poorly defined.

To overcome this disadvantage, there is a tendency to make transfer wheels with a bigger diameter, so as to define a softer profile of the bending screw. However, the increased diameter of the transfer wheel can imply a greater size of the movement members too, i.e. an increased weight, inertia and bulk, with all the disadvantages that this entails, for example higher production costs, higher energy costs to guarantee determinate speeds, and/or lower productivity, if the wheel has to be driven at a slower speed.

Another requirement in these apparatuses is to optimize the number of intermediate work stations, so as to reduce as much as possible both the diameter of the wheel, given the same operations performed, and also the number of stops and starts, and hence the accelerations and decelerations of the transfer wheel as it proceeds intermittently, also because of the high inertia that such wheels can have, which inertia requires high energy consumption to impose the desired intermittent cadence combined with high productivity.

One possible disadvantage of these known apparatuses is therefore connected to the fact that the provision of a large number of stations can entail an increase in costs, of construction and maintenance, and energy consumption of the

apparatus. Furthermore, it should be noted that a limited number of stations can be installed on each individual transfer wheel, depending on the sizes of the transfer wheel, and to separate the packeting steps in different stations can make it necessary to use a bigger number of wheels.

There is therefore a need to find solutions which allow to reduce the number of stations, while maintaining the same number of operations performed.

Furthermore, a very important disadvantage concerns the dirtying of the intermediate work stations and the blanks that are processed, caused by the glue delivered, which entails downtimes of the machine so that it can be cleaned, maintenance and replacement costs, costs connected to the wasted blanks that are dirtied and discarded and, in general, loss of productivity and quality.

Other limitations and disadvantages of conventional solutions and technologies will be clear to a person of skill after reading the remaining part of the present description with reference to the drawings and the description of the embodiments that follow, although it is clear that the description of the state of the art connected to the present description must not be considered an admission that what is described here is already known from the state of the prior art.

There is therefore a need to perfect an apparatus, method and device for working blanks to make rigid packets for smoking articles, which can overcome at least one of the disadvantages of the state of the art.

In particular, one purpose of the present invention is to obtain an apparatus, method and device that allow to make precise and well-defined bending lines, quickly and economically, using an apparatus that is no bigger in size.

Another purpose is to perform a sequence of operations on a blank with a reduced number of stations needed in a transfer wheel, compared with known solutions.

Another purpose of the present invention is to obtain an apparatus, method and device that are particularly efficient and allow high production speeds, together with low costs of construction, maintenance and energy.

The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

In accordance with some embodiments, an apparatus is provided for working blanks to make rigid packets with a hinged lid for smoking articles, starting from a substantially flat blank. According to some embodiments, the apparatus comprises a wheel to transfer the blanks provided with an entrance station and an exit station, between which a predefined transfer path develops, and with a flexing and bending station provided in an intermediate position between the entrance station and the exit station. The entrance station is associated to a blank feeding store.

Furthermore, in correspondence with the flexing and bending station there is a device to work blanks comprising a structure in a single body provided with:

- a pair of first flexing or pre-bending members, configured to flex a transverse bending line between a first smaller upper panel and a second smaller upper panel of the blank and to pre-bend the first smaller upper panel,
- a pair of second flexing or pre-bending members, configured to flex longitudinal bending lines of the blank and to pre-bend at least longitudinal lateral panels of the blank associated with the longitudinal bending lines,
- at least one complete bending member, configured to bend at 180° the first smaller upper panel adjacent against the second smaller upper panel of the blank for gluing purposes.

According to other embodiments, a method is provided for working blanks to make rigid packets with hinged lid for smoking articles, starting from a substantially flat blank. According to some embodiments, the method comprises at least:

- feeding a blank to an entrance station of a blank transfer wheel and moving it along a predefined transfer path;
- positioning the blank in a flexing and bending station.

Moreover, in the flexing and bending station at least the following operations are carried out:

- flexing a transverse bending line between a first smaller upper panel and a second smaller upper panel of the blank and pre-bending the first smaller upper

panel,

- flexing longitudinal bending lines of the blank and pre-bending at least longitudinal panels of the blank associated with the longitudinal bending lines,
- complete bending at 180° of the first smaller upper panel adjacent against the second smaller upper panel of the blank for gluing purposes.

According to still other embodiments, a device is provided for working blanks to make rigid packets with hinged lid for smoking articles, starting from a substantially flat blank. According to some embodiments, the device comprises a structure in a single body provided with:

- a pair of first flexing or pre-bending members, configured to flex a transverse bending line between a first smaller upper panel and a second smaller upper panel of the blank and to pre-bend the first smaller upper panel,
- a pair of second flexing or pre-bending members configured to flex longitudinal bending lines of the blank and to pre-bend at least longitudinal lateral panels of the blank associated with the longitudinal bending lines,
- at least a complete bending member, configured to bend at 180° the first smaller upper panel adjacent against the second smaller upper panel of the blank for gluing purposes.

According to other embodiments, a rigid packet is provided with hinged lid for smoking articles made starting from a substantially flat blank. According to some embodiments, the blank comprises:

- a transverse bending line between a first smaller upper panel and a second smaller upper panel of the blank, which bending line is flexed for the pre-bending of the first smaller upper panel and for the subsequent complete bending at 180° of the first smaller upper panel adjacent against the second smaller upper panel of the blank for gluing purposes,
- flexed longitudinal bending lines, to pre-bend at least longitudinal panels associated with the longitudinal bending lines;

wherein the flexing of the transverse bending line and the flexing of the longitudinal bending lines are carried out in a single work step.

According to other embodiments, a semi-worked blank is provided, to make a rigid packet with hinged lid for smoking articles. According to some embodiments, the blank comprises:

- a transverse bending line between a first smaller upper panel and a second smaller upper panel of the blank, which bending line is flexed for the pre-bending of the first smaller upper panel and the subsequent complete bending at 180° of the first smaller upper panel adjacent against the second smaller upper panel of the blank for gluing purposes,
- flexed longitudinal bending lines, for the pre-bending of at least longitudinal panels associated with the longitudinal bending lines;

wherein the flexing of the transverse bending line and the flexing of the longitudinal bending lines are carried out in a single work step.

These and other aspects, characteristics and advantages of the present disclosure will be better understood with reference to the following description, drawings and attached claims. The drawings, which are integrated and form part of the present description, show some embodiments of the present invention, and together with the description, are intended to describe the principles of the disclosure.

The various aspects and characteristics described in the present description can be applied individually where possible. These individual aspects, for example aspects and characteristics described in the description or in the attached dependent claims, can be the object of divisional applications.

It is understood that any aspect or characteristic that is discovered, during the patenting process, to be already known, shall not be claimed and shall be the object of a disclaimer.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other characteristics of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a perspective view of a packet for smoking articles in a closed condition;
- fig. 2 is a perspective view of a packet for smoking articles in an open condition;
- fig. 3 is a plan view of a blank for making an external casing of a packet according to some embodiments described here;
- fig. 4 is a perspective view of a bending device for working blanks according

to some embodiments described here in an operating position;

- fig. 5 is a perspective view of the bending device in fig. 4 in another operating position;

- fig. 6 is a plan view from above of an apparatus for working blanks according to some embodiments described here;

- fig. 7 is a section view of the bending device in the operating position of fig. 4;

- fig. 8 is a section view of the bending device in the operating position of fig. 5;

- fig. 9 is a section of an enlarged detail of fig. 6.

To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can conveniently be incorporated into other embodiments without further clarifications.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

We shall now refer in detail to the various embodiments of the present invention, of which one or more examples are shown in the attached drawings. Each example is supplied by way of illustration of the invention and shall not be understood as a limitation thereof. For example, the characteristics shown or described insomuch as they are part of one embodiment can be adopted on, or in association with, other embodiments to produce another embodiment. It is understood that the present invention shall include all such modifications and variants.

Before describing these embodiments, we must also clarify that the present description is not limited in its application to details of the construction and disposition of the components as described in the following description using the attached drawings. The present description can provide other embodiments and can be obtained or executed in various other ways. We must also clarify that the phraseology and terminology used here is for the purposes of description only, and cannot be considered as limitative.

Embodiments described here concern an apparatus 10 for working blanks 100 to make rigid packets 102 for smoking articles. Examples of possible smoking articles are cigarettes, cigars or similar or comparable smoking articles.

We must point out here that the expression “rigid packet” means a rigid packet 102 with a hinged lid that comprises a rigid external containing casing 108 and

an upper lid 106 hinged to the external containing casing 108 by a hinge 110 (see figs. 1 and 2). The external containing casing 108 can contain inside it an organized group of smoking articles, generally completely wrapped by a wrapping sheet 104, for example aluminum, metallized paper, tin foil, and which can be partly enclosed by an internal casing 105, like a collar, or a cup-like internal container which can slide toward the outside to be partly removable from the external containing casing 108.

When the lid 106 is closed (see fig. 1), the packet 102 is shaped like a rectangular parallelepiped, delimited laterally by two bigger lateral walls, front 112 and rear 114, parallel and opposite to each other, and by two smaller lateral walls 121, also parallel and opposite to each other and formed by double walls.

Between the bigger lateral walls 112, 114 and the smaller lateral walls 121, four longitudinal edges are defined, which can be straight edges, also called "sharp" edges, beveled edges or rounded edges.

The lid 106 has an external front lid wall 124 which, when the lid 106 is closed, is continuous with the front bigger lateral wall 112, defining overall a front face of the packet 102. An internal front lid wall 122 is also provided, bent internally by 180° on the external front lid wall 124, to define a double walled structure.

