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(54) **PRODUCTION SYSTEM FOR CRATE-TYPE PACKAGING, ESPECIALLY FOR FRUIT AND VEGETABLES, AND RELATED PACKAGING**

(57) Plant for production of crate-type packaging (200), starting from a panel (1) comprising a sheet (2) of rigid, non-flexible material and a film (20) applied to the sheet (2). The plant comprises a shearing machine (A), a first milling machine (B), a second milling machine (C), and a stapling machine (E) used to staple corner posts (6; 106), in the form of a rigid column, to parts of the panel intended to form transverse sides (5) and/or longitudinal sides (4) of the crate and related packaging.

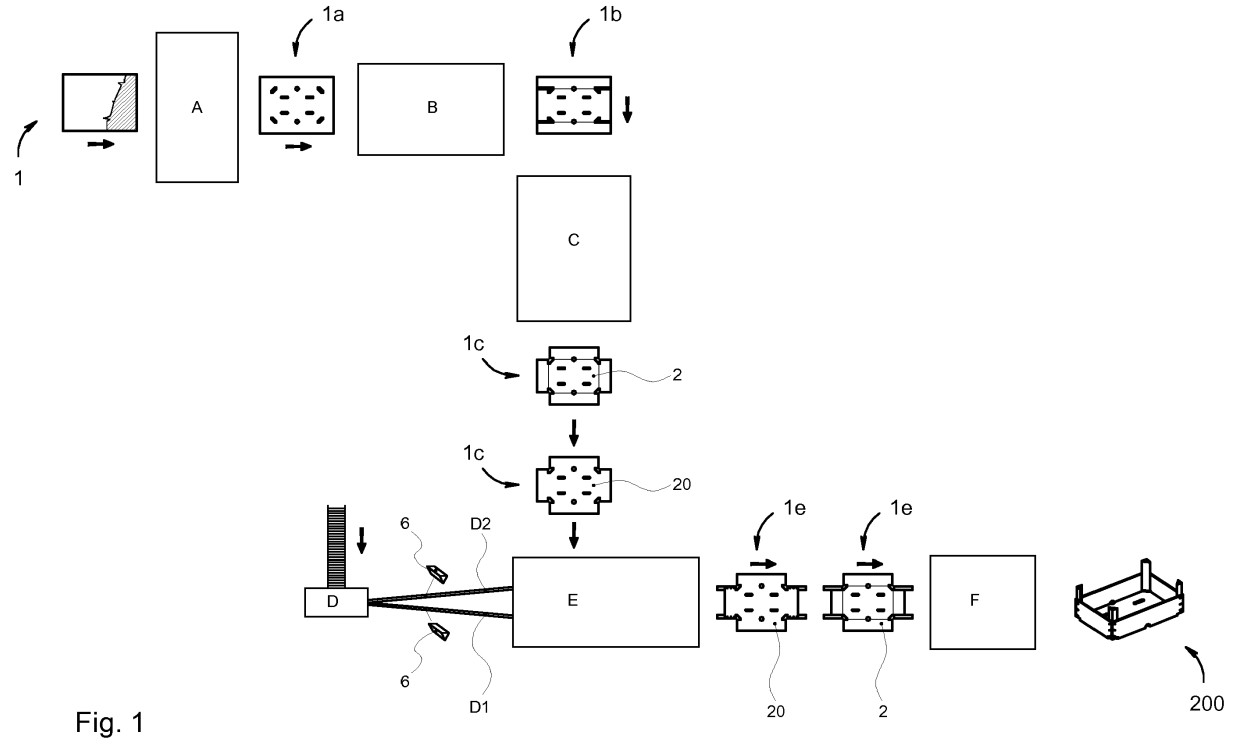


Fig. 1

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Description

[0001] This invention is intended for the sector of production of packaging made in rigid, non-folding material, commonly called crates, featuring high resistance to vertical compression. This kind of packaging is suitable for any kind of use, particularly for containing, transporting, storing and distributing all kinds of products, especially foodstuffs and/or fruits and vegetables, which, in view of their fragility, need adequate protection, both during storage and during transportation from points of production to destinations, including in refrigerated environments.

[0002] The commonly known packaging, called crates, include a base (mainly made out of various elements stapled together with metal wire), four corner posts rising from the corners of the base and four sides, fixed to the posts, generally with the use of metal wire. The base panel, posts and sides are generally made from rigid material of a natural or ecological type, such as wood, MDF, plywood or compound material.

[0003] Making a crate like this involves cutting various panels, which have to form the base and the four sides of the crate, and these panels are fixed to the posts by stapling with metal wire facing to the inside of the crate.

[0004] It is obvious that producing a crate of this type becomes rather long and complicated, since it has to be made in a series of stages and requires manual intervention.

[0005] Apart from that, the metal wire for the stapling is exposed to humidity and can become rusty. Obviously, if the rusty metal wire comes into contact with foodstuffs contained inside the crate, this will no longer meet satisfactory standards of hygiene and health.

[0006] There also exists packaging obtained starting from a flat panel, building up in volume. Generally this type of packaging is made from plastic and/or cardboard material, which is not natural or ecological and requires special treatment with chemical substances if used with foodstuffs, but also does not resist well to compression and humidity. Furthermore, to obtain the packaging, a lot of material from the original panel is wasted.

[0007] It is known that a creaser is used to fold the cardboard. The cardboard is squeezed along a line (representing the fold line) or is perforated in places. Whereas, for folding panels made of wood, fibre wood, MDF, plywood or similar materials, a film has to be glued to the panel and a channel cut into the panel with a cutting tool.

[0008] US5673848A describes a crate made in cardboard. A film can be applied to the cardboard to protect against humidity. Such a film does not function as a hinge. The cardboard does not have a stopped channel cut with a milling machine, by removing material. The cardboard has a crease, to allow the fold. The crate has corners made by folding the cardboard. The machinery does not have an automatic stapler, because the cardboard is glued.

[0009] FR1181969 and FR2642398 describe a packaging made from a sheet of cardboard, with wooden corners stapled or glued to the cardboard. However, these documents do not describe any equipment, nor any method for making the packaging. In particular, it is not explained how the corners are stapled, therefore it is assumed that the corners are stapled manually to the cardboard. Instead of cardboard, sheets of other foldable materials (plastic or light metal materials) may be used, but the use of non-foldable materials, such as wood, fibre wood, MDF, plywood or similar materials is excluded. Therefore the equipment does not require a cutting tool to form fold lines. Furthermore, the equipment does not require a forming machine or a stapling machine.

[0010] FR2985504 describes a cardboard box with corners made by folding and gluing the cardboard. No stapling is described. Also, in the fold at the corner, the corner fixing flap remains on the outside. Therefore, if stapling were used, the metal wire of the stapling would be inside the box and would be in contact with the contents of the box, with consequent hygiene/health problems. However, the equipment does not require cutting tools or forming or stapling machines.

[0011] DE2450702A1 describes cardboard packaging made from a cut-out, which folds along creases or perforated stretches. On the sheet of cardboard there are no channels on the fold lines with milling machines involving removal of material. This type of packaging does not require any stapling.

[0012] EP2228206A1 describes equipment for making boxes from corrugated cardboard. The process starts from a large sheet, from which several boxes are made, passing through the following units:

1) Unit (C): SLOTTER-CREASER (creates slots and creases in traditional boxes of corrugated cardboard);
2) Unit (D): DIE CUTTER;
3) Unit (I): Cuts the large sheet in half, to leave two smaller sheets to form two boxes;
4) Unit (J): Increases the speed of the sheets to separate them and pass them to the next steps of gluing and folding.

[0013] The fold lines are made by the creaser (squeezing the cardboard with creasing rollers) in unit (C). The slotter makes slots, which are actually cuts separating the various flaps of the cardboard making up the box. The cuts are made with a blade and counter blade, which rotate during cutting at a peripheral speed similar to that of the movement of the sheet of cardboard. The creaser rollers also rotate at a speed similar to that of the sheet of cardboard. However, the packaging does not require posts and the plant does not require milling, forming or stapling machines.

[0014] EP2366633A1, in the name of this applicant, describes a forming machine and packaging made with that forming machine. The forming machine enables a completely automatic method for making packaging starting from a flat sheet. However, the said forming ma-

chine is not suitable for making crate-type packaging with corner posts on the crate to give the crate rigidity.

[0015] The purpose of this invention is to eliminate the inconveniences of existing techniques and provide crate-type packaging, particularly for containing and transporting foodstuffs and/or fruits and vegetables, which have the advantages typical of packaging made from rigid, non-flexible materials, i.e. robustness, stability and hygiene.

[0016] Another purpose for this invention is to provide plant and an industrial production process for making crate-type packaging that is practical, economical, versatile and completely automatic.

[0017] These purposes are achieved according to the invention with crate packaging, the plant and the procedure of independent claims.

[0018] According to this invention, the plant is used for production of crate-type packaging starting from a panel, comprising a sheet of rigid, non-flexible material and a film attached to the sheet.

[0019] The plant includes:

- a shearing machine, used to make openings in the shape of a circle and/or oblong eyelet in the panel, in order to leave the panel with openings,
- a first milling machine, used to make longitudinal incisions in the panel of rigid material, in order to leave the panel with longitudinal channels in correspondence with the incisions, enabling the longitudinal sides of the crate to be folded up from the base,
- a second milling machine, used to make transverse incisions in the panel of rigid material, in order to leave the panel with transverse channels in correspondence with the incisions, enabling the transverse sides of the crate to be folded up from the base, and
- a stapling machine, used to staple posts in the shape of rigid columns, from parts of the original panel intended to form the said transverse sides and/or the said longitudinal sides of the crate, in order to obtain a panel with posts fixed on the said parts of the panel, intended to form the said transverse sides and/or the said longitudinal sides of the crate.

[0020] The crate obtained with the plant and method according to the invention is particularly suitable for containing all kinds of products, especially foodstuffs and/or fruits and vegetables.

[0021] The crate obtained features the following advantages compared to known crates in rigid material:

- better hygiene and guaranteed health/hygiene, since the product does not come into contact with the metal wire used for the staples;
- faster and cheaper production and savings on energy and labour, since the crate is made starting from a single panel, to which the four corner posts are already fixed; and
- lower transport costs, since the panel with posts already fixed can be transported in flat form and set up into volume in the place of use.

[0022] Furthermore, the crate made with the plant and method according to the invention, features the following advantages compared to traditional packaging made starting from a single panel:

- lower proportion of the panel to be used for equivalent format;
- better aeration for the product contained, so better preservation of the product;
- greater resistance to compression from vertically stacked loads;
- greater resistance to damp environments without need to undergo treatment with chemical products, and
- more hygienic, because the materials (wood, fibre wood, plywood, M.D.F. and the like) that will come into contact with the contained product are more natural and ecological and also ensure better preservation of the products contained.

[0023] The process and the plant, according to the invention, are particularly simple and cheap, in that they do not require special equipment, high energy consumption or specialised labour. Furthermore, the process and the plant, according to the invention, enable the packaging to be made from a panel of rigid, non-foldable material (wood, fibre wood, plywood, M.D.F. compound material, etc.), which is particularly resistant to compression from vertically stacked loads.

[0024] Crate packaging, according to the invention, is especially suitable and cheap for containing all kinds of products, especially foodstuffs and/or fruits and vegetables, which, given that they are fragile, need adequate protection, both in considerable storage in refrigerators and during transport from production sites to those of destination.

[0025] Once they have been emptied of products, the crate packaging, according to the invention, may be replaced in flat form, in order to save space, for recycling when possible or for sending for disposal.

[0026] Further features of the invention will appear more clearly from the following detailed description, referring to forms of production that are purely illustrative examples and, as such, in no way limiting.

Fig. 1 is a block diagram, showing, from the top of the diagram, the plant and the procedure for making a crate packaging according to the invention,

Fig. 2 is an axonometric projection of the crate packaging according to the invention coming out of a forming/stapling machine of the plant shown in Fig. 1

Fig. 3 is a plan view of a panel fed into a shearing machine of the plant shown in Fig. 1;

Fig. 4 is a plan view of a panel coming out of the

shearing machine;
Fig. 5 is a plan view of a panel coming out of a first milling machine of the plant shown in Fig. 1;
Fig. 6 is a plan view of a panel coming out of a second milling machine of the plant shown in Fig. 1;
Fig. 7 is a plan view from above of the first milling machine of the plant shown in Fig. 1;
Fig. 8 is a longitudinal cross section view of the first milling machine taken along the plane of section VIII-VIII of fig. 7,
Fig. 9 is an enlarged detail of Fig. 8 showing a first cutting station of the first milling machine;
Fig. 10 is an enlarged detail of an axial section of a cutting disc and an idler wheel of the first cutting station shown in Fig. 9;
Fig. 11 is an enlarged detail of Fig. 8 showing a second cutting station of the first milling machine;
Fig. 12 is an enlarged detail of an axial section of a cutting disc and an idler wheel of the second cutting station shown in Fig. 11;
Fig. 13 is a plan view from above of the first milling machine and of the second milling machine set up at a right angle to one another;
Fig. 14 is a plan view from above of the second milling machine;
Fig. 15 is a plan view of a variation of a panel coming out of the shearing machine shown in Fig. 1,
Fig. 16 is an axonometric projection of the stapling machine for the posts of the plant shown in Fig. 1;
Fig. 17 is a plan view from above of the stapling machine shown in Fig. 16;
Fig. 18 is a side view of the stapling machine shown in Fig. 17,
Fig. 19 is a view in cross-section of the stapling machine taken along the plane of section XIX-XIX of Fig. 17;
Fig. 20 is a plan view of a panel coming out of the stapling machine of the plant shown in Fig. 1;
Fig. 21 is an axonometric projection of the forming and stapling machine of the plant shown in Fig. 1;
Figs. 22 and 23 are two axonometric projections showing two successive stages of the forming and stapling machine shown in Fig. 21;
Fig. 24 is an axonometric projection showing two crates shown in Fig. 2 stacked;
Fig. 25 is an axonometric projection showing a second embodiment of a panel coming out of the stapling machine of the plant shown in Fig. 1;
Fig. 26 is an axonometric projection of the forming and stapling machine with the panel shown in Fig. 25;
Figs. 27 and 28 are two axonometric projections showing two successive stages of the forming and stapling machine shown in Fig. 26;
Fig. 29 is an axonometric projection of the crate coming out of the forming and stapling machine shown in Fig. 28;
Fig. 30 is an axonometric projection showing a third embodiment of a panel coming out of the stapling machine of the plant according to the invention;
Fig. 31 is an axonometric projection of an overturned view of the panel shown in Fig. 30;
Fig. 32 is an axonometric projection of a crate obtained with the panel shown in Fig. 31, before folding the upper wings;
Fig. 33 is an axonometric projection of the crate shown in Fig. 32, after folding the upper wings;
Fig. 34 is an axonometric projection showing two crates shown in Fig. 33 stacked;
Fig. 35 is an axonometric projection showing a fourth embodiment of a panel coming out of the second milling machine of the plant according to the invention;
Fig. 36 is an axonometric projection of the panel shown in Fig. 35 after folding the side wings to form the corner posts;
Fig. 37 is an axonometric projection of a panel shown in Fig. 36 coming out of the stapling machine of the plant according to the invention;
Fig. 38 is an axonometric projection of the forming and stapling machine with the panel shown in Fig. 37;
Figs. 39 and 40 are two axonometric projections showing two successive stages of the forming and stapling machine shown in Fig. 38;
Fig. 41 is an axonometric projection of the crate coming out of the forming and stapling machine shown in Fig. 40;
Fig. 42 is an axonometric projection showing two crates shown in Fig. 41 stacked.

[0027] The Figures are used to help describe the system for production of crate-type packaging according to the invention.

[0028] Referring to Fig. 1, the plant includes:

- a shearing or punching machine (A) used to make holes and eyelets in panels,
- a first milling machine (B) used to make longitudinal cuts and incisions in panels,
- a second milling machine (C) used to make transverse cuts and incisions in panels, and
- a stapling machine (E) used to staple corner posts on the panels.

[0029] As an option, the plant may include a cutting saw and feeder (D), used to cut battens to form corner posts (posts with a triangular section), which are then fed into the stapling machine (E).

[0030] As an option, the plant may also include a forming and stapling machine (F), used to form a crate from a flat panel and to staple the sides of the crate to the corner posts.

[0031] In Fig. 2 a crate (200) is shown, as obtained with plant according to the invention. The crate (200) comprises a base (3), four corner posts (6), which rise from the corners of the base, two longitudinal sides (4) and two transversal sides (5), fixed to the corner posts (6).

[0032] Referring to Fig. 1, the crate (200) is obtained starting from a panel (1).

[0033] Referring to Fig. 3, the panel (1) has a substantially rectangular or square shape and features two longitudinal edges (10) and two transversal edges (11). The panel (1) comprises a sheet (2) in rigid non-folding material, such as, for example, wood, fibre wood, plywood, MDF, compound material and the like. A film (20) is attached to the sheet (2), by gluing, for example. The film (20) is positioned on a face of the sheet that is to be turned towards the outside of the crate.

[0034] The dimensions of the panel (1) are substantially the same as the proportions of the base (3) and the sides (4, 5) of the crate. The desired height of the crate (200) is determined by the length of the corner posts (6).