The lid 106 also has lateral lid walls 130 which, in the closed condition of the lid 106, are continuous with the smaller lateral walls 121 of the external containing casing 108, defining overall the flanks of the packet 102.

Moreover, the lid 106 also has a rear lid wall 131 which, in the closed condition of the lid 106, is continuous with the rear bigger lateral wall 114 of the external containing casing 108, defining overall a rear back of the packet 102.

Furthermore, the external containing casing 108 has a bottom wall 116 and the lid 106 has a top wall 126 which, in the closed condition (fig. 1) is parallel and opposite the bottom wall 116.

Furthermore, a blank 100 of the type adopted in the embodiments described here can typically be a flat sheet of cardboard, millboard or paper, provided with pre-weakened bending lines, transverse and longitudinal, which define panels and flaps to be bent and glued to make the walls of the packet 102. Hereafter, we will indicate where possible the flaps and panels of the blank 100 with the same

reference number, followed by an apostrophe, which have the respective walls of the packet 102 formed by said panels and flaps.

With reference to fig. 3, the blank 100 comprises an intermediate main panel 112' and a lower main panel 114', both substantially rectangular in shape, connected by transverse bending lines 115' to a lower smaller panel 116', interposed between them. The intermediate main panel 112' and the lower main panel 114', bent by 90° with respect to the lower smaller panel 116', define respectively the front bigger lateral wall 112 and the rear bigger lateral wall 114 of the packet 102, while the lower smaller panel 116' defines the bottom wall 116.

The blank 100 also comprises pairs of first and second longitudinal lateral panels 118', 119', connected on one side and the other respectively to the intermediate main panel 112' and the lower main panel 114', by means of longitudinal bending lines 120'. The first and second longitudinal lateral panels 118', 119', bent by 90° toward the inside with respect to the corresponding intermediate main panel 112' and lower main panel 114', overlapping and glued to each other, define the smaller lateral walls 121 with the double-walled structure of the packet 102.

With reference to fig. 3, going from top to bottom, the blank 100 also comprises a first smaller upper panel, or first smaller transverse panel, 122', or flap, a second smaller upper panel, or second smaller transverse panel, 124' and a third smaller upper panel 126', respectively joined by transverse bending lines 115'.

An intermediate smaller panel 131' is provided between the intermediate main panel 112' and the third smaller upper panel 126', connected to them respectively by a transverse bending line 110' and a transverse bending line 115'.

The second smaller upper panel 124' is intermediate between the first smaller upper panel 122', which has a free end, and the third smaller upper panel 126', which as we said is joined to the intermediate smaller panel 131'.

The first smaller upper panel 122', once bent by 180° on the second smaller upper panel 124' and glued to it, defines the internal front lid wall 122 of the packet 102, while the second smaller upper panel 124' defines the external front lid wall 124 of the packet 102. Moreover, the third smaller upper panel 126', bent

by 90° with respect to the double-walled structure formed by the first smaller upper panel 122' and the second smaller upper panel 124', defines the top wall 126 of the packet 102.

Furthermore, by bending the third smaller upper panel 126' and the intermediate main panel 112' by 90° with respect to the intermediate smaller panel 131', the latter defines the rear lid wall 131. The transverse bending line 110' between the intermediate smaller panel 131' and intermediate main panel 112' defines the hinge 110 of the packet 102.

Upper lateral flaps 130' are provided at the sides of the second smaller upper panel 124', connected to it by longitudinal bending lines 120'. The upper lateral flaps 130', once bent by 90°, define the lateral lid walls 130. We must point out that, advantageously, the upper lateral flaps 130' have an upper shaped edge 130a' mating with a lower shaped edge 119a' of the second longitudinal lateral panels 119', so that, in the packet 102, the lateral lid walls 130 fit with the smaller lateral walls 121 in the closed condition (see fig. 1).

Moreover, first intermediate lateral flaps 132' are provided, protruding laterally from one side and the other of the intermediate smaller panel 131' and connected to it by longitudinal bending lines 120'. The first intermediate lateral flaps 132', bent by 90° and glued to the upper lateral flaps 130', define a double-walled structure of the lateral lid walls 130 of the packet 102.

Furthermore, protruding from the top of the first intermediate lateral flaps 132', second intermediate lateral flaps 134' are provided, connected by transverse bending lines 115'. The second intermediate lateral flaps 134' are bent by 90° and glued to the third smaller upper panel 126'. In this way they can define a stronger top wall 126 of the lid 106.

Finally, lower lateral flaps 136' are provided, protruding from the first longitudinal lateral panels 118', connected by transverse bending lines 115'. The lower lateral flaps 136' are bent by 90° and glued to the lower smaller panel 116'. In this way they can define a stronger bottom wall 116 of the external containing casing 108.

Embodiments described here concern a device 30 for working blanks, hereafter defined for short as bending device, configured to perform at least some work operations on a blank 100, including flexing and/or bending panels or flaps

of the blank 100. The bending device 30 can be used in an apparatus 10 according to the present description.

The term "flexing" in the present description means a process of flexing the material with which the blank is made, by pre-bending in correspondence with suitable pre-weakened bending lines present on the blanks 100, to reduce the residual elastic return of the material once definitively bent.

According to embodiments described using figs. 4-9, which can be combined with all the embodiments described here, the bending device 30 can perform at least two distinct operations. In particular, the bending device 30 can be configured to flex the blank 100 along the longitudinal bending lines 120' and along the transverse bending line 115' which is between the first smaller upper panel 122' and the second smaller upper panel 124', and to bend the first smaller upper panel 122' against the second smaller upper panel 124', for gluing purposes.

According to embodiments described using figs. 4 and 5, and which can be combined with all the embodiments described here, the bending device 30 includes a single-body structure provided with:

- a pair of first flexing or pre-bending members 32, configured to flex a transverse bending line 115' between a first smaller upper panel 122' and a second smaller upper panel 124' of the blank 100 and to pre-bend the first smaller upper panel 122',
- a pair of second flexing or pre-bending members 34, configured to flex longitudinal bending lines 120' of the blank 100 and to pre-bend at least longitudinal lateral panels 118',119' of the blank 100 associated with the longitudinal bending lines 120',
- at least one complete bending member 52, configured to bend at 180° the first smaller upper panel 122' adjacent against the second smaller upper panel 124' of the blank 100 for gluing purposes.

According to some embodiments, which can be combined with all the embodiments described here, the first flexing members 32 are configured to flex the blank 100 along the transverse bending line 115' that joins the first smaller upper panel 122' and the second smaller upper panel 124'. During the operations of the bending device 30, the blank 100 is disposed between the two first flexing

members 32 and can be kept in this operating position thanks to a suction retaining member, such as a sucker, which can be present on a holding head of an apparatus for working blanks as described in detail hereafter.

The cooperation between the first flexing or pre-bending members 32 and the complete bending member 52 allows to obtain a straight, precise and well-defined transverse bending line 115'.

Preferably, the first flexing or pre-bending members 32 and the second flexing or pre-bending members 34 can be driven by a single command, thus exploiting the drive of the first flexing or pre-bending members 32 to activate the second flexing or pre-bending members 34 as well. Consequently, advantageously with a single command and movement, it is possible to flex or pre-bend the transverse bending line 115' and also the longitudinal bending lines 120'.

According to embodiments described using figs. 4 and 5, and which can be combined with all the embodiments described here, the first flexing members 32 and the second flexing members 34 are mounted on rotation shafts 36, 38 disposed parallel and distanced with respect to each other. One rotation shaft 36 is therefore provided with a first flexing member 32 and a second flexing member 34, and the other rotation shaft 38 is provided with the other first flexing member 32 and with the other second flexing member 34. In particular, the first flexing members 32 are positioned at the free ends of the rotation shafts 36, 38, while the second flexing members 34 are disposed along the rotation shafts 36, 38 in an intermediate position. As we said, the rotation shafts 36, 38 are disposed parallel to each other, distanced by a space with an amplitude coordinated with the length of the short side of the intermediate main 112' and lower 114' panels of the blank 100.

According to embodiments described using figs. 4 and 5, and which can be combined with all the embodiments described here, the rotation shafts 36, 38 can be driven by one or more actuation elements 40 and made to rotate around respective axes of rotation X1 and X2, respectively in the direction of the arrows F1 and F2 (see fig. 9).

According to embodiments described using figs. 4 and 5, and which can be combined with all the embodiments described here, the actuation element 40 can comprise a drive member 41, provided with a drive shaft and configured to make

at least one rotation shaft 36, 38 rotate, which can be made to function by an energy source, for example an electric current, a hydraulic fluid pressure or a pneumatic pressure. The drive member 41 can be in particular a motor provided with an intrinsically rotary movement actuator or configured to convert a linear movement into a circular movement. The conversion can be carried out commonly through types of conversion mechanisms chosen in a group consisting of: screw actuators, such as actuators of the screw jack type, ball screw actuators and roll screw actuators, or wheel and axle, for example with drums, gears, pulleys or shafts, actuators like a lifting cable, a winch, a pinion and rack unit, a chain transmission, belt transmission, possibly toothed, actuators with a rigid chain and rigid belt, or rigid belts, possibly toothed.

The actuation element 40 can include a drive member 41 chosen from a group consisting of an electric motor, pneumatic motor, hydraulic piston or piezoelectric actuator.

The actuation element 40 as used in association with embodiments described here, can be a movement actuator that, in possible implementations, can be configured to transfer the motion to, and make rotate, both the rotation shafts 36, 38. The motion can commonly be transferred by types of motion transmission mechanisms.

According to embodiments described using figs. 4-5, the motion can be transferred from the drive member 41 to the rotation shafts 36, 38 by means of a motion transmission mechanism 35.

According to possible example embodiments described using figs. 4 and 5, and which can be combined with all the embodiments described here, the motion transmission mechanism 35 can comprise a toothed belt 37. The toothed belt 37 is typically wound around toothed pulleys, with which a toothed drive pulley 39a can be provided, keyed to the drive shaft of the drive member 41, and a plurality of toothed driven pulleys 39b. In possible implementations, two toothed driven pulleys 39b are provided for example, respectively connected to the rotation shafts 36, 38. The toothed belt 37, made to rotate by the toothed drive pulley 39a, can be configured to transfer the circular motion from the drive member 41 to the toothed driven pulleys 39b connected to the rotation shafts 36, 38. In particular, the toothed belt 37 is wound on the toothed drive pulley 39a and the toothed

driven pulley 39b of the rotation shaft 36 with its internal surface, while it is wound on the toothed driven pulley 39b of the rotation shaft 38 with its external surface. In this way, the direction of rotation of the rotation shafts 36, 38 is reciprocally opposite.

In possible implementations, the toothed belt 37 engages the toothed driven pulleys 39b of the rotation shafts 36, 38, drawing them into counter-rotation, so as to transmit simultaneously the rotation supplied by the drive member 41 to the two rotation shafts 36, 38, as we said, making them rotate in the opposite direction.

In possible embodiments, the first flexing members 32 and the second flexing members 34 can be made in a single body, that is, they can be integrated. In this way it is possible to drive the first flexing members 32 and the second flexing members 34 with a single command and movement.

In other possible embodiments, the first flexing members 32 and the second flexing members 34 can be made as different components. Advantageously, even if made as different components, the first flexing members 32 and the second flexing members 34 can be connected operatively to be driven by a single command and movement.

According to embodiments described using figs. 4 and 5, and which can be combined with all the embodiments described here, the first flexing members 32 can each comprise a saber-shaped transverse portion 42, normally facing toward the internal space comprised between the two rotation shafts 36, 38, in order to act on the front part of the blank 100 where there is the first smaller upper panel 122'. For example, the saber-shaped transverse portion 42 can be formed by a shaped plate that has a lobe 42a, rotatably constrained to the respective rotation shaft 36, 38, and a protruding curved tooth 42b. The two saber-shaped transverse portions 42 extend toward the inside by a length sufficient to reach the first smaller upper panel 122' of the blank 100, so as to be able to act against the first smaller upper panel 122' of the blank 100. This action determines a thrust of the two saber-shaped transverse portions 42, in particular of the curved teeth 42b, on one side and the other of the first smaller upper panel 122', bending it by about 90° with respect to the lying plane of the blank 100. The axes of rotation X1 and X2 are perpendicular to the two saber-shaped transverse portions 42.

During operations, the saber-shaped transverse portions 42 press on the first smaller upper panel 122', thus flexing the transverse bending line 115' between the first smaller upper panel 122' and the second smaller upper panel 124'.

In possible implementations, given by way of example, the second flexing members 34 can each include a longitudinal blade portion 44, able to act at least on the longitudinal lateral panels 118', 119', and possibly also on the upper lateral flaps 130' of the blank 100, flexing the respective longitudinal bending lines 120', rotatably connected to each rotation shaft 36, 38. Preferably, the longitudinal blade portions 44 have a length mating with the length of the longitudinal bending lines 120' of the blank 100.

In possible implementations, the longitudinal blade portions 44 can be connected to the respective rotation shafts 36, 38 for example by attachment members 43, which can be the releasable and/or adjustable type. The axes of rotation X1 and X2 are parallel to the two longitudinal blade portions 44. Grooves 45 can be provided on the rotation shafts 36, 38, configured to cooperate with the attachment members 43, so as to allow the second flexing members 34 to slide along a segment of the rotation shafts 36, 38. In this way, the second flexing members 34 can be positioned on each occasion in the most suitable position with respect to the characteristics of the blank 100 to be worked.

In possible implementations, the longitudinal blade portions 44 can be configured for example as a bent plate, for example at a right angle, in its longitudinal direction, having the bent parts configured to press at least on the longitudinal lateral panels 118', 119' and possibly also on the upper lateral flaps 130', in order to pre-bend them along the longitudinal bending lines 120'.

According to some embodiments, the longitudinal blade portions 44 can be a single blade that extends for the length of the blank 100, or they can consist of several longitudinal blade portions, positioned in correspondence with at least the longitudinal lateral panels 118', 119' and possibly also with the upper lateral flaps 130'.

The longitudinal blade portions 44, during the rotation in the direction of the arrows F1, F2, press at least on the first and second longitudinal lateral panels 118', 119' and possibly also on the upper lateral flaps 130', pre-bending them transversely, for example by an angle of 90°, with respect to the intermediate

main panel 112' and lower main panel 114' (fig. 9). Due to the elastic return of the material, the final pre-bending angle can be less than 90°.

Possibly, the longitudinal blade portions 44 can be configured to act, as described above, also on the intermediate lateral flaps 132' 134' and lower lateral flaps 136'.

In possible embodiments, the saber-shaped transverse portions 42 can be integrated in a single body with the respective longitudinal blade portions 44, or they can be made as different components, advantageously connected operatively.

Advantageously, the first flexing members 32 and the second flexing members 34 can be operatively connected and driven in rotation by 360° around respective operating axes by the respective rotation shafts 36, 38, so that, with a complete and single rotation by a round angle (360°), it is possible to intervene both on the first smaller upper panel 122' and also on the first and second longitudinal lateral panels 118', 119' and possibly also on the lateral flaps 130', 132', 134', 136', obtaining the pre-bending or flexing of the respective transverse bending line 115' and longitudinal bending lines 120'. Furthermore, it is also possible to intervene with the complete bending member 52 to further bend the first smaller upper panel 122', thus bending it by 180° overall. Therefore, advantageously with a command of a single continuous rotation of 360°, it is possible to obtain the desired pre-bending or flexing operations and, subsequently, to provide also the complete bending of the first smaller upper panel 122'.

According to embodiments described using figs. 4 and 5, and which can be combined with all the embodiments described here, the reciprocal angular position on the respective rotation shafts 36, 38 of the first flexing members 32 and of the second flexing members 34 can be such that, with the rotation of the rotation shafts 36, 38 by the desired operative angle of 360°, the first flexing members 32 and second flexing members 34 begin to interfere with the respective parts of the blank 100 to be pre-bent.

For example, but not restrictively, the reciprocal angular position on the respective rotation shafts 36, 38 of the first flexing members 32 and the second flexing members 34 can be angularly offset along the round angle (360°), so as to pre-bend the various components in different angular phases, and successive in

time, for example first the first smaller upper panel 122' and then the longitudinal lateral panels 118', 119' and possibly the lateral flaps 130', 132', 134', 136' or vice versa, or again it is possible to make the different pre-bending operations at partly overlapping times. Therefore, for example, during the operating step that provides to rotate the rotation shafts 36, 38, first the first flexing members 32 can intervene, which by means of the saber-shaped transverse portions 42 pre-bend the first smaller upper panel 122', and subsequently the second flexing members 34 can intervene, which by means of the longitudinal blade portions 44 pre-bend the longitudinal lateral panels 118', 119' and possibly the lateral flaps 130', 132', 134', 136', or vice versa.

In other variant embodiments, it is possible that the reciprocal angular position on the respective rotation shafts 36, 38 of the first flexing members 32 and the second flexing members 34 is in phase, so as to pre-bend simultaneously the first smaller upper panel 122' and the longitudinal lateral panels 118', 119' and possibly the lateral flaps 130', 132', 134', 136'.

According to embodiments described using figs. 4, 5, 7 and 8, a blank contrast plate 46 is provided, on which the blank 100 is intended to be rested and temporarily abutted, so as to contrast the pressing action of the flexing members 32, 34 and advantageously to facilitate and optimize the flexing operations, also functioning as a ridge along the edges. The blank contrast plate 46 can therefore be used to flex the blank 100 along the bending lines 120', 115' respectively. In some embodiments, the blank contrast plate 46 is configured mobile to selectively function as an abutment for the blank.

In possible implementations, the blank contrast plate 46 can have a substantially rectangular shape, configured to adapt to the area of the blank 100 comprised between the longitudinal lateral panels 118', 119', the lateral flaps 130', 132', 134', 136' and the first smaller upper panel 122'.

According to some embodiments, the bending device 30 can be provided with a support element 48 to which the blank contrast plate 46 is connected. Screws 50 can be provided, or analogous attachment members, to connect the blank contrast plate 46 to the support element 48 by any suitable mean. The bending device 30 can be provided with support brackets 56 to which, for example by pins 57, the support element 48 can be rotatably connected.

According to some embodiments, as well as the flexing members 32, 34, the bending device 30 also comprises the complete bending member 52, configured to bend further, i.e. to completely bend, thus obtaining an overall rotation of 180°, the first smaller upper panel 122', taking it into contact with the second smaller upper panel 124' for gluing. This bending system allows to make straight, precise and well-defined transverse bending lines 115'.

According to some embodiments, the complete bending member 52 can be provided with a mobile tooth portion 54 which, during use, faces toward the blank 100. The tooth portion 54 can have a flat end, configured to contact and press on the first smaller upper panel 122', bending it by 180°, i.e., completely bending it against the second smaller upper panel 124'.

The complete bending member 52 is configured mobile, in coordination with the flexing members 32, 34, to act on the first smaller upper panel 122' after this has been pre-bent by the first flexing members 32. In particular, the movement of the complete bending member 52 is configured to cause interference between the tooth portion 54 and the first smaller upper panel 122': the latter is already pre-bent transversely by about 90° and is thus intercepted and thrust by the tooth portion 54 that bends it further, by about another 90°, with respect to the blank 100 and thus bends it further against the second smaller upper panel 124', bending it by about 180° in all. As we said, in this way we obtain a straight, precise and well-defined transverse bending line 115'.