[0035] The film (20) may be glued to the sheet (2), using any known method (not shown in Fig. 1), such as, for example, a sealer, an automatic coater or a laminator. This film (20) may be of any flexible material, such as, for example paper, card, plastic film, duct tape and the like. The film (20) may be transparent, non-transparent and/or printed with a desired print.

[0036] If the sheet (2) has an external face that is decorated (for example, covered with melamine paper) and printed, the film (20) may be transparent, to show the printed external face of the sheet (2). However, if the sheet (2) is plain, the film (20) may be printed before or after application to the sheet (2), in order to save on the treatment of the sheet surfaces (2).

[0037] Going back to Fig. 1, the first stage of the process involves cutting the panel (1), with the shearing machine (A). The shearing machine (A) is of a known type and may be, for example, a shearing or punching machine, flat press or rotary press fitted with spikes to make through cuts and openings (holes and eyelets) in the panel (1), or a milling machine or laser cutter and the like may be used.

[0038] Referring to Fig. 4, a panel (1 a) exits from the shearing machine (A) with a number of through openings, which cut through the entire thickness of the panel, in other words the through openings pass completely through the sheet (2) of rigid material and the film (20). These numerous through openings include openings for transpiration (12) and four corner openings (13).

[0039] The transpiration openings (12) are circular and/or oblong eyelet shaped and are cut into a central area of the panel (1 a). The transpiration openings (12) enable transpiration of the product contained in the crate (200).

[0040] The corner openings (13) are hexagonal in shape, with a first end (13a) pointing towards the longitudinal edge (10) of the panel and a second end (13b) pointing towards the transverse edge (11) of the panel. The corner opening (13) has a through axis for its ends (13a, 13b) forming 45° angles with the longitudinal and transverse edges (10, 11) of the panel.

[0041] Going back to Fig. 1, the panel (1 a) exits from the shearing machine (A) and passes to the first milling machine (B), which executes on the panel (1 a) longitudinal cuts, parallel to the longitudinal edges (10) of the panel.

[0042] Referring to Fig. 5, a panel (1b) is shown exiting from the first milling machine (B).

[0043] The longitudinal cuts follow longitudinal through lines for the first end (13a) of the corner openings (13). Each longitudinal cut creates longitudinal through openings (14) which extend from the transverse edge (11) of the panel to the first end (13a) of the corner openings (13) and longitudinal channels (15) which extend between the two ends (13a) of two corner openings. The longitudinal channels (15) are obtained as carvings only on the sheet (2) of rigid material and not on the film (20). The longitudinal channels (15) may be interrupted by transpiration openings (12). The longitudinal channels (15) define folding lines, for folding the longitudinal sides (4) of the crate.

[0044] Going back to Fig. 1, the panel (1 b) exits from the first milling machine (B), and passes to the second milling machine (C) which executes on the panel (1 b) transverse cuts, parallel to the transverse edges (11) of the panel.

[0045] Referring to Fig. 6, a panel (1c) is shown exiting from the second milling machine (C).

[0046] The transverse cuts follow transverse through lines for the second end (13b) of the corner openings (13). Each transverse cut creates transverse through openings which extend from the longitudinal edge (10) of the panel to the second end (13b) of the corner openings (13) and transverse channels (16) which extend between the second ends (13b) of two corner openings. As a result, corner portions of the panel (1 c) are removed from the panel, so that the longitudinal sides (4) and the transverse sides (5) of the crate are defined. The portions of the longitudinal sides (4) are separated from the portions of the transverse sides (5) by windows (17) created from the corner openings (13) to the corners of the portion of the base (3).

[0047] The transverse channels (16) are obtained as carvings only on the sheet (2) of rigid material and not on the film (20). The transverse channels (16) define folding lines, for folding the transverse sides (5) of the crate.

[0048] It should be taken into consideration that, if a shearing or punching machine is used to make cutting lines on rigid material, such as MDF, plywood, fibre wood, compound materials and the like, these lines will not be sufficiently well finished, because of the density of the material and its tendency to crumble, in the area close to the cutting line. Also, material that tends to crumble absorbs more humidity along the cut edges, thereby reducing resistance in damp environments. On the other hand, a cut made with a cutting or milling disc on such rigid materials remains substantially compact and uniform and prevents crumbling of the material and absorption of humidity.

[0049] Furthermore, a shearing or punching machine requires very high power and therefore high energy con-

sumption compared to a milling machine.

[0050] For these reasons, making longitudinal and transverse cutting lines and incisions on the panel is achieved using milling machines rather than shearing machines.

[0051] Referring to Figs. 7 and 8, the first milling machine (B) comprises pushers (70) fitted on chains (71) supported by guides (72). The panel (1 a) is positioned on the chains (71). The pushers (70) push a transverse edge (11) of the panel. The panel (1 a) is positioned on the chains (71) in such a way that the longitudinal edges (10) of the panel are parallel to the direction of motion of the panel and the sheet (2) of rigid material is facing upwards.

[0052] The first milling machine (B) comprises a first cutting station (S1) to make a through cut to create the longitudinal through openings (14) and a second cutting station (S2) to make an incision (stopped) in the sheet (2) of rigid material to create the longitudinal channels (15).

[0053] Referring to Figs. 9 and 10, the first cutting station (S1) comprises cutting tools including a pair of cutting (73) or milling discs. The cutting discs (73) are fitted on a shaft (74) positioned transversely, which spins at a constant velocity of between 6,000 and 12,000 revolutions per minute.

[0054] As shown in Fig. 10, each cutting disc (73) has an edge (73') that is substantially rectangular shaped in axial cross section, with a thickness equal to the longitudinal through openings (14) that are to be made.

[0055] Counter devices (75), driven by an actuator, (77) raise the panel (1 a) to bring it into contact with the cutting disc (73).

[0056] The counter devices are a pair of idler wheels (75) which work together with the cutting discs (73). Each idler wheel (75) has a periphery groove (75') to accept the edge (73') of the cutting disc. Each idler wheel (75) is held by an "L"-shaped rocking arm (76) swivelling on the machine frame by means of a pivot (76a). The rocking arm (76) is driven by an actuator (77), either electric, electronic, pneumatic or hydraulic.

[0057] The first cutting station (S1) also comprises a bar (78) held by a bow-shaped spring (79), which presses the panel (1 a) continuously against the idler wheel (75), so that the panel (1 a) never loses contact with the idler wheel (75). The bow-shaped spring (79) may be replaced by a compression spring or traction spring with a suitable lever.

[0058] Forward movement of the panel (1 a) is continuous (in other words, the panel moves forward in a continuous, steady manner and not in an intermittent, step by step, manner). When the parts of the panel that are to form longitudinal through openings (14) pass at the level of the cutting disc (73) of the first cutting station, a command signal operates the actuator (77) that commands the rocking arm (76), which swivels on its pivot (76a) to push the idler wheel (75) and press the panel (1 a) against the cutting disc (73), in order to make the cut in the panel that determines the longitudinal through opening (14).

[0059] Detectors, such as sensors, or other devices, detect when the cut has to be made and accordingly command the actuator (77).

[0060] Referring to Figs. 11 and 12, the second cutting station (S2) is substantially the same as the first cutting station (S1). In this case, identical elements to those already described are shown with the same reference numbers and their detailed description is omitted. The only difference is represented by the fact that the second cutting station (S2) using cutting discs (173) configured to make a stopped incision on the sheet (2) of rigid material, in order to form the longitudinal channels (15). For this purpose, each cutting disc (173) on the second cutting station has a "V"-shaped periphery edge (173') in axial cross section, so as to make a "V"-shaped incision on the sheet (2) of rigid material, which creates the longitudinal channel (15), without cutting the film (20). The idler wheel (75) on the second cutting station has a groove (175) on its periphery edge. The groove (175) on the idler wheel of the second cutting station is not as deep as the groove (75') on the idler wheel of the first cutting station.

[0061] The cutting disc (173) may have a periphery edge (173') of any suitable geometrical shape, to create a channel which will allow the longitudinal sides (4) and the transverse sides (5) to fold, substantially, to 90° compared to the base (3) of the container.

[0062] Between the deepest part of the longitudinal channel (15) and the film (20), there remains a thin portion (21) of the rigid material of the sheet (2), which is sufficient to avoid unintentional folding of the panel (1a) along this longitudinal channel (15), when not subjected to deliberate application of any force. In this way, moving the panels in their flat form is made easier. Obviously this thin portion (21) of rigid material can be easily broken, to allow folding of the sides of the crate.

[0063] In Fig. 13 an illustration can be seen of the passage of the panel (1 b) from the first milling machine (B) to the second milling machine (C). For this purpose, the second milling machine (C) is positioned squarely to the first milling machine (B), so as to avoid having to rotate the panel (1 b) through 90° on exit from the first milling machine (B). In reality, the panel (1b) exits from the first milling machine (B) and is positioned on the chains (71) of the second milling machine (C), in such a way that the transverse edges (11) of the panel are parallel to the direction of motion of the panel in the second milling machine (C).

[0064] Referring to Fig. 14, the second milling machine (C) is substantially the same as the first milling machine (B), therefore elements that are identical to or correspond with those already described are shown with the same reference numbers and their detailed description is omitted.

[0065] The second milling machine (C) comprises a first cutting station (S1) and a second cutting station (S2). In the first cutting station (S1) a through cut is made,

which creates transverse through openings (18), which entail the detachment of corner portions (19) of the panel (1b). In the second cutting station (S2) a (stopped) incision is made in the sheet (2) of hard material, which creates the transverse channels (16).

[0066] Referring to Fig. 15, as an alternative to the procedure described, the shearing machine (A), as well as making the openings for transpiration (12), could also cut off and remove the corner portions (119) of the panel, where each corner portion (119) includes a square or rectangular (119') part and a hexagonal part (119"). In this way, on exit from the shearing machine (A), there is a panel (1 a') with corner portions already separated. The panel (1 a') features windows (17) corresponding to the corners of the portion that should form the crate base.

[0067] The panel (1 a) is fed into the first milling machine (B), which makes only the longitudinal channels (15) and then the second milling machine (C), which makes only the transverse channels (16). In this case the first milling machine (B) and the second milling machine (C) include only one cutting station, corresponding to the second cutting station (S2), in other words the cutting station used to make incisions on the sheet (2) of the panel to create the longitudinal and transverse channels (15, 16).

[0068] The milling machines (B, C) may be organised with the cutting disc positioned below the panel and the idler wheel above the panel, in which case the panels are fed into the milling machines with the sheet (2) of rigid material facing downwards.

[0069] The various operational stages in each milling machine (B, C) may also have different sequences, for example, the cutting stations (S1, S2) may be reversed. Also, the second milling machine (C), which makes the transverse cut may be positioned before the first milling machine (B), which makes the longitudinal cut, or the second milling machine (C) may be aligned after the first milling machine (B), in which case the panel is rotated through 90° before entering the second milling machine (C).

[0070] As an alternative, second milling machine (C) may be placed in line with the first milling machine (so that the panel need not be rotated or change its direction of movement). In this case, the cutting station (S1, S2) is set up on a transverse sliding rail compared to the direction of movement of the panel.

[0071] When a signal indicates that the areas of the panel involved in transverse incisions have reached the cutting discs (73, 173), the system of forward movement of the panel stops.

[0072] So, once the panel has stopped, the cutting discs run along the rail to make the cuts and/or incisions across the direction of movement of the panel, in order to obtain transverse channels corresponding to the incisions that enable folding of the longitudinal and/or transverse sides of the crate. However, in this mode, with the forward motion of the panel (1 a; 1 a') not being continuous, but intermittent, step by step, production is slowed down.

[0073] Or there is a further alternative, with the two milling machines (B and C) placed in line, so that one of the two milling machines can carry the cutting discs fitted on a transverse sliding rail, in order to make the cuts and/or incisions on the panel while following the panel itself. This means that, while the cutting disc fitted on a rail moves transversely to the direction of movement of the panel, making cuts and/or incisions on the passing panel, the cutting disc and the rail it runs on move forward together with the panel, in the same direction and at the same speed as the panel. Once the cut is completed, the rail on which the cutting disc runs will return to its starting position for the following cycle.

[0074] Going back to Fig. 1, the panels (1c) exiting from the second milling machine (C) are turned over, so that the film (20) is facing upwards and the sheet (2) of rigid material is facing downwards. These panels (1c) are then fed into the stapling machine (E).

[0075] A cutting saw and feeder (D) is located upstream of the stapling machine (E). The cutting saw and feeder (D), takes a batten of wood or other suitable rigid material and cuts it into a number of pieces with a triangular cross-section, to be used to form the corner posts (6) of the crate (200) (Fig. 2). The corner posts (6) may have a different geometrical shape (square cross-section, rectangular, etc.).

[0076] The cutting saw and feeder (D), has two feeder lines (D1, D2) to feed the corner posts (6) towards the stapling machine (E).

[0077] Referring to Figs. 16, 17, 18 and 19, the stapling machine (E) includes two guides (80), with a "V"-shaped cross-section, which extend longitudinally. The guides (80) are used to receive and guide the corner posts (6) arriving from the cutting saw and feeder (D). The corner posts (6) are pushed along the guides (80) by pushers (81, 82) on chains (83). The chains (83) travel on their own guides (84).

[0078] Two longitudinal bars (85) support the guides (84) for the chains and the guides (80) for the corner posts. Adjuster screws (86) are positioned between the longitudinal bars (85) to adjust the position of the longitudinal bars.

[0079] The cutting saw and feeder (D) sends four corner posts (6) for each panel (1c) fed into the stapling machine (E). Therefore the cutting saw and feeder (D) is synchronised with the continuous motion of the pushers (81, 82). The cutting saw and feeder (D) cuts and automatically sends one pair of corner posts (6) after another into the corner post guides (80), in such a way that the corner posts (6) are ready to be pushed by each pusher (81, 82). The corner posts (6) are slid along the guides (80) by the continuous push of the pushers (81, 82).

[0080] The stapling machine (E) includes guides (87) to support and guide the panel (1c). The panel guides (87) comprise two "L"-shaped profiles, in cross-section, positioned longitudinally and separated from each other

by a distance equal to the width (transverse dimension) of the panel (1 c).

[0081] Some of the corner post pushers (82) have a pushing portion (82a) raised upwards, so as to operate as a pusher for the panel (1 c).

[0082] The panel (1 c). is placed on the panel guides (87), above the corner post guides (80). Therefore the sheet (2) of rigid material of the panel faces towards the corner posts (6), which pass on the corner post guides (80). The panels (1 c) are fed into the stapling machine (E) by any suitable feeder device that can pick up and transfer one panel in succession from a stack of panels.

[0083] Alternatively, the feeder device picks up the panels at the exit from the second milling machine (C), turns them over and feeds them into the stapling machine (E).

[0084] The panel (1 c) in the stapling machine (E) is pushed by the same pushers (82, 82a) that push the corner posts (6), so the continuous forward motion of the panel (1c) is synchronised with the continuous forward motion of the corner posts (6).

[0085] The stapling machine (E) comprises a pair of stapling heads (88) positioned above the corner post guides (80). The stapling heads (88) may also be positioned below the guides (80) to staple from below.

[0086] The stapling heads (88) are used to make the stapling (P) with metal wire to staple the corner posts to the panel. The wire for the staples may be round or flat. The above mentioned stapling wire may also be in plastic material.

[0087] The stapling heads (88) are held in a swinging manner by a transverse bar (89). The stapling heads (88) are controlled by a command signal from detection devices which detect the position of the panel and of the corner posts reaching the operating area of the stapling heads.

[0088] The portion of the pusher (82a) for the panel pushes the panel (1 c) in synchronisation with the corner posts (6) pushed by the pushers (81, 82) for the corner posts. In this way, the corner posts (6) and the panel (1 c) advance in a continuous, synchronised manner through the stapling heads (88).

[0089] While the panel (1 c) and corner posts (6) are passing through the area of the stapling heads (88), the stapling heads (88) are activated by a command signal sent by the detection devices, to staple the corner posts (6) to the panel (1 c).

[0090] The stapling heads (88) are set up in such a way as to perform a swinging movement (like a pendulum). Therefore, during the stapling, the stapling heads (88) follow the panel at a speed that is substantially similar to that of the chain (83) pulling the respective pushers (81, 82, 82a).

[0091] The device which commands and activates the stapling heads (88) may be any type of actuator, for example, electric, electronic, pneumatic, mechanical or hydraulic.

[0092] For each panel (1c) passing on the stapling machine (E), there is one front pair of pushers (81) and a second rear pair of pushers (82) to push four corner posts (6) to be stapled to the panel (1 c).

[0093] The front pushers (81) for the corner posts are positioned, in relation to the portions of the pushers (82a) for the panel, in such a way that a first pair of corner posts (6) will be under the part of the panel that is to become the first transverse side (5). The rear pushers (82) for the corner posts are positioned, in relation to the portions of the pushers (82a) for the panel, in such a way that a second pair of corner posts (6) will be under the part of the panel that is to become the second transverse side (5) of the crate.

[0094] The stapling heads (88) place the staples (P), which pass through the parts of the panel that are to become the transverse side (5) of the crate and penetrate the corner posts (6) without protruding towards the inside of the crate. In this way the staples (P) are exposed only on the outside of the crate and do not come into contact with the contents of the crate.