According to some embodiments, a glue can be present on the first smaller upper panel 122', for example generally the type with a rapid gluing effect, which can be delivered by a glue delivery device provided in association with the apparatus for working blanks according to the present description, before the blank is supplied to the bending device 30. Consequently, when the first smaller upper panel 122' comes into contact with the second smaller upper panel 124', it remains adherent to it thanks to the previously delivered glue.

According to embodiments described using figs. 4, 5, 7 and 8, the complete bending member 52 can move between an inactive position, in which it is not in contact with the first smaller upper panel 122', and an operating positon in which it interferes with the first smaller upper panel 122', bending it further against the second smaller upper panel 124'.

According to some embodiments, the bending device 30 comprises a movement unit 58 configured to move, in a synchronous and coordinated manner, the support element 48, and hence the blank contrast plate 46 connected thereto, and the complete bending member 52. In particular, the movement unit 58 is configured to determine an alternate motion of the support element 48 and of the blank contrast plate 46 connected thereto. In particular, the movement unit 58 is configured to determine a movement to bring the blank contrast plate 46 nearer to the blank 100, to act as an abutment, and at the same time to distance the complete bending member 52. In this way, the first and second flexing members 32 and 34 can intervene. After this, the movement unit 58 is configured to determine a distancing movement of the blank contrast plate 46 from the blank 100, since no abutment is necessary any longer, and at the same time to bring the complete bending member 52 nearer, which can thus further bend the first smaller upper panel 122'.

According to some embodiments, the movement unit 58 can comprise a toothed driven pulley 39b, around which a part of the external surface of the toothed belt 37 is wound. The toothed driven pulley 39b is connected to a rotation shaft 62. Furthermore, the movement unit 58 can also comprise a connecting rod-handle mechanism 64, driven by the rotation shaft 62 coupled to the toothed driven pulley 39b.

In particular, the connecting rod-handle mechanism 64 comprises a handle element 66 connected to the rotation shaft 62 made to rotate by the toothed driven pulley 39b. The rotation shaft 62 makes the handle element 66 rotate around its axis of rotation Z in the direction indicated by arrow Q in figs. 7 and 8. The connecting rod-handle mechanism 64 also includes a connecting rod element 68 connected to the handle element 66 and configured to make a rectilinear motion, in a direction perpendicular to the direction in which the blank 100 is aligned.

The connecting rod element 68 can be connected to the handle element 66 by a rod 70, pivoted to a handle pin 72 positioned eccentrically with respect to the axis Z, to convert the circular motion of the handle element 66 into a rectilinear motion of the connecting rod element 68.

The connecting rod element 68 is connected to the support element 48. To this

purpose, the support element 48 preferably has an aperture 68a to rotatably house part of the connecting rod element 68. By connecting the connecting rod element 68 to the support element 48, it is possible to move in a coordinated manner the blank contrast plate 46 with an alternate motion as described above. In fact, the connecting rod element 68, during its rectilinear motion, is configured to cause the translation of the support element 48 and the blank contrast plate 46 connected to it from an adjacent position, for example essentially parallel to that of the blank 100, to a position distanced from it, for example by means of a rotation that can cause the inclination of the support element 48 and the blank contrast plate 46 connected to it by an angle α, which can be comprised for example between 15° and 60°, for example between 30° and 45°, or between 15° and 30°, or again between 45° and 60°, depending on needs.

According to some embodiments, which can be combined with all the embodiments described here, the movement unit 58 also comprises a motion transfer unit 74, configured to move at least the complete bending member 52 that further bends the first smaller upper panel 122' as described above.

According to embodiments described using figs. 4, 5, 7 and 8, the motion transfer unit 74 is configured to transfer the alternate movement of the support element 48 and the blank contrast plate 46 to the complete bending member 52. Preferably, therefore, support element 48 and blank contrast plate 46 are moved in phase opposition from and toward the blank 100, with respect to the movement of the complete bending member 52. In fact, when support element 48 and blank contrast plate 46 are moved nearer to each other, the complete bending member 52 is distanced from the blank 100, and vice versa.

The motion transfer unit 74 can comprise a return rod 76, with one end pivoted to the support element 48 and an opposite end pivoted to a lever element 78. In this way, the return rod 76, driven by the movement of the support element 48, in turn drives the lever element 78, which takes the tooth portion 54 into contact with the front lid wall 124.

A pair of opposite support brackets 79 can be provided, to which the lever element 78 is pivoted by pins 80.

In some implementations, the lever element 78 can itself define the complete bending member 52 (see figs. 7 and 8 for example), while according to other

variants the lever element 78 can be distinct from the complete bending member 52 and connected thereto by means of connection elements, such as an arm or a connection rod, not shown here.

In possible implementations, the lever element 78 can be an angled lever, or L-lever, which can have a shape with two sides 78a, 78b, positioned inclined with respect to each other by an angle β. Angle β can be chosen for example between 80° and 120°, for example between 90° and 110°, or between 80° and 90°, or again between 110° and 120°, according to needs.

The bending device 30 is therefore able to perform, in succession after each other, different work operations on the blank 100, in particular flexing/pre-bending and bending proper, in the case of the first smaller upper panel 122'. In fact, as we said above, at first the first and second flexing members 32, 34, cooperating with the blank contrast plate 46, act on the blank 100, flexing it and pre-bending it along the longitudinal bending lines 120' and the transverse bending line 115' between the first 122' and second 124' smaller upper panels.

Subsequently, the movement unit 58 moves the blank contrast plate 46, distancing it from the blank 100 and, at the same time, takes the tooth portion 54 of the complete bending member 52 into contact with the first smaller upper panel 122', so as to further bend it against the second smaller upper panel 124'.

The actuation element 40, which drives the rotation shafts 36, 38 connected to the toothed driven pulleys 39b of the first and second flexing members 32, 34 and the rotation shaft 62 connected to the toothed driven pulley 39b which determines the alternate movement of the blank contrast plate 46 and the complete bending member 52, can advantageously be controlled by software, to synchronize the reciprocal movement of the first and second flexing members 32, 34, the blank contrast plate 46 and the complete bending member 52, to perform the operations described above sequentially.

According to some embodiments, the bending device 30 can be used in an apparatus 10 for working blanks according to the present description.

According to some embodiments described here, for example with reference to fig. 6, the apparatus 10 comprises a blank transfer wheel 12 provided with an entrance station 14 and an exit station 16, between which a predefined transfer path P is defined.

The blank transfer wheel 12 also comprises a flexing and bending station 18 installed in an intermediate position between the entrance station 14 and the exit station 16.

The blank transfer wheel 12 is configured to rotate with an intermittent motion, i.e. step-wise, around an axis of rotation Y, in the direction indicated by arrow R in fig. 6, to move a plurality of holding heads 20 along the predefined transfer path P.

The transfer path P can affect, for example, an angular sector of 240° of the blank transfer wheel 12, where an angle 0° is taken as reference in correspondence with the entrance station 14.

However, there is nothing to exclude that the entrance station 14 and the exit station 16 are in any other reciprocal angular position on the blank transfer wheel 12, and the transfer path P can affect for example a different angular sector, for example less than 240°, for example from 180° to 240°, or greater, for example from 240° to 270°, or other angular positions, according to needs.

According to some embodiments, the step-wise movement of the blank transfer wheel 12 can provide that the rotation steps are coordinated with angular sectors affected by the specific work stations of the apparatus 10.

In possible implementations, each holding head 20 of the blank transfer wheel 12 can comprise retaining members 24, configured to retain a blank 100 and transport it stably from the entrance station 14 to the exit station 16. Examples of retaining members 24 can be retaining members 24 that operate under suction, for example sucker members.

Embodiments described here thus provide to move the blanks 100 in order to make, along the transfer path P, semi-worked pieces from which the packets 102 will then be formed. The apparatus 10 is configured to make stops at each step in correspondence with a specific station, to perform one or more operations on the blank.

In possible implementations, the entrance station 14 is associated with a blank feeding store 22, disposed outside the blank transfer wheel 12, in which a plurality of blanks 100 are stored. The blanks 100 are taken from the blank feeding store 22 and fed to the holding heads 20 which pass through the entrance station 14 on each occasion and stay there temporarily to receive a respective

blank 100. For example, the blank 100 can be fed with its face on which there are normally writings, graphical signs, decorative patterns, logos or other printing, facing toward the holding head 20, i.e. toward the inside of the blank transfer wheel 12, while the opposite face, which has no such printed elements, faces toward the outside.

According to some embodiments, which can be combined with all the embodiments described here, the apparatus 10 includes devices to hold and/or deliver blanks 92, provided at the entrance station 14 and exit station 16.

The devices to hold and/or deliver blanks 92 can be provided to pick up the blanks 100, one at a time, from the blank feeding store 22 and to feed them to the holding heads 20 in the entrance station 14, and to pick up the blanks from the holding heads 20 at the exit station 16, in order to deliver them to further operating units downstream of the apparatus 10.

According to embodiments described using fig. 6, there can be two devices to hold and/or deliver blanks 92, one positioned at the entrance station 14 and one positioned near the exit station 16.

Each device to hold and/or deliver blanks 92 can comprise a mechanical arm 94, which moves in a constrained circular motion along an arc of a circle and which takes a free end 96 into correspondence with respectively the entrance station 14 and/or the exit station 16.

In particular, at the entrance station 14, the corresponding device to hold and/or deliver blanks 92 supplies to the holding head 20 a blank 100 taken from the blank feeding store 22, while at the exit station 16, the corresponding device to hold and/or deliver blanks 92 picks up the blank 100 from the holding head 20 and delivers it outside the blank transfer wheel 12, for example to a subsequent transfer wheel to perform the subsequent work on the blank and further make-up operations that will lead to the formation of the complete packet 102.

Each holding head 20, when it is in the entrance station 14, therefore receives one blank 100 and retains it stably by means of the retaining members 24.

Then, the holding head 20 transfers the blank 100 to the flexing and bending station 18 to flex the longitudinal bending lines 120', the transverse bending line 115' between the first smaller upper panel 122' and the second smaller upper panel 124', and to bend definitively the first smaller upper panel 122' against the

second smaller upper panel 124'.

According to some embodiments, between the entrance station 14 and the flexing and bending station 18 there is a first glue dispensing station 26, provided with glue deliverers 28. The glue deliverers 28 are configured to deliver glue onto the first smaller upper panel 122' of the blank 100, typically on the face that has no printed elements, which faces toward the outside of the holding head 20 and hence of the blank transfer wheel 12.

According to some embodiments, the glue can be delivered by the glue deliverers 28 during the rotation of the blank transfer wheel 12, in the travel between the entrance station 14 and the flexing and bending station 18, without needing to stop, i.e. during an advance step of the blank transfer wheel 12. In other words, the glue can be delivered by the glue deliverers 28 on the fly, for example exploiting the instants of acceleration and deceleration of the blank transfer wheel 12 arriving at and leaving the work stations.

For example, the glue deliverers 28 are positioned upstream of the flexing and bending station 18 and can deliver the glue onto the first smaller upper panel 122' in particular during the deceleration of the blank transfer wheel 12, before a holding head 20 is positioned in the flexing and bending station 18.

Examples of glue deliverers 28 are jet glue deliverers, nozzles, pistols, syringes or similar glue delivery members.

According to some embodiments, the flexing and bending station 18 comprises a bending device 30 to work the blanks according to embodiments described here. The bending device 30 is provided to flex and subsequently to completely bend the first smaller upper panel 122' on the second smaller upper panel 124', and to flex the first longitudinal lateral panels 118', and the second longitudinal lateral panels 119' and possibly the lateral flaps 130', 132', 134', 136'. In possible implementations, it can be provided that the flexing and bending station 18 comprises exclusively the bending device 30. Consequently, in possible implementations, it is provided that at the flexing and bending station 18 only said flexing and subsequent complete bending operations of the first smaller upper panel 122' on the second smaller upper panel 124' are performed, and the flexing of the first longitudinal lateral panels 118' and the second longitudinal lateral panels 119' and possibly the lateral flaps 130', 132', 134',

136'.

At exit from the flexing and bending station 18, the blank 100 therefore has the longitudinal lateral panels 118', 119' and possibly the lateral flaps 130', 132', 134', 136' pre-bent, partly inclined toward the outside with respect to the blank transfer wheel 12, and the first smaller upper panel 122' is located adjacent against the second smaller upper panel 124', with the glue between them.

According to some embodiments, which can be combined with all the embodiments described here, the apparatus 10 also comprises a pressing station 82, configured to consolidate the gluing of the first smaller upper panel 122' to the second smaller upper panel 124'. The pressing station 82 is downstream of the flexing and bending station 18 along the transfer path P.

According to embodiments described using fig. 6, the pressing station 82 comprises pressing members 84, 86, for example rollers, or press elements, configured to act in compression simultaneously on the opposite faces of the blank 100. In particular, the pressing members 84, 86 are configured to exert a pressure on the first smaller upper panel 122' on one side and on the second smaller upper panel 124' on the other side, pressing them against each other, so as to consolidate the gluing between them.

In particular, the pressing members 84, 86 can be rolls, disposed so as to rotate around the respective axes of rotation in an opposite direction to each other, in the direction indicated by arrows G1, G2 respectively.

According to some embodiments, which can be combined with all the embodiments described here, the apparatus 10 also comprises another glue dispensing station 88, configured to deliver glue at least onto the second longitudinal lateral panels 119', so that they can be glued overlapping the longitudinal lateral panels 118'. The glue dispensing station 88 is downstream of the pressing station 82 along the transfer path P.

According to some embodiments, the glue dispensing station 88 comprises one or more glue deliverers 90 configured to deliver jets of glue, for example at different points, i.e. to deliver points of glue or, in combination, to deliver glue in a linear distribution, in strips, or to nebulize it.

The type of glue that can be delivered can be hot glue and/or cold glue. The glue deliverers 90 can be provided to deliver all the same type of glue or different

types of glue.

For example, one or more glue deliverers 90 can be provided to deliver glue that immediately gives a certain grip, albeit with less stability over time, while another one or more glue deliverers 90 can be provided to deliver another type of glue which instead guarantees stability and resistance over time.

Examples of glue deliverers 90 are jet glue deliverers, nozzles, pistols, syringes or similar glue delivery members.

According to embodiments described using fig. 6, the glue dispensing station 88 comprises a plurality of glue deliverers 90, disposed in series or arrays, in a vertical disposition, perpendicular to the transfer path P.

The glue deliverers 90 can be fixed glue deliverers 90, configured to deliver glue on the second longitudinal lateral panels 119' of the blanks 100 during the deceleration and acceleration of the blank transfer wheel 12 approaching the glue dispensing station 88 or away from it.

In particular, the glue deliverers 90 deliver the glue on the second longitudinal lateral panels 119' disposed on the right in fig. 3 during the deceleration of the holding head 20 approaching the glue dispensing station 88.

Generally, while the holding head 20 is stationary in the glue dispensing station 88, the glue deliverers 90 do not deliver glue.

Furthermore, the glue deliverers 90 deliver the glue onto the second longitudinal lateral panels 119' disposed on the left in fig. 3 during the acceleration of the holding head 20 exiting from the glue dispensing station 88.

It is clear that modifications and/or additions of parts may be made to the apparatus 10 for working blanks as described heretofore, without departing from the field and scope of the present invention.

It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of the apparatus for working blanks, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Although the above refers to embodiments of the present description, other embodiments can be provided without departing from the main field of protection, which is defined by the following claims.

In the following claims, the only purpose of the references in brackets is to facilitate reading: they must not be considered as limiting factors regarding the field of protection intended in the specific claims.

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CLAIMS

1. Apparatus for working blanks to make rigid packets with a hinged lid for smoking articles, starting from a substantially flat blank (100), said apparatus comprising a wheel to transfer the blanks (12) provided with an entrance station (14) and an exit station (16), between which a predefined transfer path (P) develops, and with a flexing and bending station (18) provided in an intermediate position between the entrance station (14) and the exit station (16), wherein said entrance station (14) is associated with a blank feeding store (22), **characterized in that**, in correspondence with said flexing and bending station (18) there is a device (30) to work blanks comprising a structure in a single body provided with:

- a pair of first flexing or pre-bending members (32), configured to flex a transverse bending line (115') between a first smaller upper panel (122') and a second smaller upper panel (124') of said blank (100) and to pre-bend said first smaller upper panel (122'),
- a pair of second flexing or pre-bending members (34), configured to flex longitudinal bending lines (120') of said blank (100) and to pre-bend at least longitudinal lateral panels (118',119') of said blank (100) associated with said longitudinal bending lines (120'),
- at least one complete bending member (52), configured to bend at 180° said first smaller upper panel (122') adjacent against said second smaller upper panel (124') of said blank (100) for gluing purposes.

2. Apparatus as in claim 1, wherein, between the entrance station (14) and the flexing and bending station (18) a first glue dispensing station (26) is provided to dispense glue on the first smaller upper panel (122') of the blank (100).

3. Apparatus as in claim 2, said apparatus also comprising a pressing station (82), downstream of the flexing and bending station (18) along the transfer path (P) and configured to consolidate the gluing of the first smaller upper panel (122') to the second smaller upper panel (124') of the blank (100).

4. Apparatus as in claim 3, said apparatus also comprising another glue dispensing station (88), downstream of the pressing station (82) along the transfer path (P) and configured to dispense glue at least on the second longitudinal lateral panels (119').

5. Apparatus as in any of the claims from 1 to 4, said apparatus also comprising

devices to hold and/or deliver blanks (92), provided at the entrance station (14) and the exit station (16), in order to pick up the blanks (100) one at a time from the blank feeding store (22) and to feed them to the holding heads (20) in the entrance station (14) and to pick up the blanks from the holding heads (20) at the exit station (16), to deliver them to other operating units downstream of the apparatus.

6. Method to work blanks to make rigid packets with hinged lid for smoking articles, starting from a substantially flat blank (100), said method comprising at least:

- feeding a blank (100) to an entrance station (14) of a blank transfer wheel (12) and moving it along a predefined transfer path (P);
- positioning said blank (100) in a flexing and bending station (18),

characterized in that in said flexing and bending station (18) at least the following operations are carried out:

- flexing a transverse bending line (115') between a first smaller upper panel (122') and a second smaller upper panel (124') of said blank (100) and pre-bending said first smaller upper panel (122'),
- flexing longitudinal bending lines (120') of said blank (100) and pre-bending at least longitudinal lateral panels (118', 119') of said blank (100) associated with said longitudinal bending lines (120'),
- complete bending at 180° of said first smaller upper panel (122') adjacent against said second smaller upper panel (124') of said blank (100) for gluing purposes.

7. Method as in claim 6, said method also comprising a first dispensing of glue on the first smaller upper panel (122') of the blank (100) between the entrance station (14) and the flexing and bending station (18).