[0095] If the format of the panel (1 c) is changed (i.e. the longitudinal dimension of the panel (1 c) is changed), it is preferable to keep the rear pair of pushers (82) in the same position on the chain (83) and move the front pair of pushers (81) on the chain (83), to achieve the desired format for the panel (1c).

[0096] The portion of the pusher (82a) for the panel is adjustable on the corner post pusher (82) it is fitted to, according to the height of the corner post (6) compared to the height of the transverse sides (5) of the crate.

[0097] Alternatively extra pairs of parallel chains (83) may be used. One pair of chains can be used to attach all the rear pairs of pushers (82) for the corner posts, while a second pair of chains can be used to attach the front pairs of pushers (81) for the corner posts. In this way, when the format is changed for the panel, in order to adjust the position of the front pushers (81) in relation to the rear pushers (82), it is sufficient and faster just to move the position of one of the two pairs of chains (83), which moves, at the same time, all the pushers attached to the chain.

[0098] The pushers (82a) that move the panel can also be separated from the rear pushers (82) for the corner posts and may be fitted to the pairs of chains separate from the chains which carry the pushers for the corner posts.

[0099] The corner posts (6) can be stapled on the stapling machine (E) on the longitudinal sides (4) rather than the transverse sides (5). In this case, the panel (1 c) is fed into the stapling machine (E) with its transverse edges parallel to the direction of forward motion.

[0100] Referring to Fig. 20, on exiting from the stapling machine (E) a panel (1 e) is obtained with the four corner posts (6) attached with the staples (P) to the part of the panel that is to form the transverse sides (5) of the crate. Each corner post (6) has an upper end (60) protruding above the edge of the transverse sides (5) and a lower end (61) aligned with the windows (17) positioned at the

corners of the base (3).

[0101] Going back to Fig. 1, the panel (1e) exiting from the stapling machine (E) is then turned over, so that the sheet of rigid material (2) and the corner posts (6) are set up facing upwards and the film (20) is set up facing downwards. Therefore the panel (1e) is fed into the forming and stapling machine (F) for putting the crate (200) into shape, starting from the panel (1e) in flat form. The panel (1e) is passed into the forming and stapling machine (F) using any suitable means, for example, a chain, an actuator, a pusher or the like.

[0102] It has to be taken into consideration that the panel (1 e) in flat form can be stored and transported with the minimum space requirement and maximum economy, therefore the panel (1 e) can also be put into shape on other premises, for example, on the premises where the crates (200) are to be used. The panel (1 e) can be put into shape both manually or with a forming and stapling machine (F).

[0103] Referring to Figs. 21, 22 e 23, the forming and stapling machine (F) comprises a forming mandrel (90) and a tunnel (99) positioned below the forming mandrel.

[0104] The forming mandrel (90) is in the shape of a parallelepiped block, with a base substantially the same as the base (3) of the crate it has to form. The forming mandrel (90) is held by guides (91) fitted to slide vertically in a supporting frame (92).

[0105] A motor (93), by means of a transmission (93a), drives the forming mandrel (90) in such a way that the forming mandrel (90) can make an alternating movement in a vertical direction to enter and exit from the tunnel (99). The forming mandrel (90) can be driven by any suitable means, for example, an actuator, a connecting rod, a chain or the like.

[0106] The tunnel (99) comprises four sides formed by two longitudinal plates (94) and two transverse plates (95), which make up a parallelepiped tunnel through which the forming mandrel (90) can pass. Each plate (94, 95) of the tunnel has its upper part curved towards the outside. The upper part of the plates (94, 95) can be replaced respectively by rollers. Inside the tunnel (99), the forming mandrel (90) slides alternately.

[0107] The panel (1 e) is positioned on the tunnel (99) in such a way that the parts of the longitudinal sides (4) of the panel lie on the externally curved parts of the longitudinal plates (94) of the tunnel and the parts of the transverse sides (5) of the panel lie on the externally curved parts of the transverse plates (95) of the tunnel. In this way, the forming mandrel (90) pushes the part of the base (3) of the panel downwards and the longitudinal and transverse plates (94, 95) of the tunnel raise the parts of the sides (4, 5) of the panel in relation to the base (3), forming the crate (200).

[0108] The forming and stapling machine (F) also comprises two pairs of stapling heads (96), fitted to swing on respective bars (97) positioned parallel to the longitudinal plates (94) of the tunnel. The stapling heads (96) place the staples (P1) (see Fig. 2) which attach the longitudinal sides (4) of the crate to the corner posts (6).

[0109] Fig. 21 shows the panel (1e) in flat form above the tunnel (99). Figs. 22 and 23 show two successive stages of the forming of the crate (200); this is while the forming mandrel (90) descends inside the tunnel (99), pressing on the base (3) of the panel, the longitudinal sides (4) and the transverse sides (5) with corner posts (6) fold along the longitudinal and transverse (15, 16) channels until reaching a position which is substantially perpendicular in relation to the base (3).

[0110] After that, a command signal activates the stapling heads (96) to place the staples. The stapling heads (96) are set up in such a way as to perform a swinging movement (like a pendulum). Therefore, during the stapling, the stapling heads (96) follow the longitudinal sides (4) of the crate at a speed that is substantially similar as that of the forming mandrel (90).

[0111] Once the stapling stage is concluded, the formed crate (200) is expelled from the tunnel (99) and the forming mandrel (90) repositions itself above the tunnel (99) for a successive cycle.

[0112] The motor (93) of the forming mandrel (90) is configured in such a way as to vary the speed of the forming mandrel (90) during the forming cycle, in order to optimise timings and production.

[0113] The device which commands and activates the stapling heads (96) may be any type of actuator, for example, electric, electronic, mechanical, pneumatic, hydraulic or the like.

[0114] It is obvious that, by carrying out the stapling with the forming mandrel (90) moving and, therefore, with the crate (200) moving continuously in the stapling stage, there is an advantage in terms of increased production and reduced costs.

[0115] The crate (200) exits from the tunnel (99) of the forming and stapling machine (Fig. 2) already in shape and permanently fixed with the staples (P, P1). The crate (200) is ready for use or for stacking.

[0116] Referring to Fig. 24, when two crates (200) are to be stacked, the upper ends (60) of the corner posts of the first crate are inserted into the corner windows (17) of the second crate, in such a way that the lower ends (61) of the corner posts of the second crate butt against the upper ends (60) of the corner posts of the first crate.

[0117] The corner windows (17) of the second container ensure both the stacking alignment of the second container onto the first container and stability, preventing side movement of the second container in relation to the first container.

[0118] To make stacking easier, each corner window (17) of the base (3) of the crate has to be of slightly greater dimensions than those of the upper end (60) of the corner post (6).

[0119] Fig. 25 shows a second embodiment of a panel (1 e') on exit from the stapling machine (E). This panel (1e') features four side flaps (50), of a rectangular or square shape, connected to the parts of the transverse sides (5), through longitudinal channels (114), which are

staggered by a distance equal to the thickness of the panel, compared to the longitudinal channels (15). In this case the first milling machine (B) provides the first station (S1) set up with cutting discs (173) substantially similar as those used in the second station (S2) (Figs. 11, 12) to make longitudinal incisions on the panel, in such a way as to form the longitudinal channels (114), staggered and parallel to the folding channels (15).

[0120] Referring to Figs. 26, 27 and 28, if the panel (1 e') has side flaps (50), the tunnel (99) of the forming and stapling machine (F) features four guides (98) obtained from plates curved towards the outside, to enable folding of the side flaps (50) along the longitudinal channels (114). The guides (98) are parallel to the longitudinal plates (94) and positioned at the ends of the longitudinal plates (94), closer to the inside of the tunnel (99) compared to the longitudinal plates.

[0121] Referring to Fig. 26, when the panel (1e') is positioned above the tunnel (99), the side flaps (50) of the panel lie on the guides (98) of the tunnel.

[0122] Referring to Figs. 27 and 28, when the forming mandrel (90) is lowered it presses the base (3), the side flaps (50), being in contact with the guides (98), fold along the longitudinal channels (114) and close against the longitudinal sides (4). At this point, the stapling head places the staples (P1), attaching the longitudinal side (4) to the side flap (50) and to the corner post (6).

[0123] The forming and stapling machine (F) is suitable for forming a container similar to the crate (200') without corner posts (6). In this case the forming mandrel could include a suitable device to hold and flatten the tip of the staple.

[0124] Fig. 29 shows a crate (200') obtained from the panel (1e') of Fig. 25. The crate (200'), since it has side flaps (50) folded back on its longitudinal sides (4) has greater resistance to compression compared to the crate (200) of the first embodiment.

[0125] Figs. 30 and 31 show a third embodiment of a panel (1 e") on exit from the stapling machine (E). In this case, the transverse sides (5) are higher than the longitudinal sides (4). The transverse sides (5) are the same height as the corner posts (6).

[0126] The shearing machine (A) does not make corner openings (13), but instead makes oblong eyelets (55, 57) in the parts that are to become the transverse sides (5). The first oblong eyelet (55) is at the base of the transverse side (5) and is used for stacking the crates. The second oblong eyelet (57) is in a central position of the transverse side and is used as a carrying handle.

[0127] Also, the shearing machine (A) cuts the transverse edges of the panel, in such a way as to create a rectangular shaped central flap (56) positioned between two triangular shaped upper flaps (53). The central flap (56) is slightly smaller than the first oblong eyelet (55) at the base of the transverse side (5).

[0128] The upper flaps (53) could have a different geometrical shape and/or be joined.

[0129] The first milling machine (B) makes the longitudinal channels (15) to fold the longitudinal sides (4) and the through cut (14) (Fig. 5) which extends from the edge of the panel to the beginning of the fold channel (15) (Fig. 31). The second milling machine (C) makes the transverse channels (16) to fold the transverse sides (5) and second transverse channels (54) to fold the upper flaps (53), which butt onto the upper ends (60) of the corner posts (6).

[0130] In this case, the second cutting station (S2) of the second milling machine (C) includes an extra pair of cutting discs complete with their respective idler wheels, as shown in Figs. 11 and 12, to form the second transverse channels (54). Therefore the four second transverse channels (54) are made at the same time as the transverse channels (16) in the second milling machine (C).

[0131] The first cutting station (S1) of the second milling machine (C) makes the transverse through cut (18), (Fig. 14) which causes the detachment of the corner parts (19) of the panel (1 e").

[0132] In this case, in the stapling machine (E), the part of the pusher (82a) (Fig. 16) which pushes the panel is positioned further back in relation to the rear pusher (82), which pushes the corner posts.

[0133] Fig. 32 shows the putting into shape of the panel (1 e") using the forming and stapling machine (F). In this case, a crate (200") exits from the forming and stapling machine (F) with upper flaps (53) facing upwards and unfolded.

[0134] Subsequently, as shown in Fig. 33, the upper flaps (53) are folded along the second transverse channels (54) in such a way that they are positioned on the upper ends (60) of the corner posts. Staples (P3) then attach the upper flaps (53) to the corner posts (6).

[0135] Referring to Fig. 34, a second crate (200") is positioned on a first crate (200"). In this case, the central flaps (56) of the first crate interlock with the oblong eyelets (55) of the second crate.

[0136] Fig. 35 shows a fourth embodiment of a panel (1c"') on exit from the second milling machine (C). In this case, the transverse sides (5) are higher than the longitudinal sides (4). A through oblong eyelet (57) is made in the transverse sides (5) to act as a carrying handle.

[0137] The panel (1c"') has four side flaps (150), substantially rectangular shaped and connected to the transverse sides (5) through a second longitudinal channel (114). Four rectangular shaped windows (117) are made at the corners of the base (3).

[0138] The first station (S1) of the first milling machine (B) is used to make the longitudinal channels (15) to fold the longitudinal sides (4), while the second station (S2), again of the first milling machine (B), is used to make the longitudinal channels (114) to fold the side flaps (150) and on each side flap (150) two longitudinal channels (151, 152) are made, parallel to each other. The first cutting station (S1) of the first milling machine (B), in place of the cutting disc (73), includes a cutting disc (173), which is suitable for making the longitudinal fold channel

(15).

[0139] The second cutting station (S2) of the first milling machine (B) includes two extra pairs of cutting discs complete with their respective idler wheels, like those shown in Figs. 11 and 12 which make the longitudinal channels (151, 152) of each side flap (150).

[0140] In detail, each side flap (150) has another longitudinal flap on its end (153), with a protruding part (154) protruding outwards in relation to the transverse edge of the panel (1c"').

[0141] Referring to Fig. 36, each side flap (150) is folded along the longitudinal channels (151, 152) in such a way that it takes the shape of a corner post (106), with a triangular cross-section. In detail, the protruding part (154) of the longitudinal end flap (153), protrudes further, in relation to the corner post (106) formed by the folded side flap. Also, the corner post (106) formed out of the folded side flap has a hole (155) which faces on to the window (117) made in the corners of the base (3).

[0142] The panel (1c"') is fed into the stapling machine (E), which places the staples (P) (Fig. 37) to attach the corner posts (106) (obtained by folding the side flap (150)) to the transverse sides (5).

[0143] In this case, the stapling machine (E) includes a rotation station (not shown in the drawings) positioned before the stapling heads (88). The rotation station is used to rotate the side flaps (150) along the longitudinal channels (151, 152) in such a way as to obtain the corner post (106) shown in Fig. 36.

[0144] Obviously, this kind of crate packaging does not require the use of the cutting saw and feeder (D) for the corner posts (6).

[0145] Taking into account that the corner post (106) is made from the same starting panel, there would be a double thickness of the same panel to staple; therefore the stapling heads of the stapling machine (E) will have to perform flattened stapling (P), to achieve a firm corner post (106).

[0146] Taking into account that the panel comprises a sheet of rigid material (2) of high density, the stapling machine (E) could include a support that could be inserted inside the corner post (106) to reinforce the corner post (106) during the stapling and help the flattening of the staple tips (P).

[0147] A panel (1e"') exits from the stapling machine (E) as shown in Fig. 37, in which the tips of the staples (P) attach the corner post (106) to the transverse side (5).

[0148] Fig. 38 shows the panel (1e"') positioned above the tunnel (99) of the forming and stapling machine (F).

[0149] Referring to Figs. 39 and 40, the forming mandrel (90) is lowered, also lowering the base (3) of the panel, and the longitudinal and transverse sides (4, 5) come into contact with the longitudinal and transverse plates (94, 95) of the tunnel, folding along their respective longitudinal and transverse channels (15, 16).

[0150] Referring to Fig. 40, since the parts of the panel to be stapled are of double thickness, the stapling heads (96) have to make a flattened tip on the staples, in order to ensure the hold between the corner post and the longitudinal side (4). For this purpose, the forming and stapling machine (F) could include a support to reinforce the corner post (106), also on the inside, during the stapling and help the flattening.

[0151] Referring to Fig. 41, a fourth embodiment is shown for making a crate (200"') exiting from the forming and stapling machine (F). In this case, the crate (200"') has four corner posts (106) obtained from folding the side flaps (150) of the panel (1c"'). Each of the corner posts (106) features the protruding part (154) which protrudes at the top and the hole (155) which faces on to the windows (117) at the corners of the base (3).

[0152] Referring to Fig. 42, a second crate (200"') is positioned on a first crate (200"'). In this case the protruding parts (154) of the corner posts of the first crate interlock with the windows (117) of the second crate in order to ensure stacking alignment of the crates and stable stacking of the same.

[0153] A variation could be that the flap at the end (153) (Fig. 35) of each side flap (150), instead of being folded towards the inside of the corner post (106) (Fig. 36) can be folded towards the outside of the corner post, so the flap at the end (153) would remain visible on the inside face of the transverse side (5) of the crate. In this case the staples that attach the corner post (106) to the transverse side (5) would be facing towards the inside of the crate and would come into contact with the products contained in the crate.

[0154] For this reason, it is preferable that the flap at the end (153) of the side flap (150) folds towards the inside of the corner post (106), so that the line of staples (P) can never come into contact with the product contained in the packaging.

[0155] In all the methods of making the crates, any protrusions for interlocking when stacking the crates must coincide with the respective windows while the protrusions and windows can be made in various positions and dimensions.

[0156] In all the methods of making the crates, in place of staples (P, P1) or in addition to staples (P, P1), other means of attachment may be employed, such as, for example, rivets, dowels, nails, glue or the like. In this case, in the shearing stage, where necessary, fixing holes are made in the panel (1; 1a'), positioned in such a way that, when the crate is put into shape, the fixing holes coincide with the parts of the crate to be attached and allow for the insertion of such fixings. The diameter of the above-mentioned fixing holes depends on the size of the rivet or dowel to be used. In this case, in addition to the stapling heads on the stapling machine (E) and/or the forming and stapling machine (F) a suitable head is fitted to apply the fixings, such as rivets, dowels, nails, glue or the like.

[0157] It is obvious that the process of packaging made in this way can be altered and/or have parts or stages added by a qualified person in the sector, without exceeding the scope of the claims. It is stressed that the validity of the invention is not limited to specific geomet-

rical shapes, dimensions or layouts, nor to aesthetic aspects, nor to the sequence of processes nor the kind of materials used to engineer the various embodiments, both of the process and the packaging produced with it.

Claims

1. Plant for production of crate-type packaging (200; 200'; 200"; 200"') starting from a panel (1) comprising a sheet (2) and a film (20) applied to the sheet (2), the plant comprises:

    - a shearing machine (A), used to make through openings (12, 13; 17; 55, 57) in the shape of a circle and/or oblong eyelet in the said panel (1), in order to obtain the panel (1 a; 1 a') with through openings,
    - a first machine for folding lines (B) used to make longitudinal channels (15), enabling the longitudinal sides (4) of the crate to be folded up at right angles to the base (3),
    - a second machine for folding lines (C) used to make transverse channels (16) enabling the transverse sides (5) of the crate to be folded up at right angles to the base (3),

    featuring the fact that
    the said sheet (2) is in rigid, non-flexible material;
    the said first and second machines for folding lines (B, C) are milling machines comprising mills or cutting discs (173) revolving at around 6,000 - 12,000 rpm to make incisions, through removal of material, in the said sheet (2), in such a way as to form the said longitudinal and transverse channels(15, 16) constituted by stopped grooves; where each milling machine includes a counter device (75) to support the panel while it is in contact with the mills or cutting discs (173); and
    the said plant also comprises a stapling machine (E) used to staple posts (6; 106) in the shape of rigid columns, to parts of the said panel intended to form the said transverse sides (5) and/or the said longitudinal sides (4) of the crate, in order to obtain a panel (1 e; 1 e'; 1 e"; 1e"') with corner posts (6; 106) attached to the said parts of the panel intended to form the said transverse sides (5) and/or the said longitudinal sides (4) of the crate.

2. Plant according to claim 1 also comprising a forming and stapling machine (F) set up in such a way as to:

    - put the said crate into shape, starting from the said panel (1e; 1e'; 1 e"; 1e"') with longitudinal channels (15), transverse channels (16) and corner posts (6; 106) attached to the said parts of the panel intended to form the said transverse sides (5) and/or the said longitudinal sides (4) of the crate;
    - staple the said transverse (5) and/or the said longitudinal sides (4) of the crate to the corner posts (6; 106).

3. Plant according to claim 1 or 2, in which the said first milling machine (B) and/or the said second milling machine (C) comprises a cutting station (S2) including a cutting disc or mill (173) set up in order to make a stopped incision on the sheet (2) of rigid material of the panel, in such a way as to form the said longitudinal channels (15) and/or the said transverse channels (16).

4. Plant according to claim 3, in which the said first milling machine (B) and/or the said second milling machine (C) comprises a further cutting station (S1) including a cutting disc or mill (73) set up in order to make a through cut on the panel (1 a; 1b) in such a way as to form longitudinal openings (14) and/or transverse openings (18).

5. Plant according to any of the previous claims, also comprising a cutting saw and feeder (D) used to cut posts (6) and feed the said posts into the said stapling machine (E).

6. Plant according to any of the previous claims, in which the said stapling machine (E) includes means of transport (83; 82a) to transport the panel (1c) and stapling heads (88) fitted so that they swing from a bar (89) positioned transversely to apply staples (P) to the panel, in order to attach the said corner posts (6; 106) to the panel.

7. Plant according to claim 6, in which the said stapling machine (E) comprises:

    - first guides (80) to guide the said corner posts (6),
    - second guides (87) to guide the said panels (1 c);
    - first pushers (81, 82) to push the said corner posts in the first guides;
    - second pushers (82a) to push the said panels in the second guides.

8. Plant according to any of the claims from 2 to 7, in which the said forming and stapling machine (F) comprises a tunnel (99), a forming mandrel (90), set up to be able to move alternately in the tunnel (99) and stapling heads (96), fitted so that they swing from a bar (97) to apply staples (P1) to the longitudinal sides (4) and/or transverse sides (5) of the crate, in order to attach longitudinal sides (4) and/or transverse sides (5) to the corner posts (6; 106).

9. Plant according to any of the previous claims, where

the said milling machines (B, C) include actuators (77) which activate the said counter device to raise the sheet and bring it into contact with the mill or cutting disc (173);

10. Procedure for production of crate-type packaging (200; 200'; 200"; 200"') starting from a panel (1) comprising a sheet (2) and a film (20) applied to the sheet (2), the procedure comprising the following steps:

- shearing of the panel (1) in such a way as to make through openings (12, 13; 17; 55, 57), in the shape of circles and/or oblong eyelets, to obtain a panel (1a; 1a') with through openings, and with any kind of profile along longitudinal (10) and/or transverse (11) edges of the panel,
- formation of longitudinal channels (15), enabling the longitudinal sides (4) of the crate to be folded up from a base (3),
- formation of transverse channels (16), enabling the transverse sides (5) of the crate to be folded up from a base (3), and
- stapling of corner posts (6; 106) in the form of rigid columns, to parts of the said panel intended to form the said transverse sides (5) and/or the said longitudinal sides (4) of the crate, in order to obtain a panel (1 e; 1 e'; 1 e"; 1e"') with posts (6; 106) attached to the said parts of the panel intended to form the said transverse sides (5) and/or the said longitudinal sides (4) of the crate

featuring the fact that
the said sheet (2) is in rigid, non-flexible material,
the formation of the longitudinal and transverse channels (15, 16) is achieved using milling machines comprising mills or cutting discs (173) revolving at around 6,000 - 12,000 rpm to make incisions, through removal of material, in the said sheet (2), in such a way as to form the said longitudinal and transverse channels (15, 16) constituted by stopped grooves; where a counter device (75) supports the panel while it is in contact with the mills or cutting discs (173),
the stapling of the corner posts (6; 106) is achieved using a stapling machine (E).

11. Procedure according to claim 10, comprising also the steps of:

- putting the said crate into shape, starting from the said panel (1e; 1 e'; 1 e"; 1e"') with longitudinal channels (15), transverse channels (16) and corner posts (6; 106) attached to the said parts of the panel intended to form the said transverse sides (5) and/or the said longitudinal sides (4) of the crate; and
- stapling the said transverse (5) and/or the said longitudinal sides (4) of the crate to the corner posts (6; 106)

12. Procedure according to claim 10 or 11, in which the said step of stapling the corner posts involves the transport of the panel (1 c) into the stapling machine and the application of staples (P), using stapling heads (88) fitted so that they swing from a bar (89) positioned transversely, in order to attach the said corner posts (6; 106) to the panel.

13. Procedure according to any of the claims from 10 to 12, where during the formation of the longitudinal and transverse channels (15, 16) the counter devices (75) are activated by an actuator (77) to raise the sheet and bring it into contact with the mill or cutting disc (173).

14. Panel (1 e; 1 e'; 1 e"; 1e"') for the production of crate-type packaging (200; 200'; 200"; 200"') comprising:

- a sheet (2),
- a film (20) applied to the said sheet (2),
- through openings (12, 13; 17; 55, 57) in the shape of circles and/or oblong eyelets cut out of the said panel,
- longitudinal channels (15), in such a way as to enable the longitudinal sides (4) to be folded up from a base (3) to form a crate (200; 200'; 200"; 200"'),
- transverse channels (16) in such a way as to enable the transverse sides (5) to be folded up from a base (3) to form the said crate;
- corner posts (6; 106) attached to the said longitudinal sides (4) and/or transverse sides (5)

featuring the fact that
the said sheet (2) is made from rigid, non-distorting material, and
the said longitudinal channels (15) and transverse channels (16) are stopped grooves obtained in the said sheet (2) through removal of material, by means of incisions made by mills or cutting discs, revolving at around 6,000 - 12,000 rpm.

15. Panel (1e"') according to claim (14) in which each corner post (106) is obtained by means of folding a side flap (150), connected to a part of the panel intended to obtain the said longitudinal side (4) or the said transverse side (5) of the crate, in which the side flap (150) is part of the panel and the said fold of the said side flap (150) is made along fold channels (151, 152, 114) obtained by means of incisions in the said sheet (2) of rigid material of the panel, made by mills or cutting discs, revolving at around 6,000 - 12,000 rpm, for production of crate-type packaging (200; 200'; 200"; 200"').