8. Method as in claim 7, said method also comprising a pressing, downstream of the flexing and bending station (18) along said transfer path (P), in order to consolidate the gluing of the first smaller upper panel (122') to the second smaller upper panel (124').

9. Method as in claim 8, said method also comprising another dispensing of glue, downstream of the pressing along said transfer path (P), to dispense glue at least on the second longitudinal lateral panels (119').

10. Method as in any claim hereinbefore, wherein said flexing of a transverse bending line (115') and said pre-bending of said first smaller upper panel (122'), and said flexing of longitudinal bending lines (120') and said pre-bending of said longitudinal lateral panels (118', 119') of said blank (100) are carried out by a single continuous rotation movement through 360° of a pair of first flexing or pre-bending members (32) and of a pair of second flexing or pre-bending members (34).

11. Device for working blanks to make rigid packets with hinged lid for smoking articles, starting from a substantially flat blank (100), **characterized in that** it comprises a structure in a single body provided with:

- a pair of first flexing or pre-bending members (32), configured to flex a transverse bending line (115') between a first smaller upper panel (122') and a second smaller upper panel (124') of said blank (100) and to pre-bend said first smaller upper panel (122'),
- a pair of second flexing or pre-bending members (34) configured to flex longitudinal bending lines (120') of said blank (100) and to pre-bend at least longitudinal lateral panels (118',119') of said blank (100) associated with said longitudinal bending lines (120'),
- at least a complete bending member (52), configured to bend at 180° said first smaller upper panel (122') adjacent against said second smaller upper panel (124') of said blank (100) for gluing purposes.

12. Device as in claim 11, wherein the first flexing members (32) and the second flexing members (34) are mounted on rotation shafts (36, 38) disposed parallel and distanced with respect to each other, wherein one rotation shaft (36) is provided with a first flexing member (32) and a second flexing member (34), and the other rotation shaft (38) is provided with the other first flexing member (32) and with the other second flexing member (34).

13. Device as in claim 12, wherein one or more actuation members (40) are provided, configured to rotate at least the rotation shafts (36, 38) around respective axes of rotation (X1, X2) and provided with a drive member (41), a motion transmission mechanism (35) being provided to transmit motion from the drive member (41) at least to the rotation shafts (36, 38).

14. Device as in claim 13, wherein said motion transmission mechanism (35)

comprises a toothed belt (37), wound around a toothed drive pulley (39a), keyed to the drive shaft of the drive member (41), and toothed driven pulleys (39b) respectively connected to the rotation shafts (36, 38).

15. Device as in claim 12, 13 or 14, wherein said first flexing members (32) each comprise a saber-shaped transverse portion (42), normally facing toward an internal space comprised between the two rotation shafts (36, 38), in order to act on said first smaller upper panel (122').

16. Device as in any of the claims from 12 to 15, wherein said second flexing members (34) each comprise a longitudinal blade portion (44), able to act at least on the longitudinal lateral panels (118', 119') and connected to a respective rotation shaft (36, 38).

17. Device as in any of the claims from 12 to 16, wherein the reciprocal angular position on the respective rotation shafts (36, 38) of the first flexing members (32) and of the second flexing members (34) is such that, by rotating the rotation shafts (36, 38) synchronously at a complete angle of revolution, said first flexing members (32) and second flexing members (34) begin to interfere with the respective parts of the blank (100) to be pre-bent.

18. Device as in any of the claims from 11 to 17, wherein said complete bending member (52) is configured mobile, in coordination with the first flexing members (32) and second flexing members (34), to act on the first smaller upper panel (122') after this has been pre-bent by the first flexing members (32).

19. Device as in any of the claims from 11 to 18, said device also comprising a blank contrast plate (46), configured at least to contrast the pressing action of said first flexing members (32) and second flexing members (34).

20. Device as in claim 19, wherein said blank contrast plate (46) is configured mobile to selectively act as an abutment for the blank (100).

21. Device as in claim 19 or 20, wherein said device also comprises a support element (48) to which the blank contrast plate (46) is connected.

22. Device as in claim 21, said device also comprising a movement unit (58) configured to move the support element (48), and the blank contrast plate (46) connected thereto, and the complete bending member (52), in a synchronous and coordinated manner.

23. Device as in claim 22, wherein said movement unit (58) is configured to

determine an alternate motion of the support element (48) and of the blank contrast plate (46) connected thereto, bringing the blank contrast plate (46) nearer to the blank (100), to act as an abutment, and at the same time distancing the complete bending member (52), and is also configured to determine a distancing movement of the blank contrast plate (46) from the blank (100), and at the same time bringing the bending member (52) nearer to the first smaller upper panel (122') of the blank (100).

24. Device as in claims 13 and 22 or 13 and 23, wherein said movement unit (58) is driven by said motion transmission mechanism (35).

25. Device as in claims 14 and 24, wherein said movement unit (58) comprises a toothed driven pulley (39b) of said motion transmission mechanism (35), around which said toothed belt (37) is wound, said toothed driven pulley (39b) being connected to a rotation shaft (62), the movement unit (58) also comprising a connecting rod-handle mechanism (64), driven by the rotation shaft (62) coupled to the toothed driven pulley (39b).

26. Device as in claim 25, wherein said connecting rod-handle mechanism (64) comprises a handle element (66) rotatably connected to the rotation shaft (62) to rotate around an axis of rotation (Z) and a connecting rod element (68) connected to the handle element (66).

27. Device as in claim 26, wherein said connecting rod element (68) is connected to the handle element (66) by means of a rod (70), pivoted to a handle pin (72) positioned eccentrically with respect to the axis of rotation (Z), to convert the circular motion of the handle element (66) into a rectilinear motion of the connecting rod element (68).

28. Device as in claim 26 or 27, wherein said connecting rod element (68) is connected to the support element (48), to move the blank contrast plate (46) in alternate motion.

29. Device as in any of the claims from 22 to 28, wherein said movement unit (58) also comprises a motion transfer unit (74), configured to move at least the complete bending member (52) with respect to said first smaller upper panel (122') of the blank (100), transferring the alternate movement of the support element (48) and of the blank contrast plate (46) connected thereto to the complete bending member (52).

30. Device as in claim 29, wherein said motion transfer unit (74) comprises a return rod (76), with one end pivoted to the support element (48) and an opposite end pivoted to a lever element (78) associated with the complete bending member (52), said lever element (78) defining said complete bending member (52) or being distinct from the complete bending member (52) and connected thereto by means of connection elements.

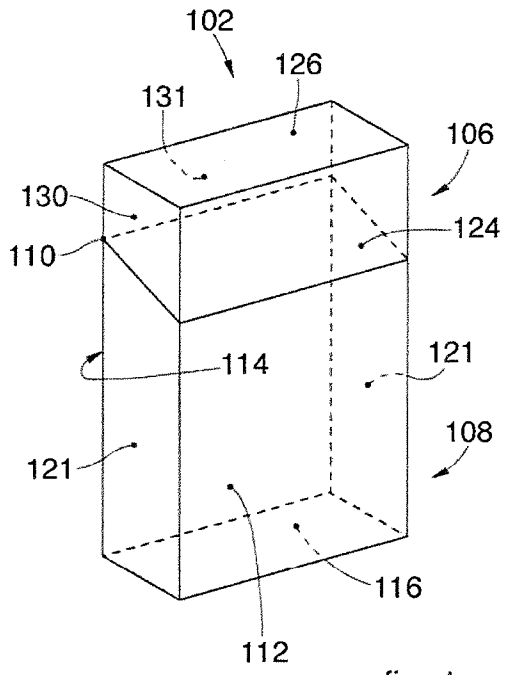

fig. 1

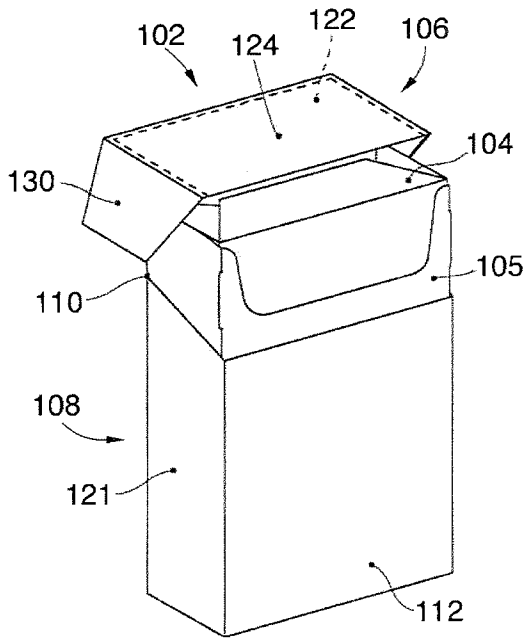

fig. 2

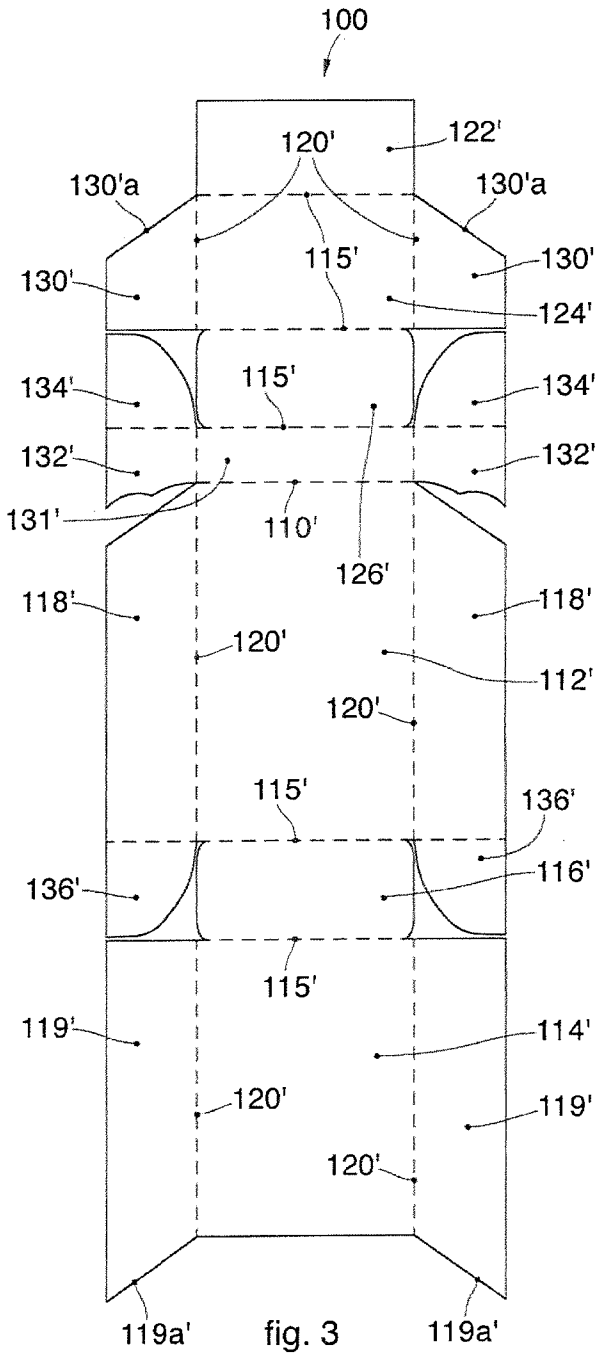

fig. 3

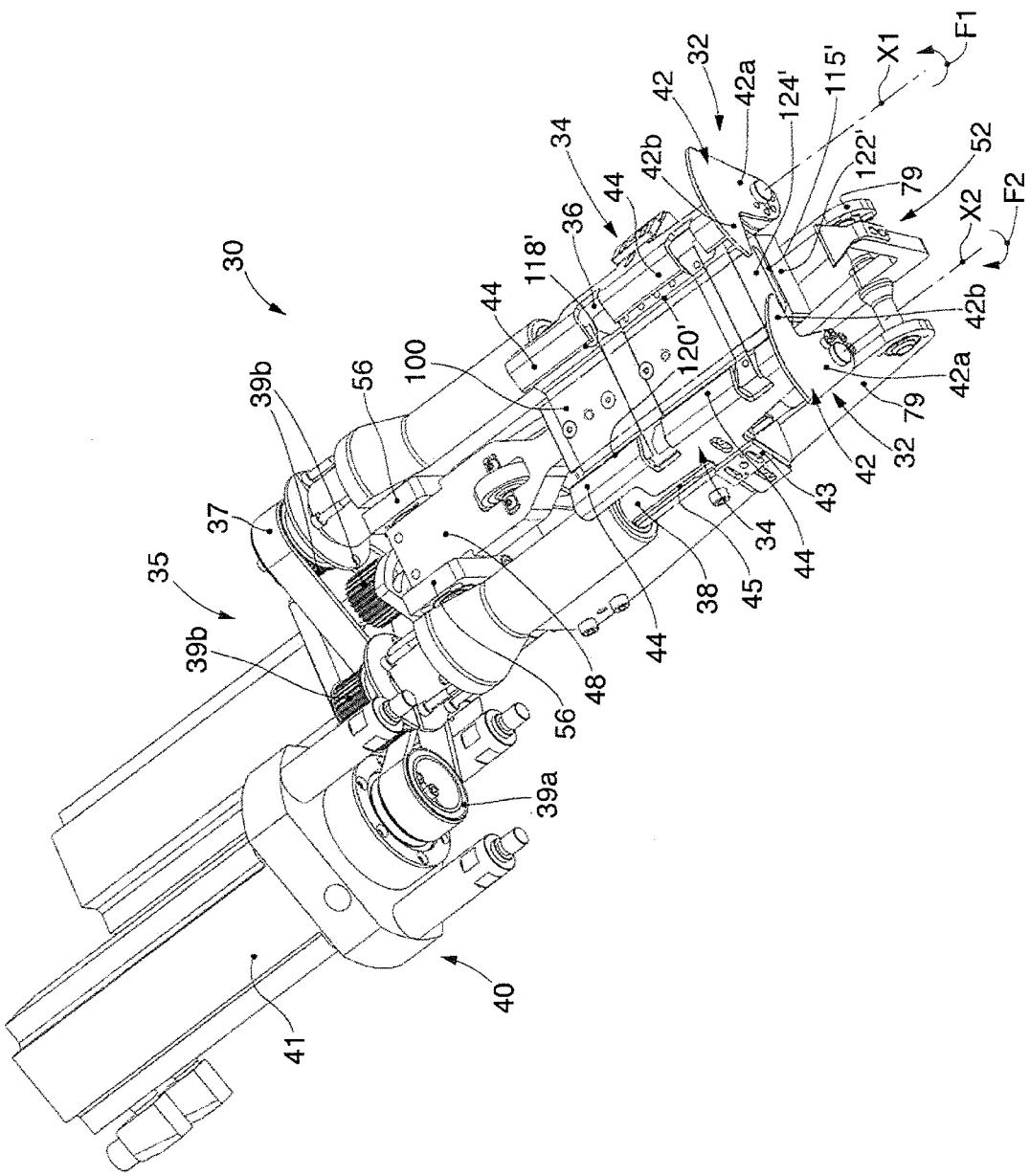
30
35
37
39b
56
100
44
118'
36
34
42b
42
32
42a
124'
115'
X1
F1
122'
52
79
X2
F2
120'
43
38
45
48
39a
40
41

fig. 4

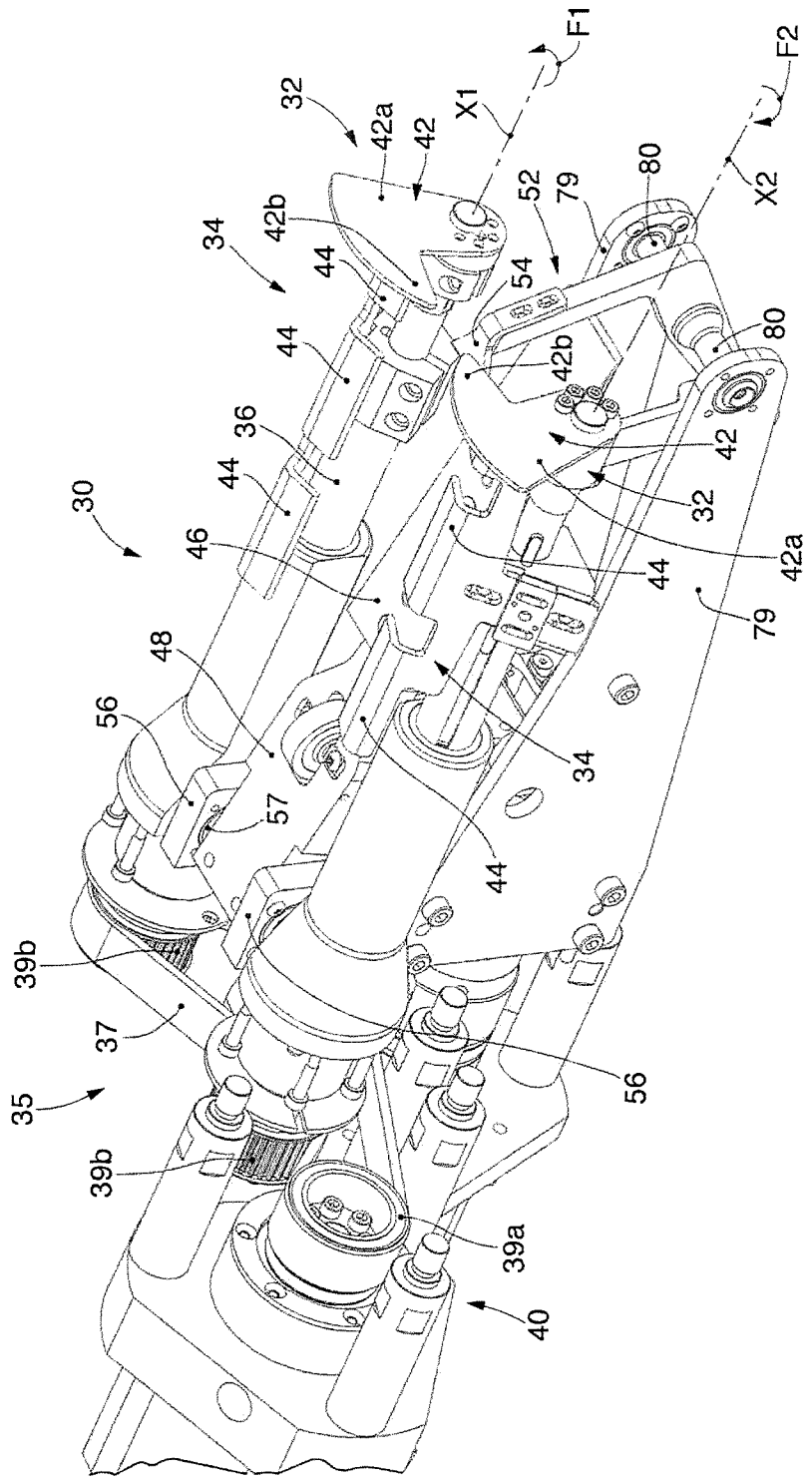
F1
F2
X1
X2
32
42a
42
42b
34
44
52
54
79
80
36
46
30
48
56
57
39b
37
35
39a
40