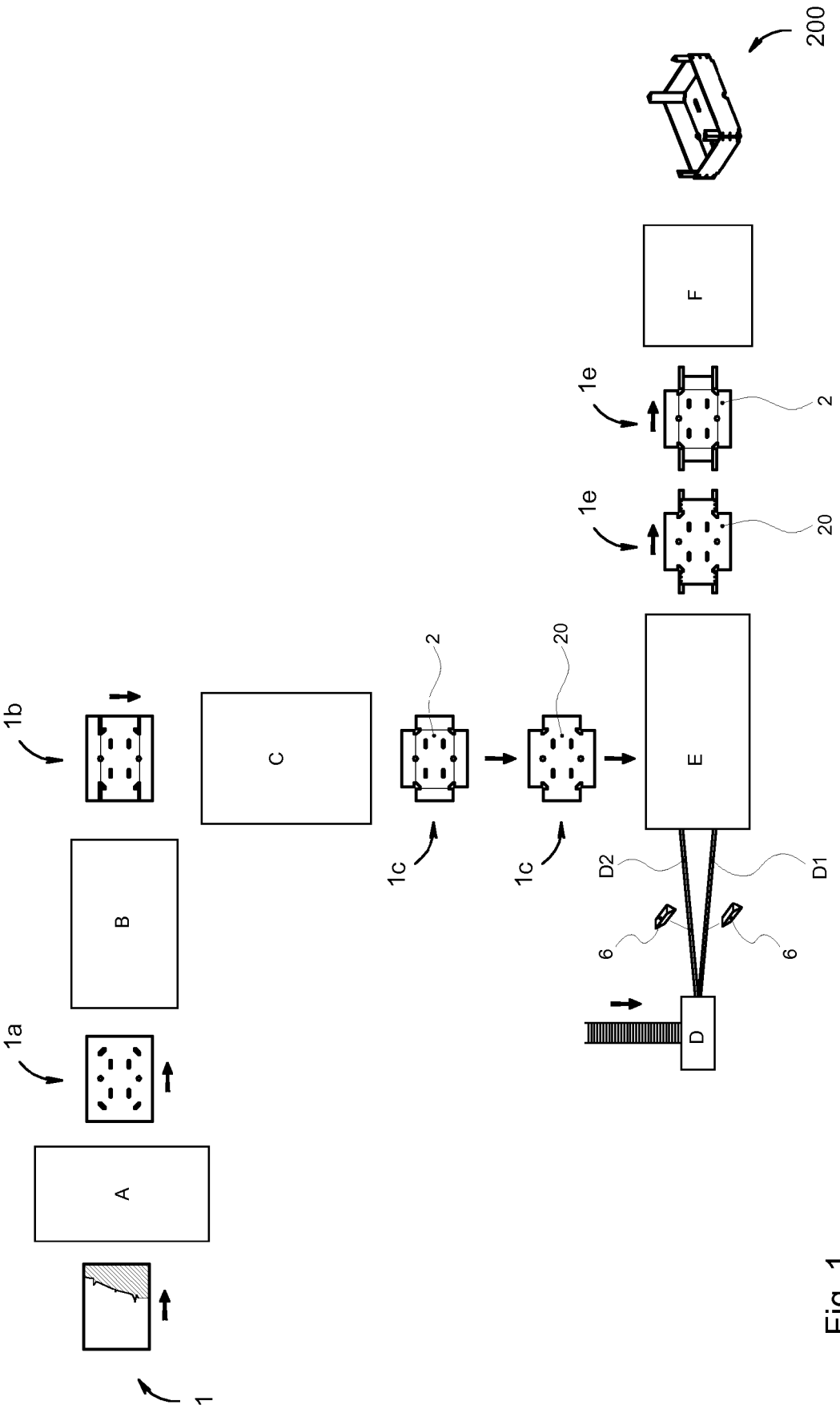


Fig. 1

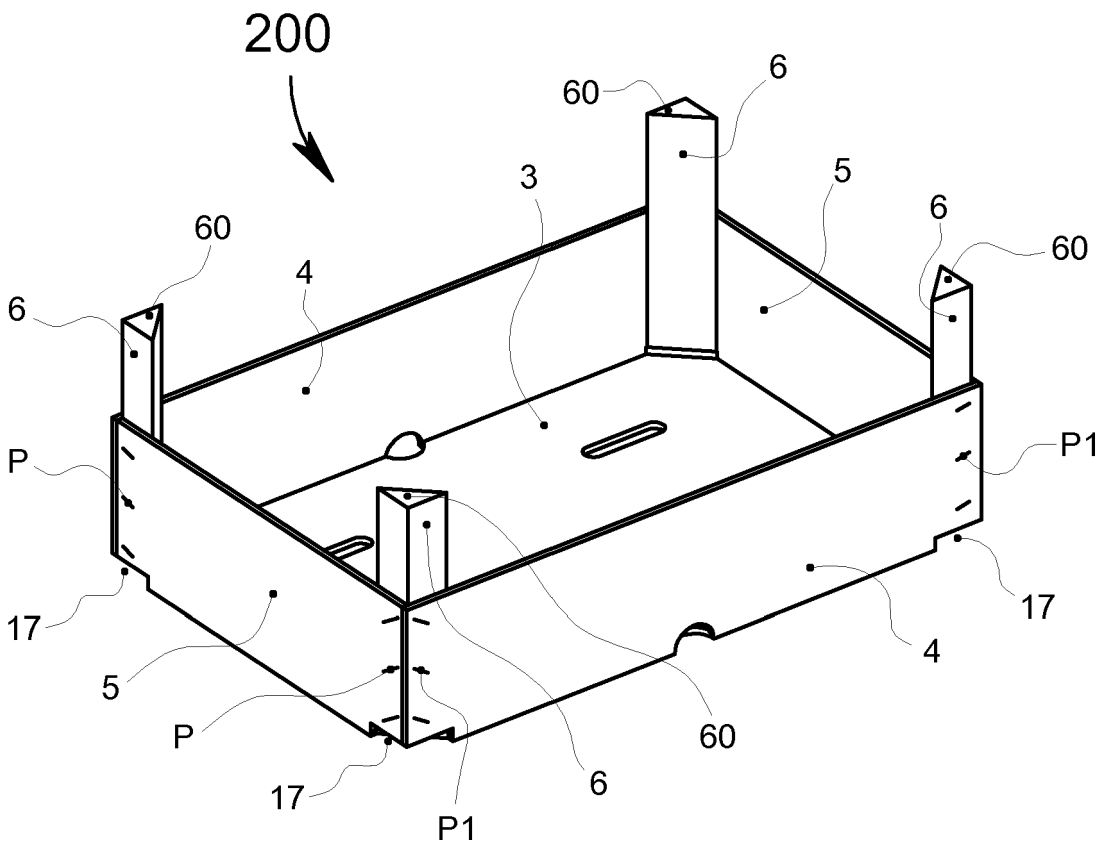


Fig. 2

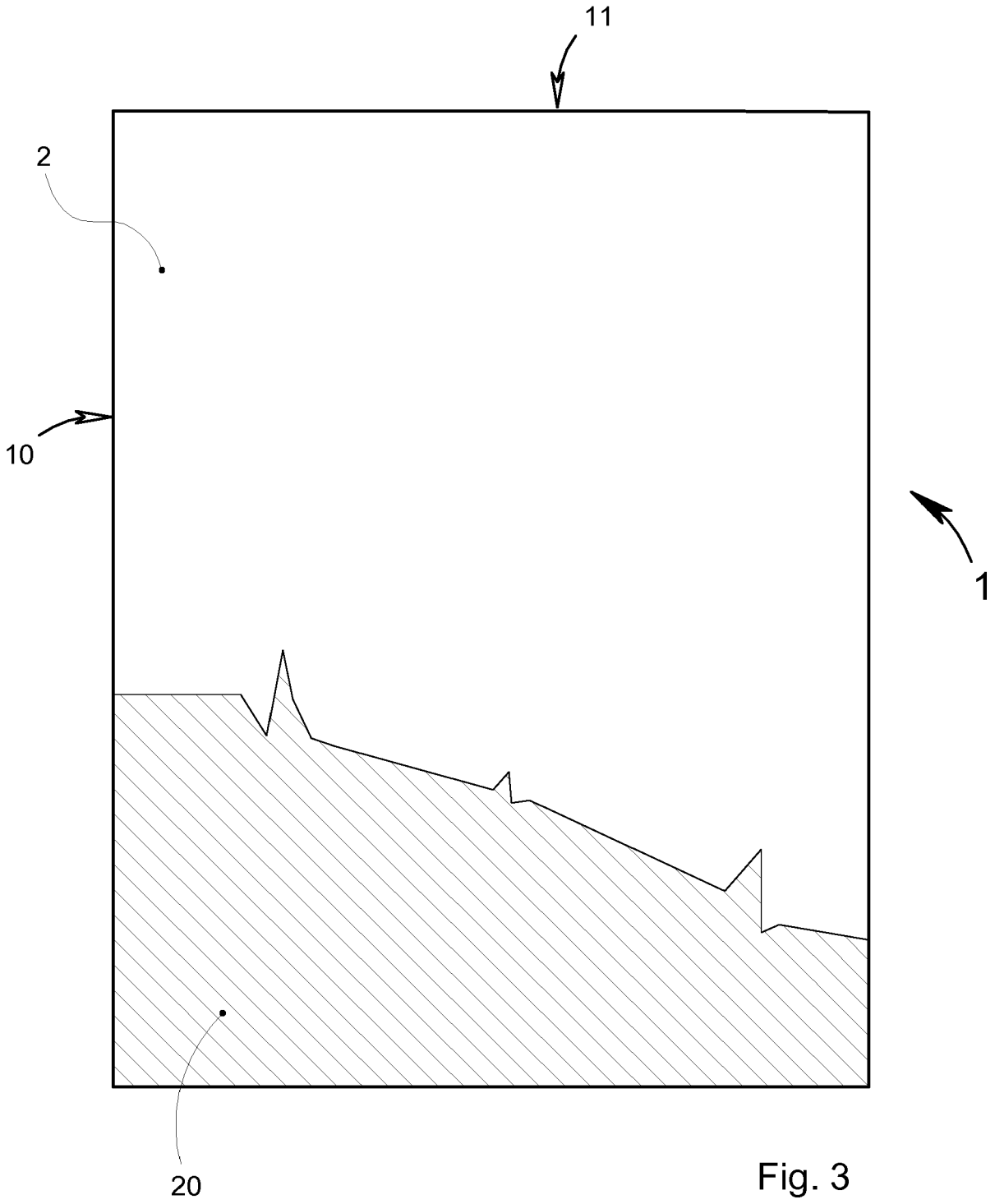


Fig. 3

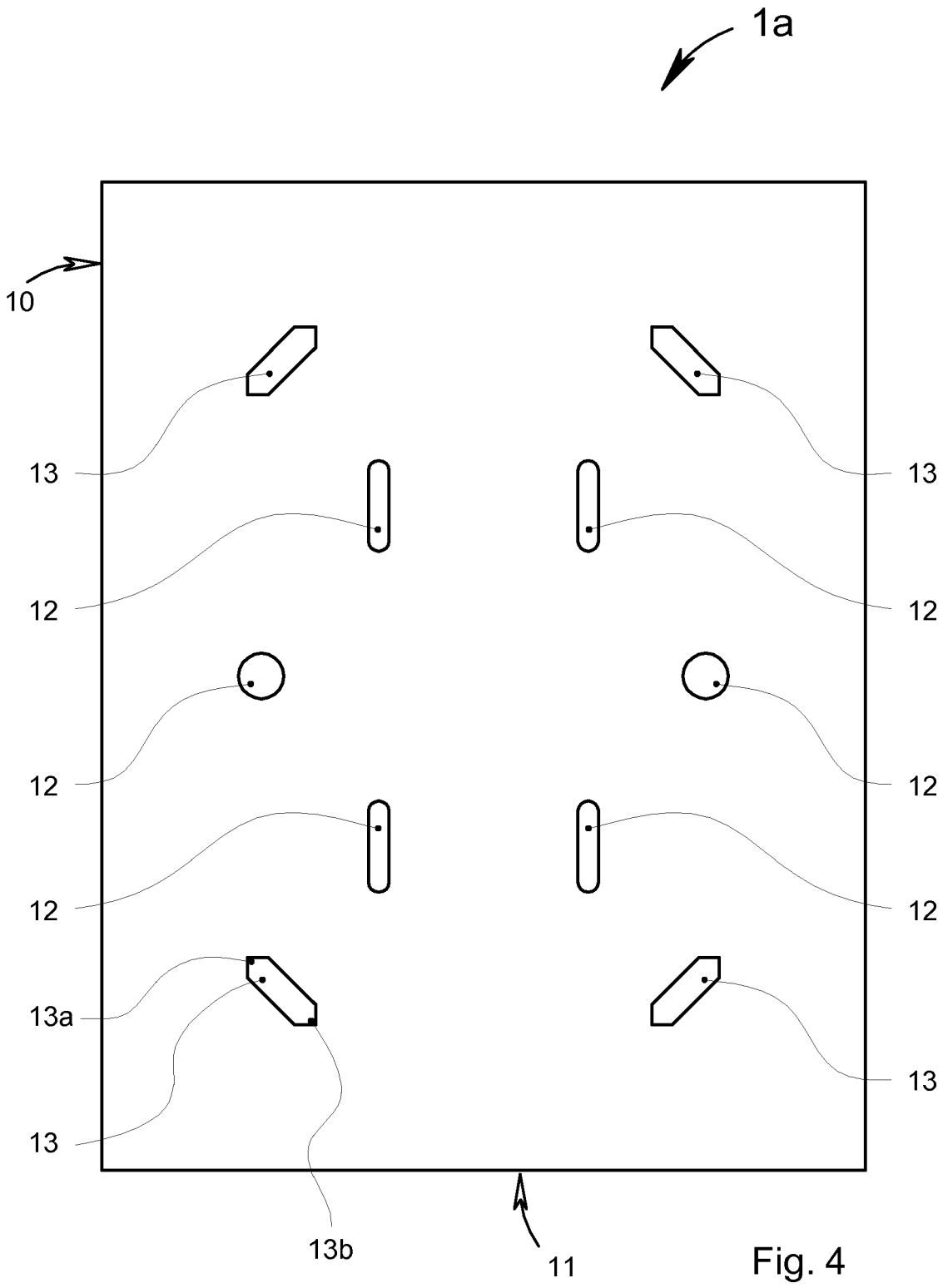


Fig. 4

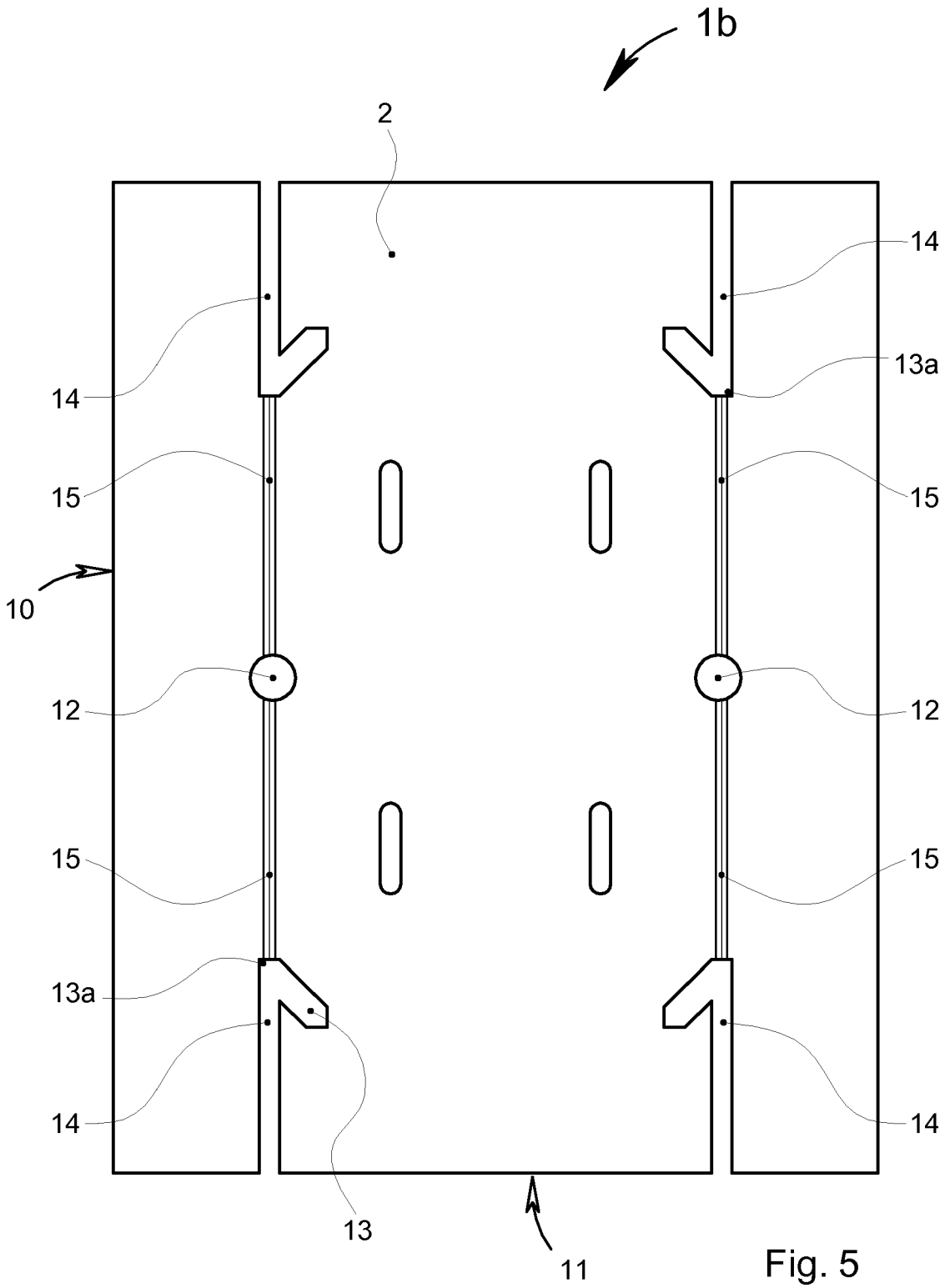


Fig. 5

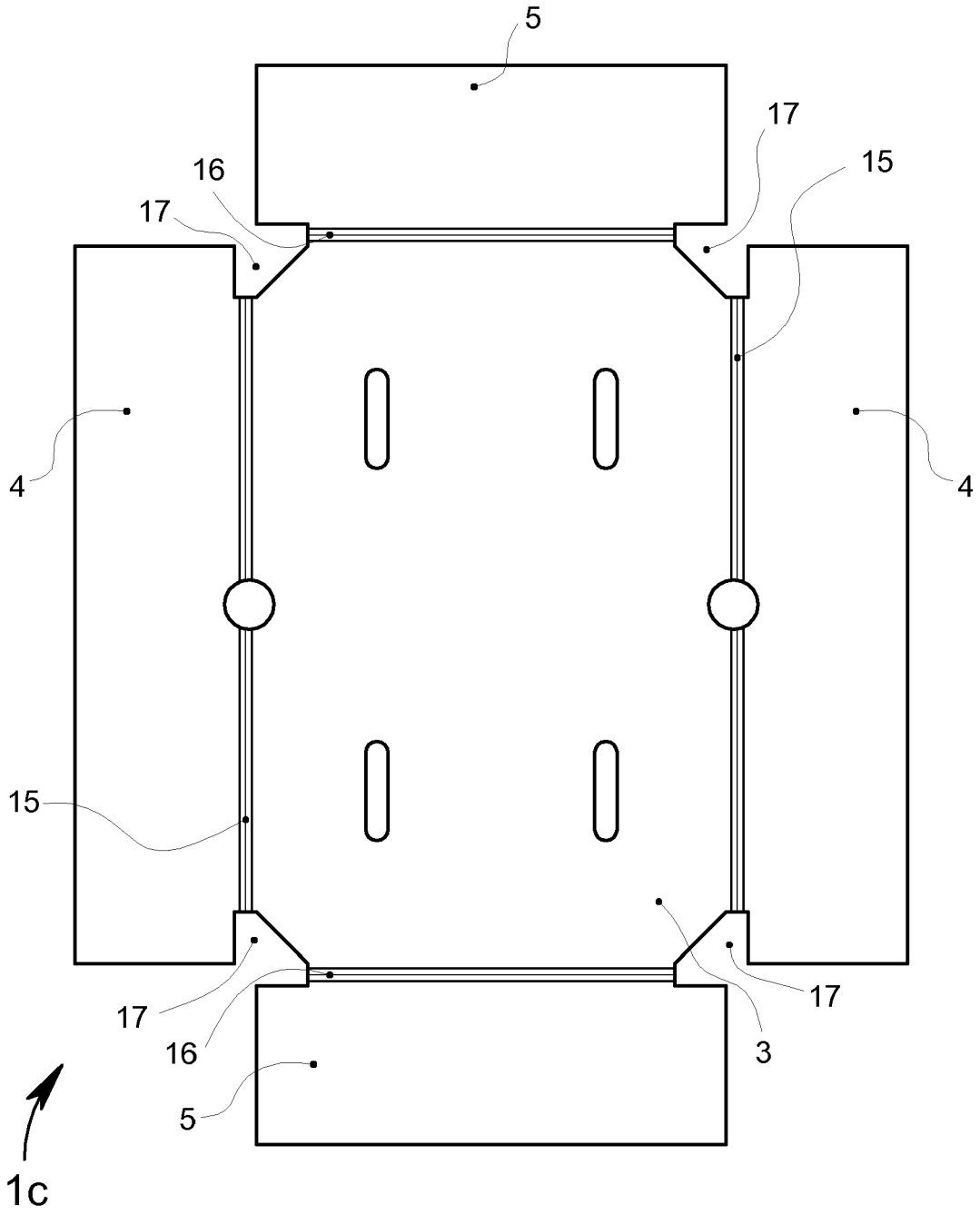


Fig. 6

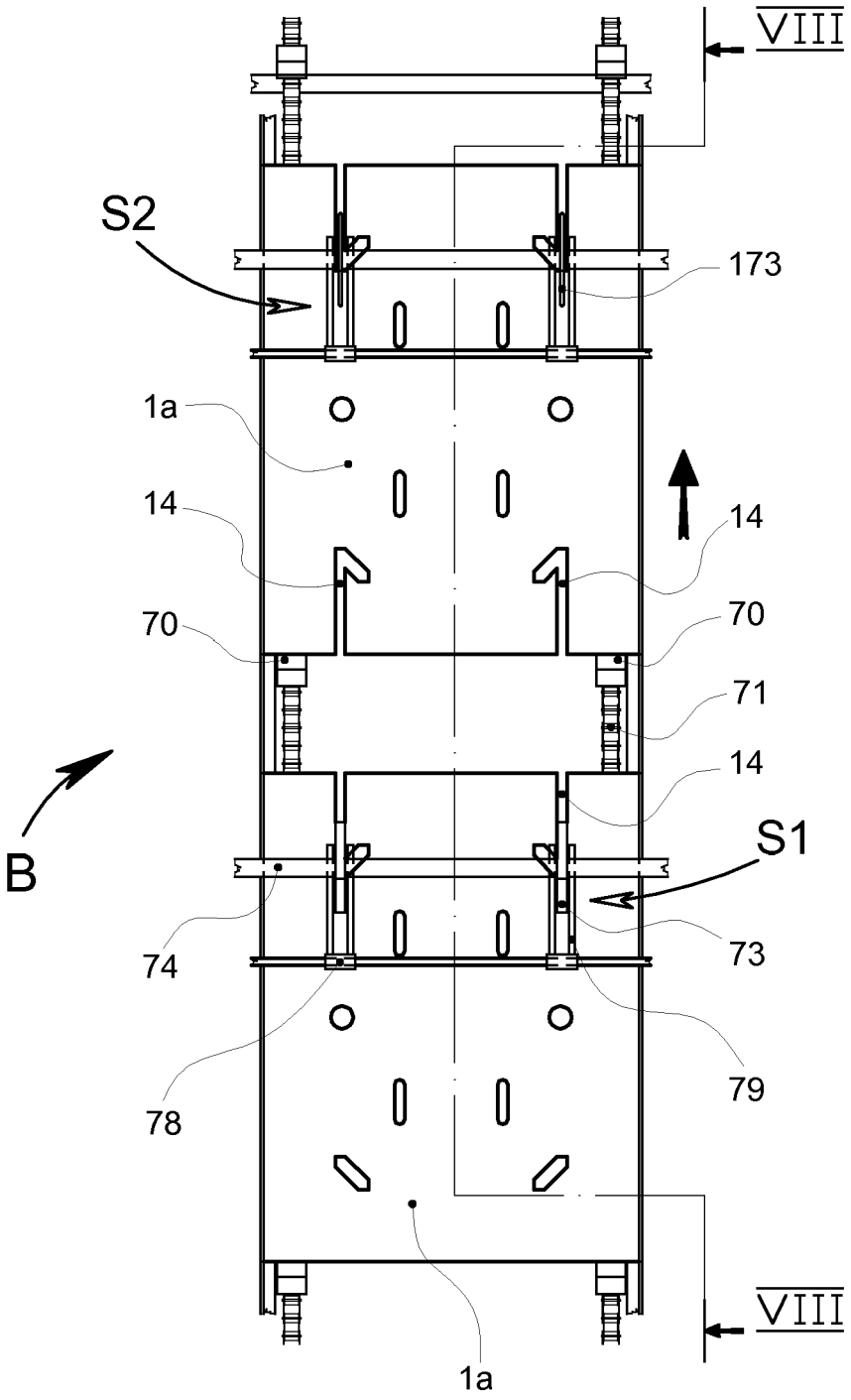


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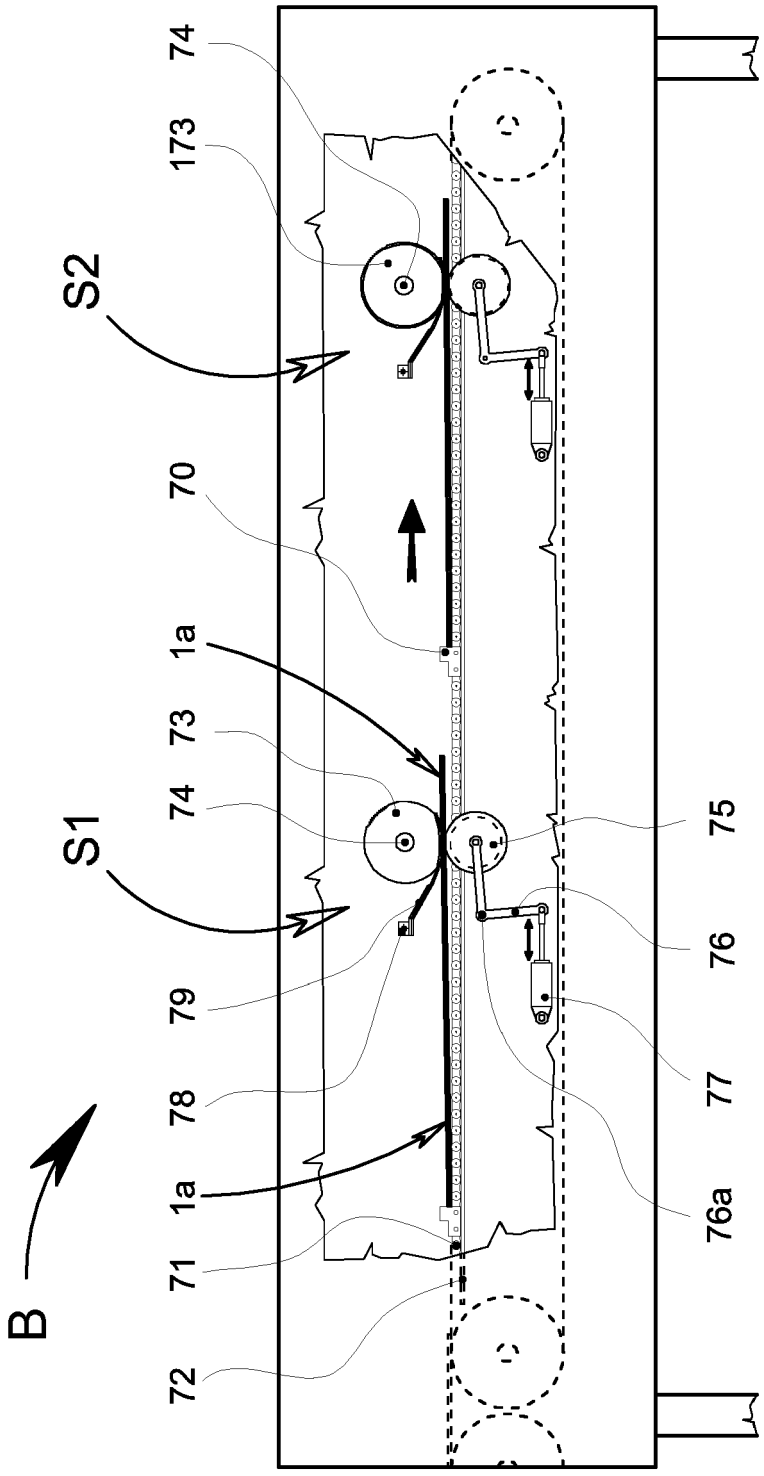


Fig. 8

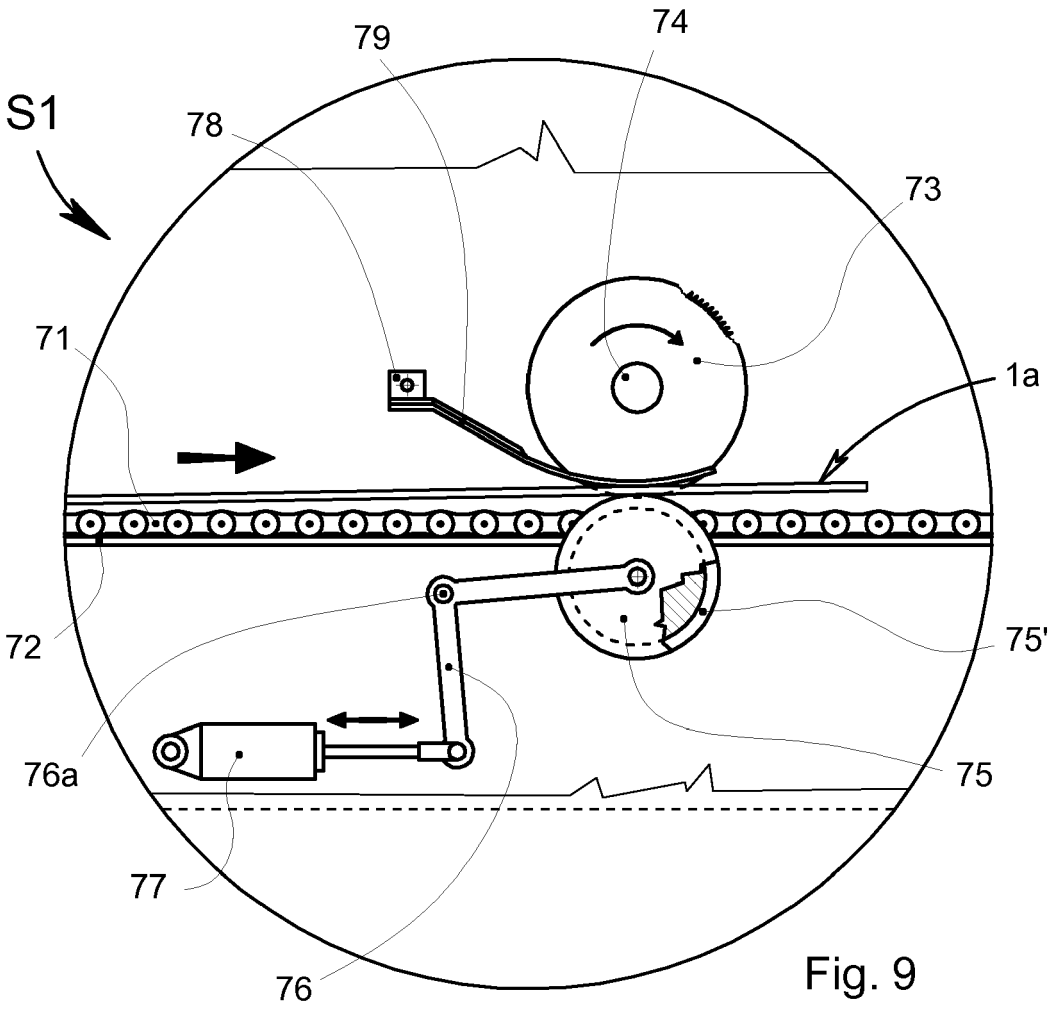


Fig. 9

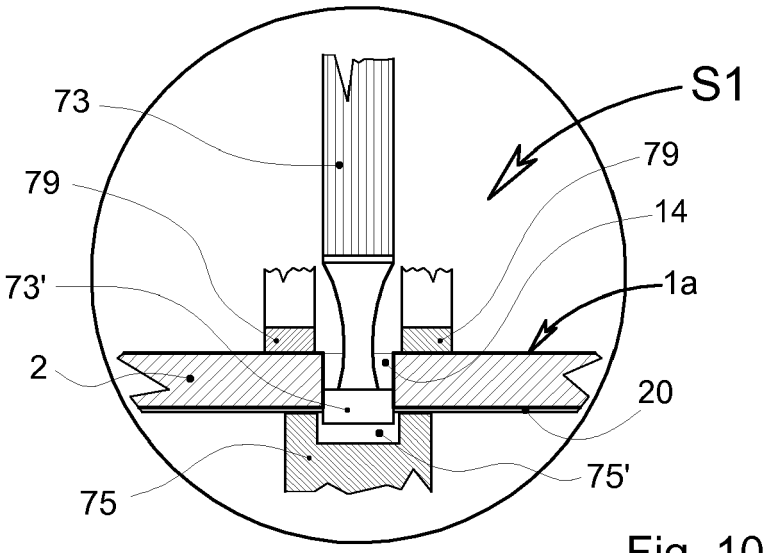


Fig. 10

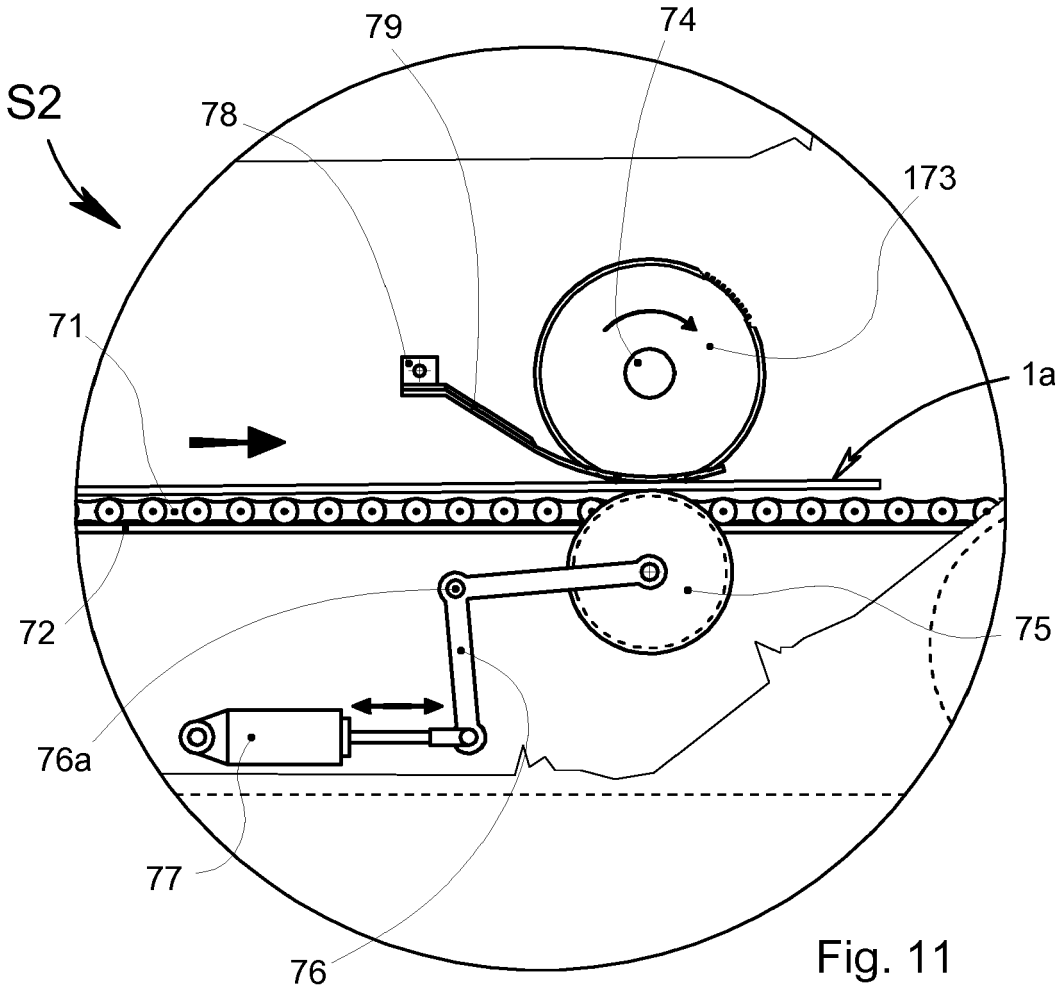

S2
79
74
78
173
71
1a
72
75
76a
77
76

Fig. 11

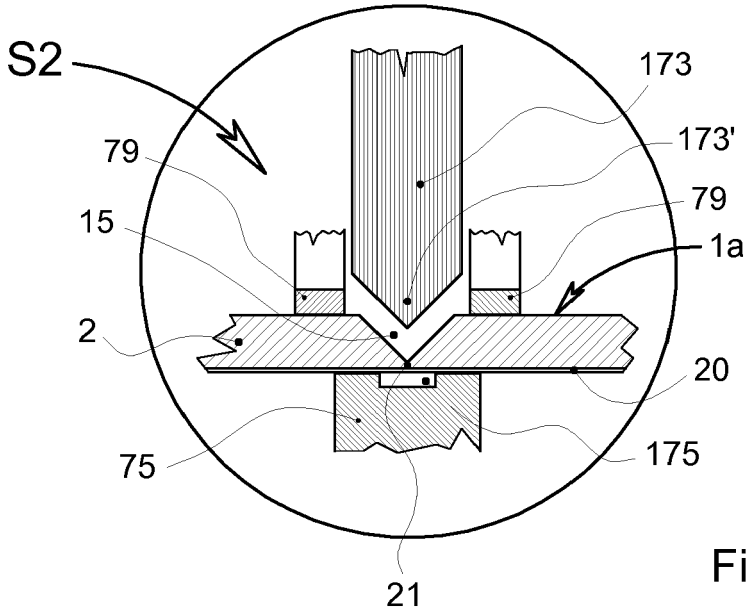

S2
173
173'
79
79
15
1a
2
20
75
175
21

Fig. 12

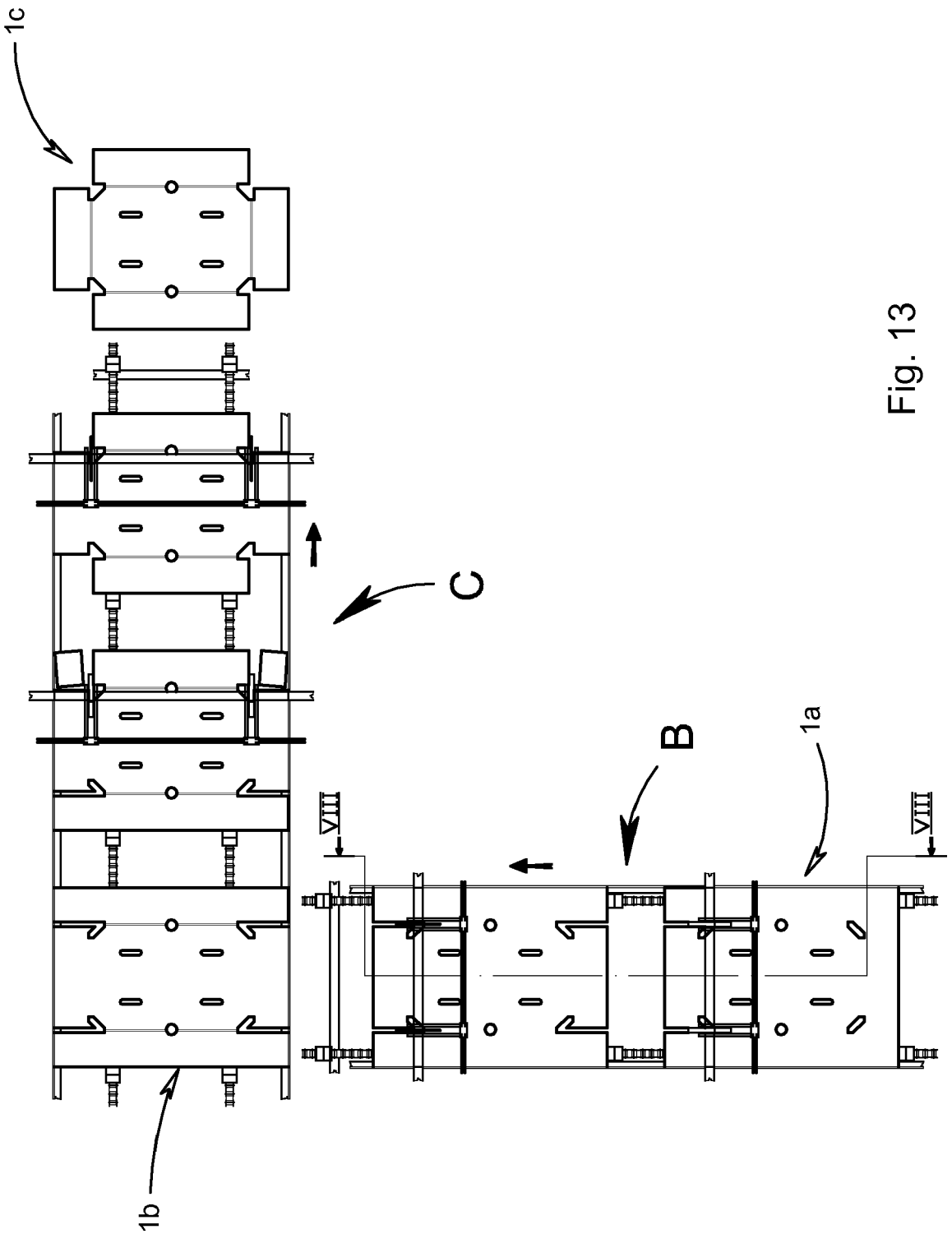