fig. 5

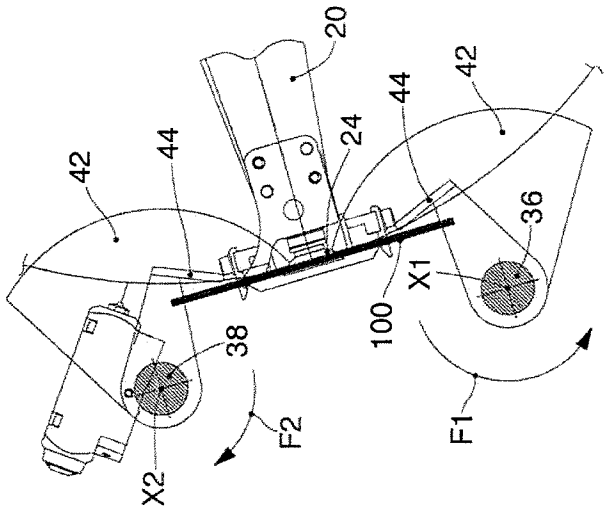
20
42
44
24
44
42
36
X1
100
38
F2
F1
X2

fig. 9

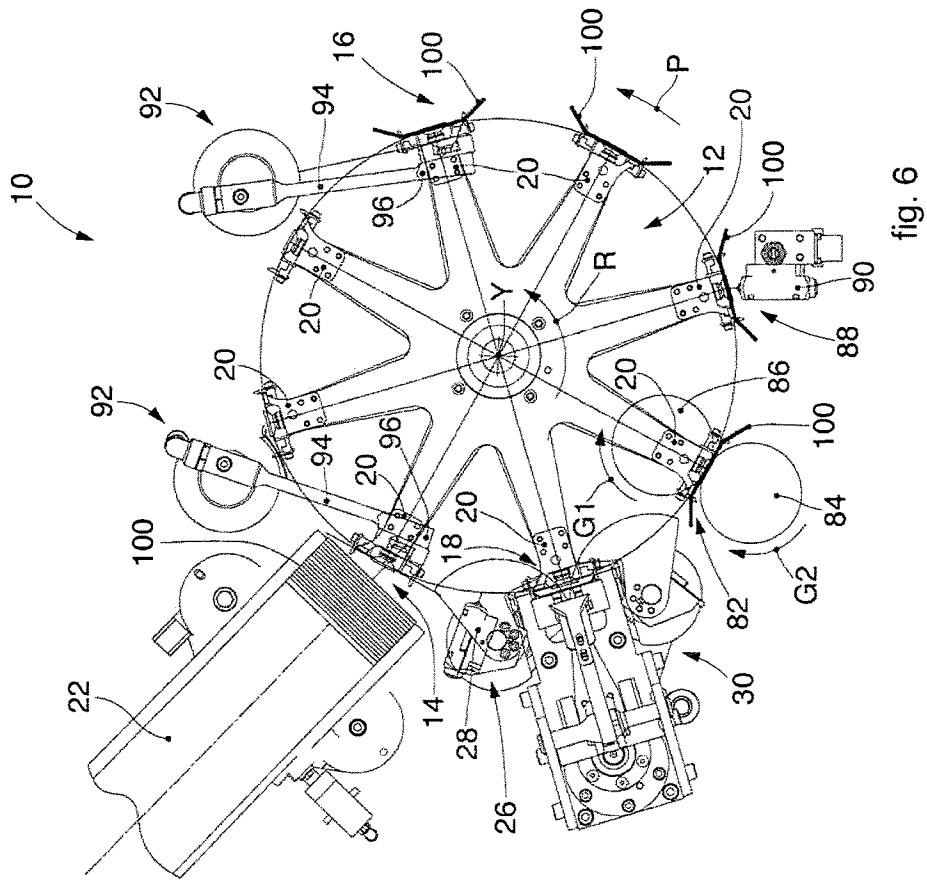
10
92
94
16
100
100
P
20
12
20
100
96
R
Y
90
88
20
20
92
86
100
94
96
20
G1
84
100
18
20
G2
82
22
14
28
26
30

fig. 6

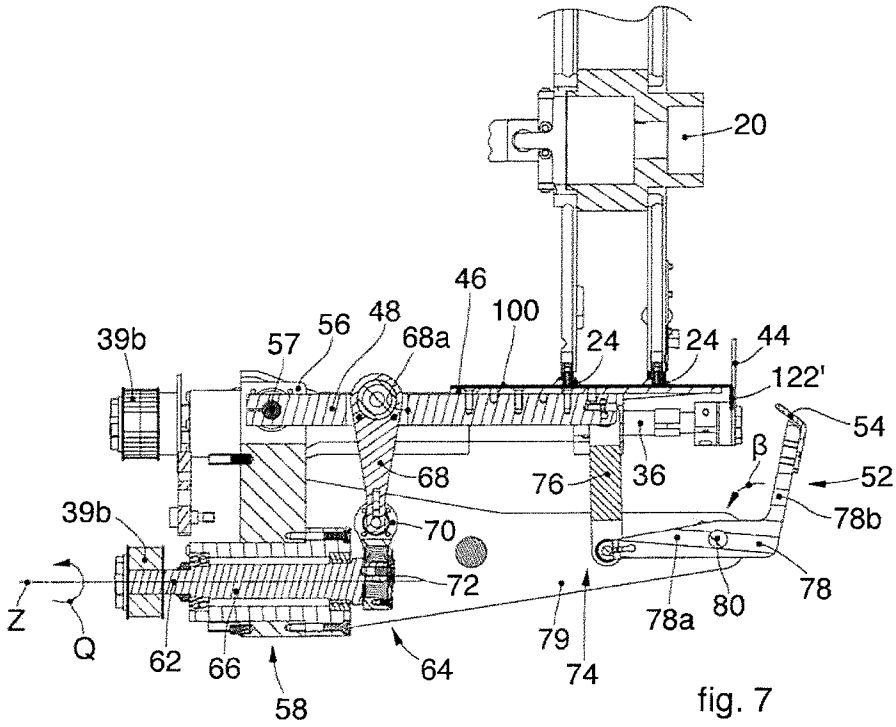
20
46
100
48
56
57
68a
39b
24
24
44
122'
54
β
52
78b
68
76
36
39b
70
72
78
80
78a
79
74
64
58
62
66
Z
Q

fig. 7

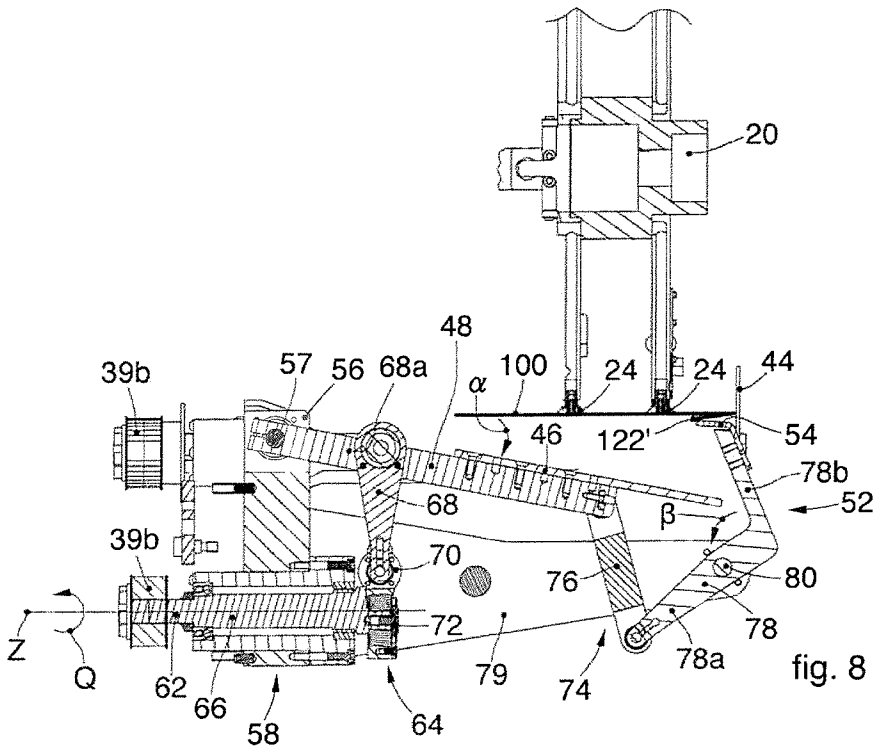
20
48
57
56
68a
39b
α
100
24
24
44
46
122'
54
78b
52
68
β
39b
70
76
80
78
72
78a
79
74
64
58
62
66
Z
Q

fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/051064

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65B19/22 B65B43/24 B31B1/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65B B31B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 10 2008 023782 A1 (GD SPA [IT]) 11 December 2008 (2008-12-11) paragraph [0020] - paragraph [0037]; figures 3-6	1-30
A	WO 2015/015409 A1 (GD SPA [IT]) 5 February 2015 (2015-02-05) the whole document	1-30
A	EP 0 900 646 A1 (GD SPA [IT]) 10 March 1999 (1999-03-10) paragraph [0020] - paragraph [0024]; figures 1,2	1-30
A	US 4 188 024 A (SERAGNOLI ENZO [IT]) 12 February 1980 (1980-02-12) figures 3-6	1,11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 May 2016	25/05/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Dick, Birgit

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2016/051064

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