Fig. 13

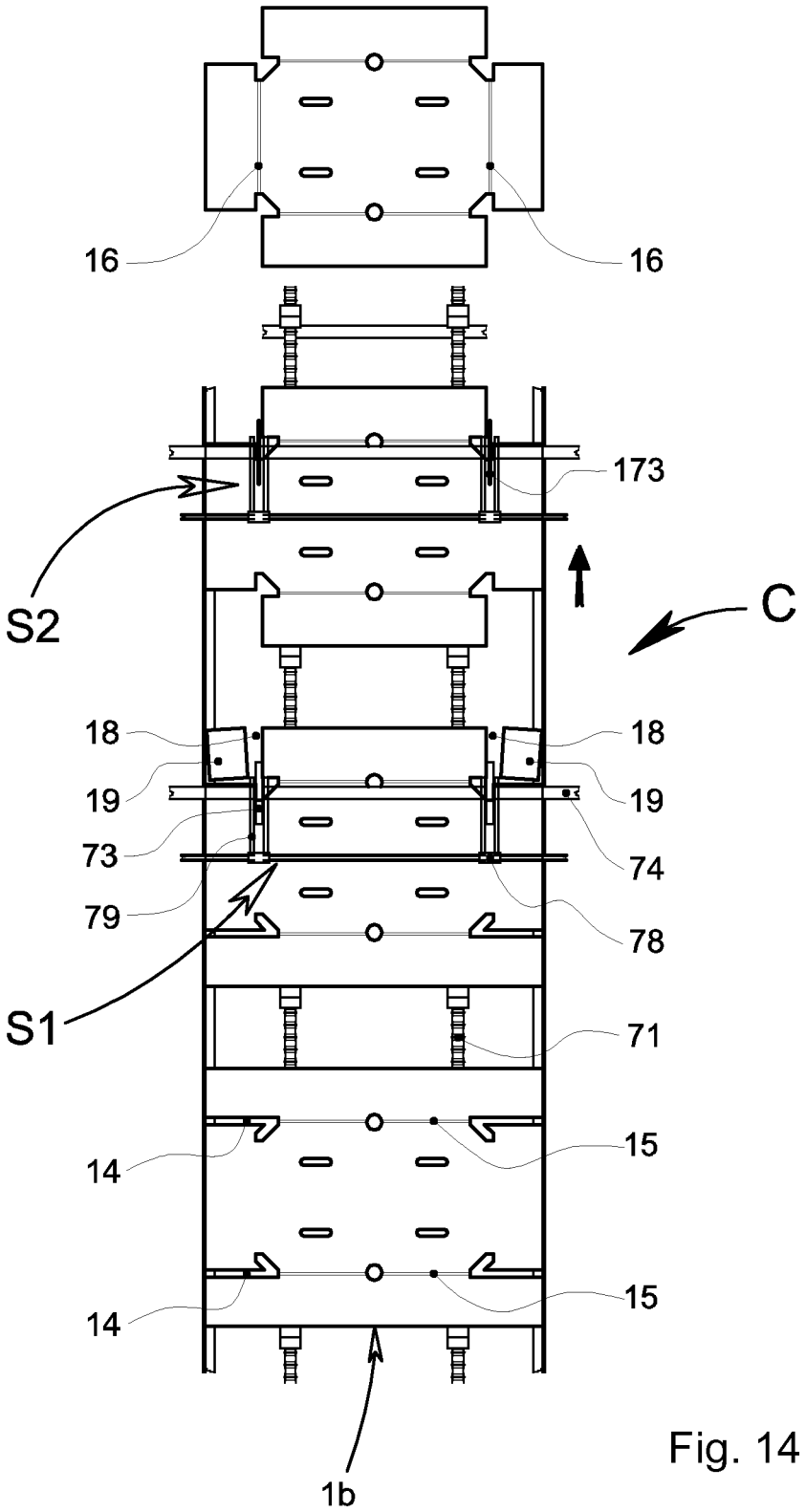


Fig. 14

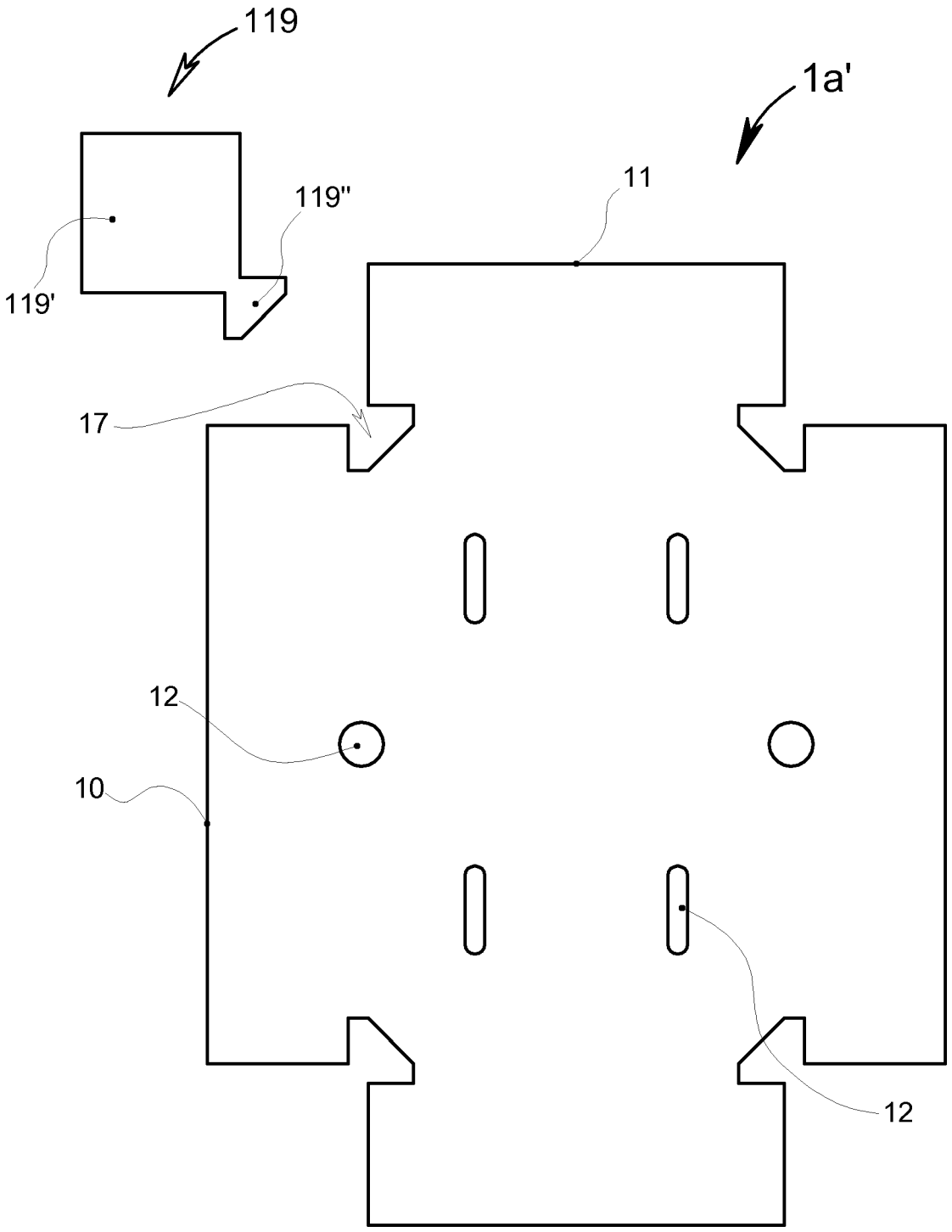


Fig. 15

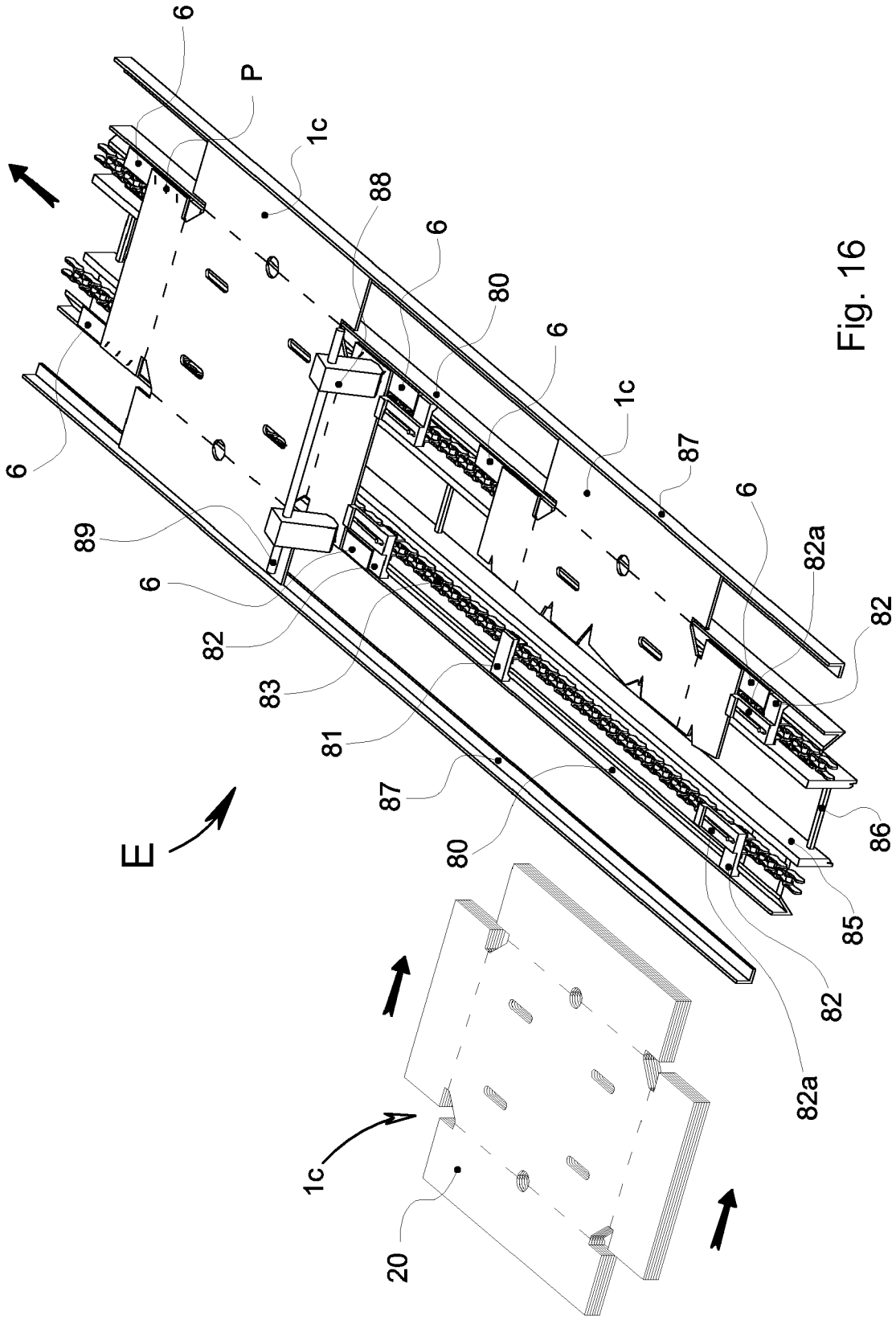


Fig. 16

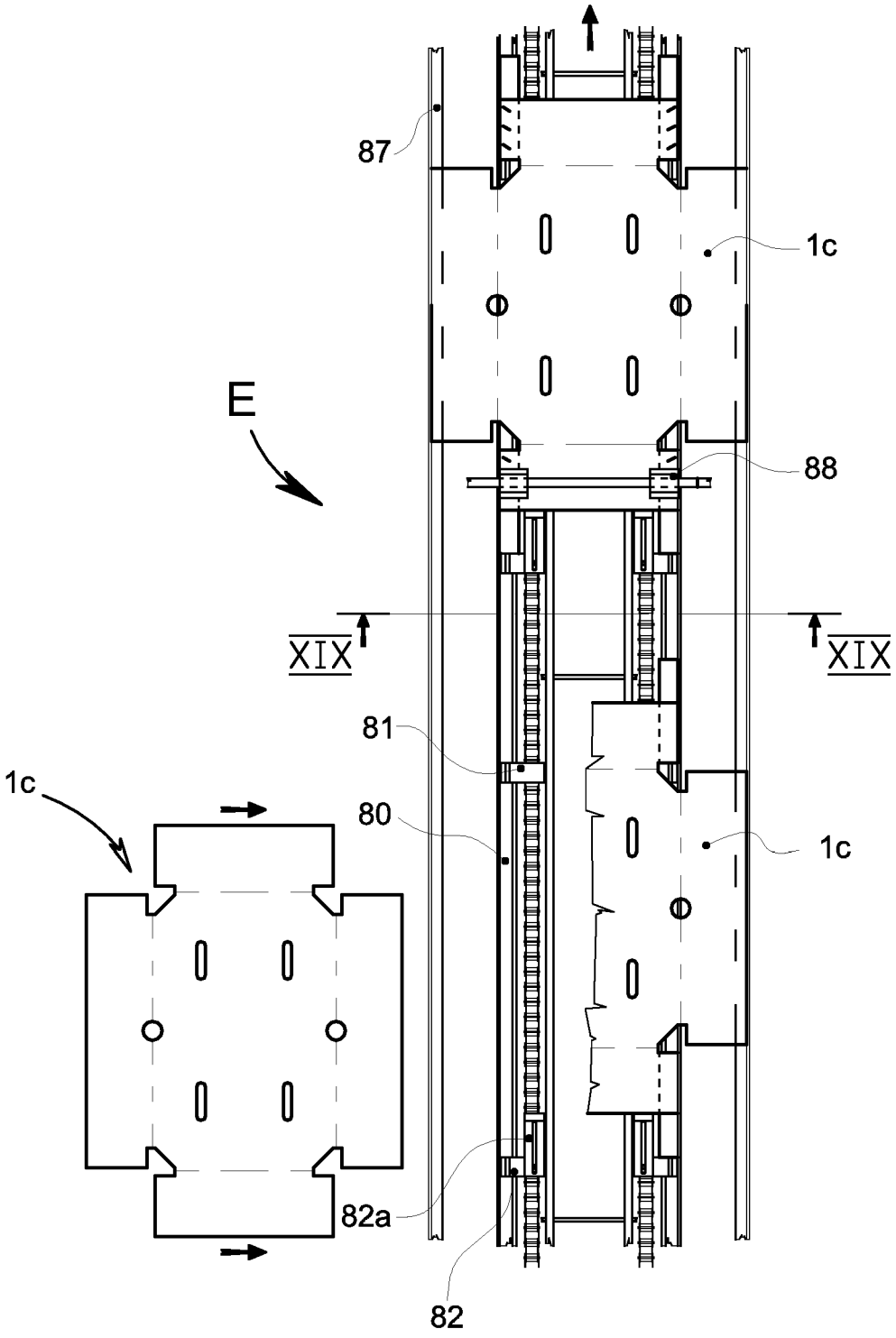


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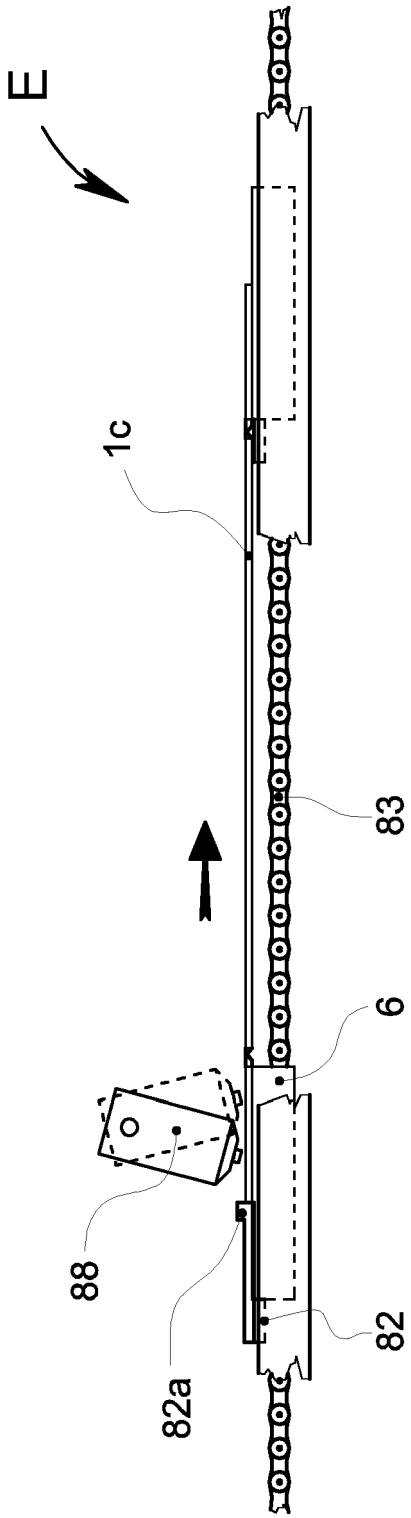


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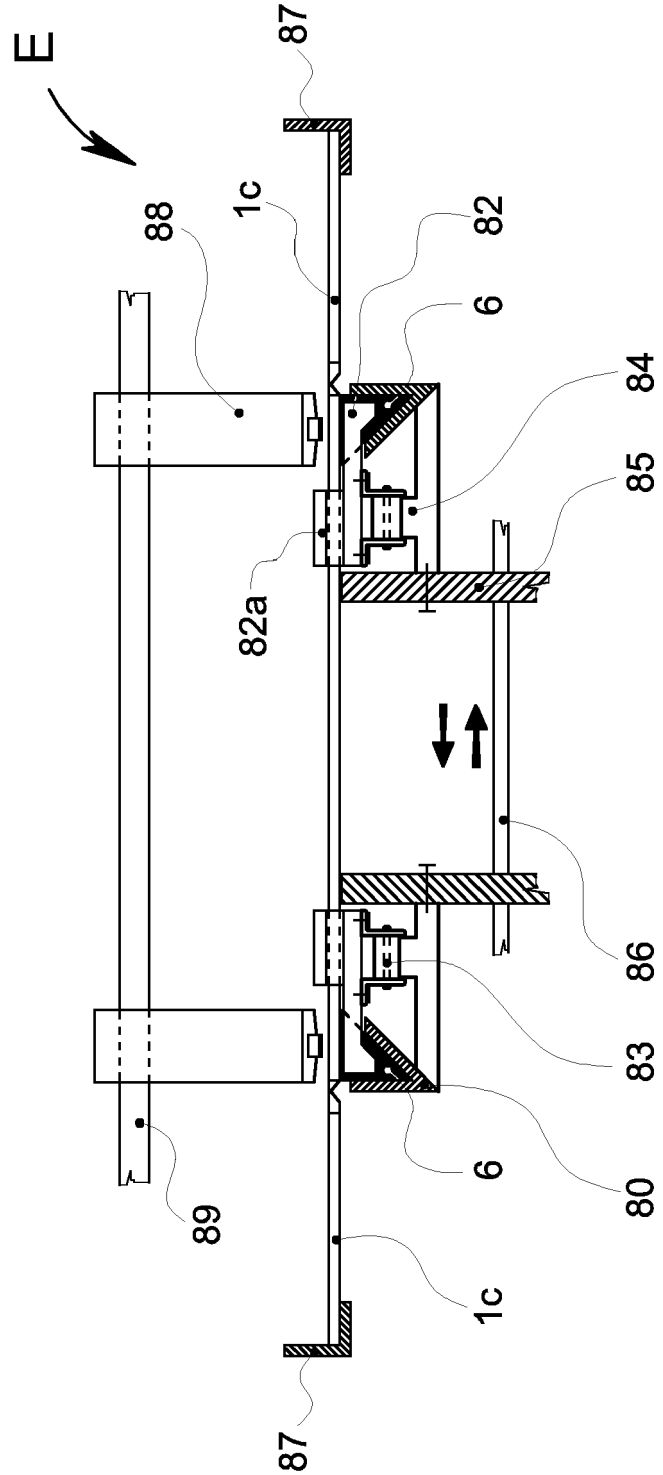


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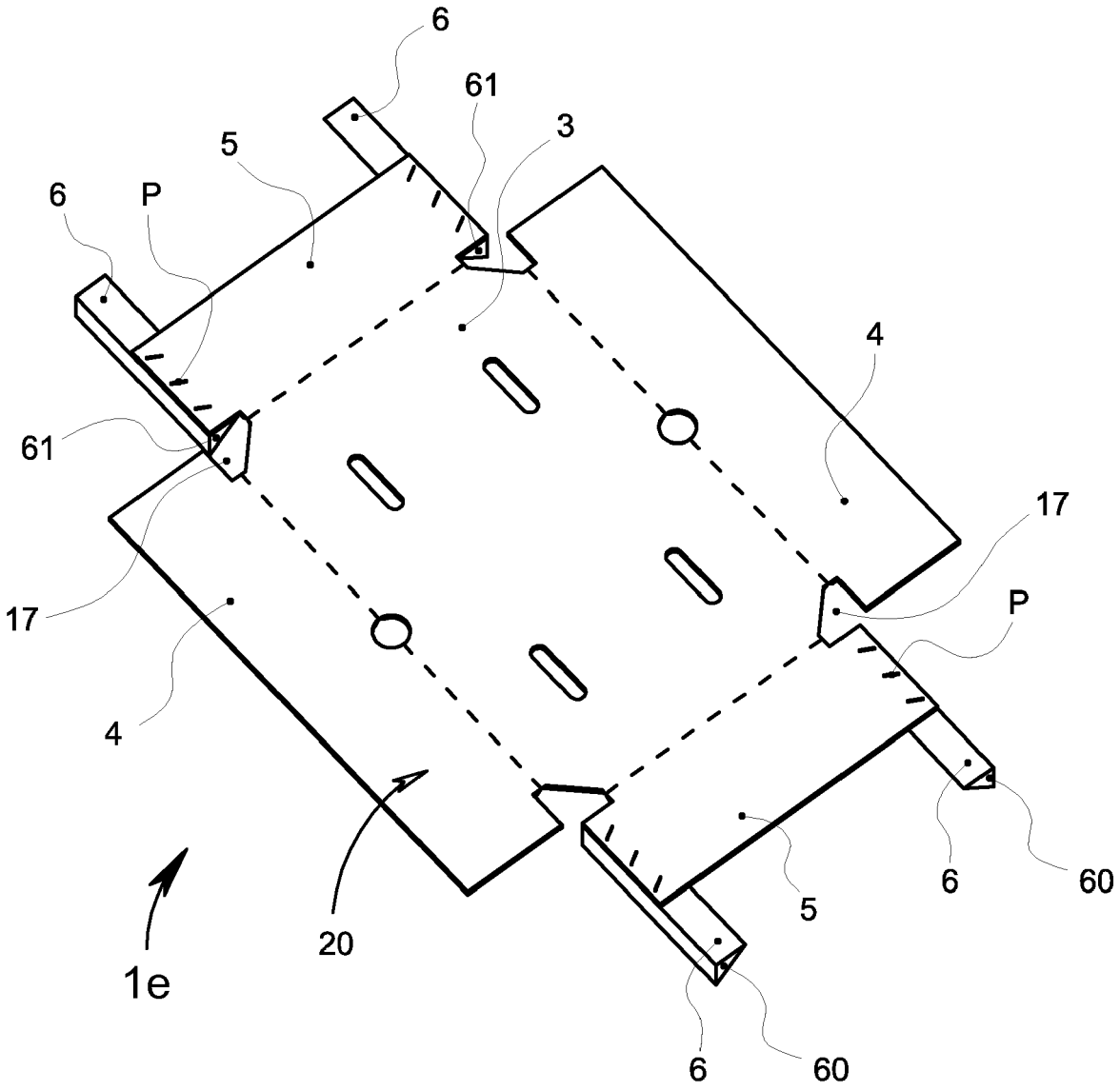


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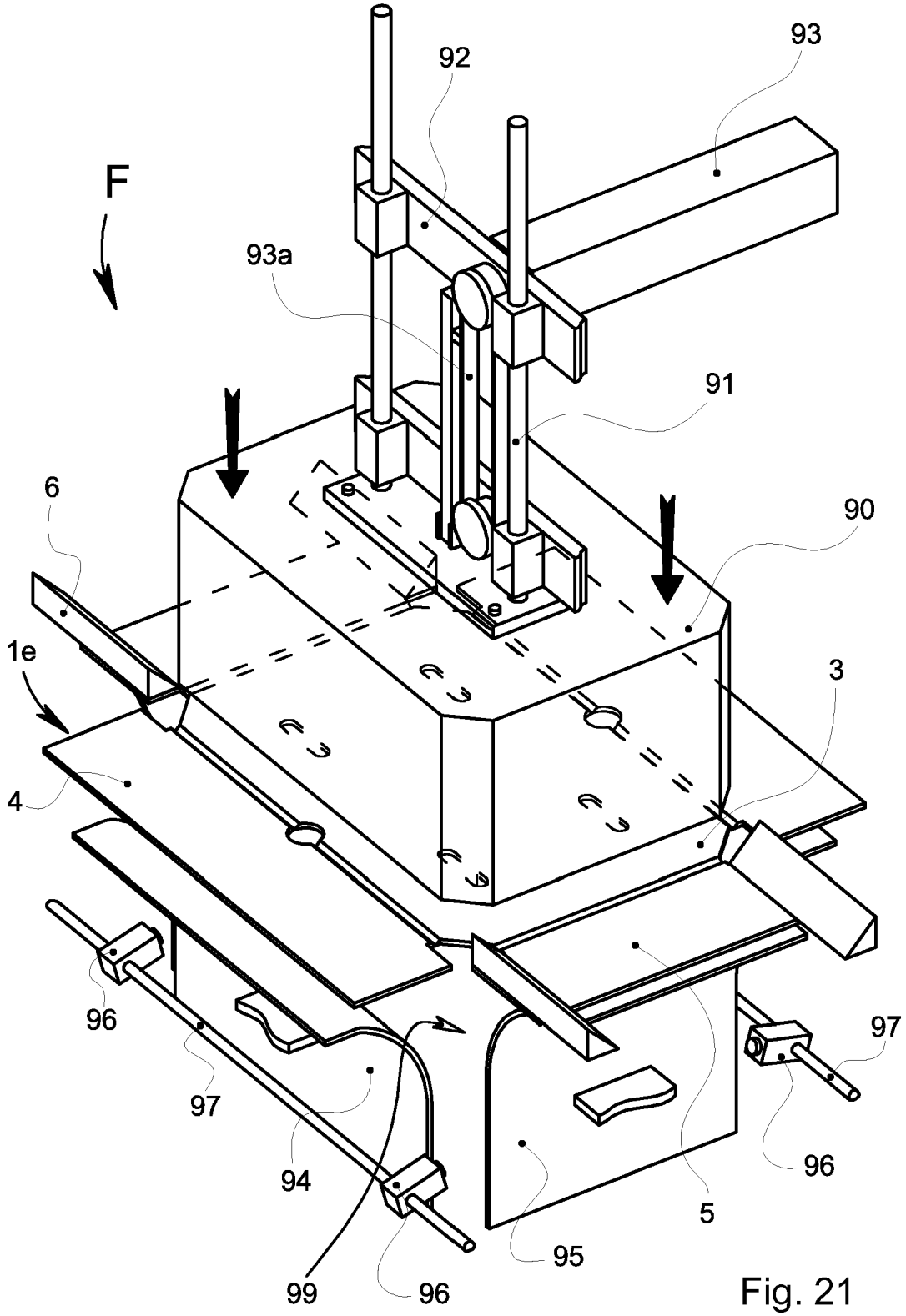


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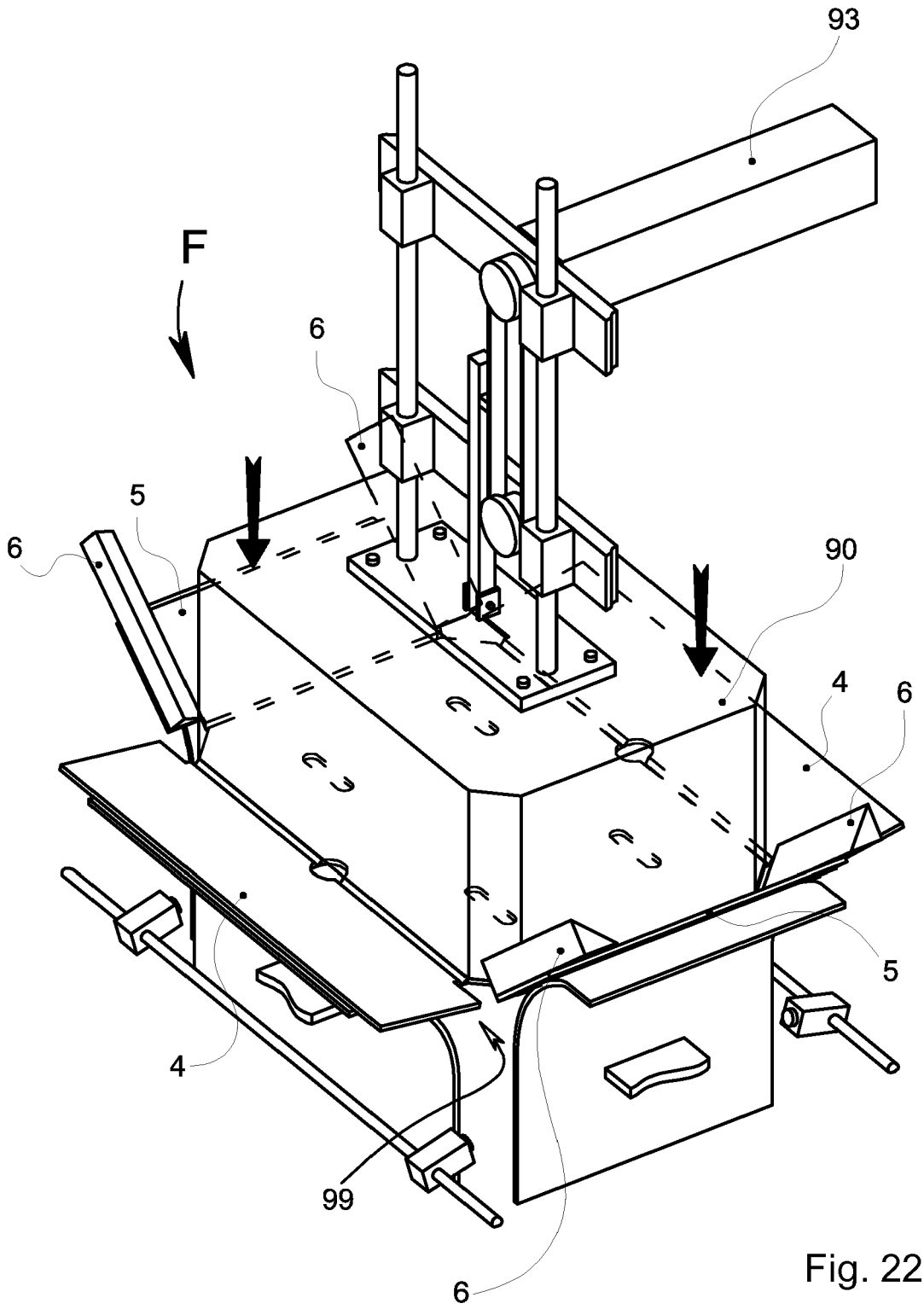


Fig. 22

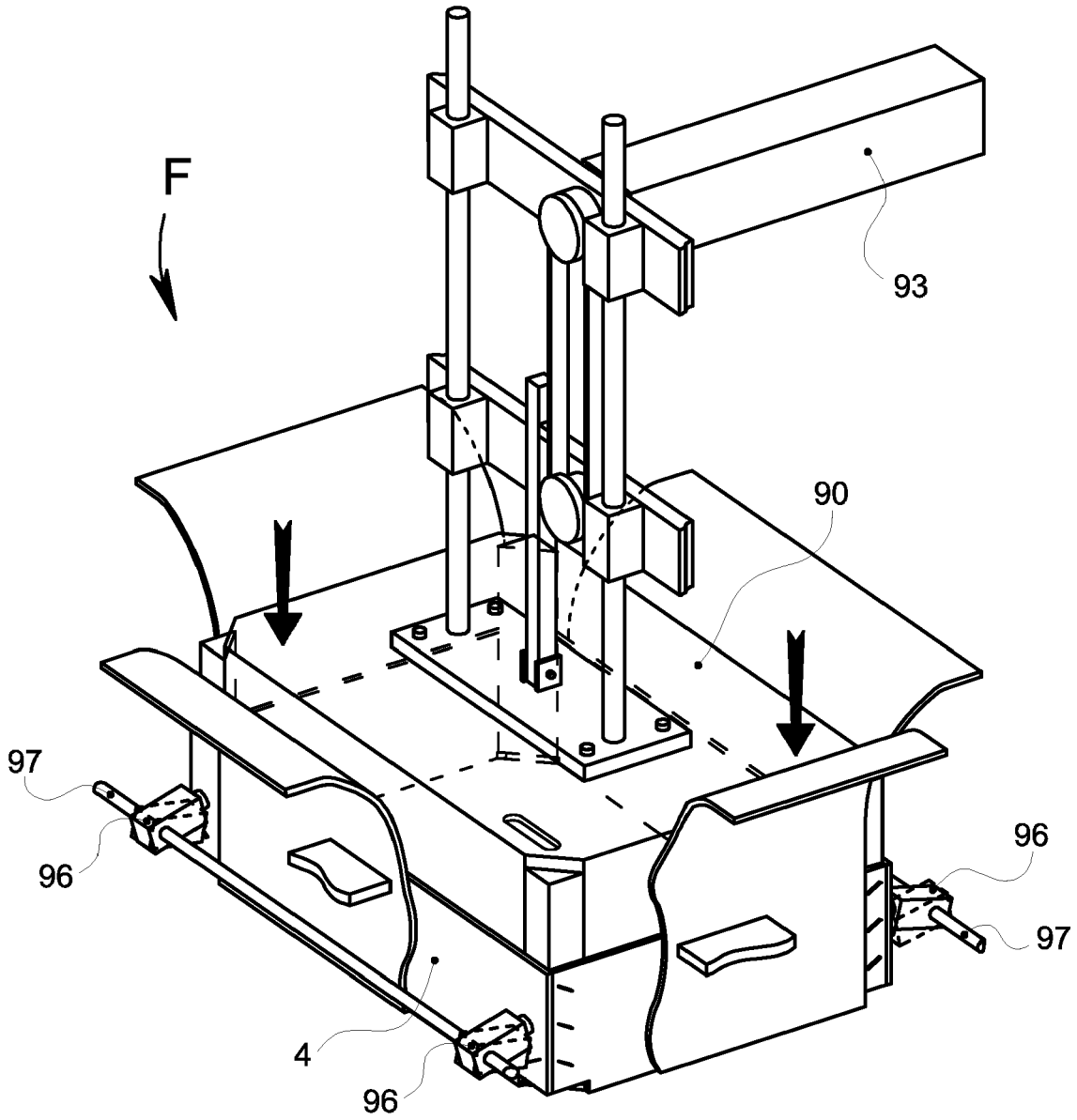


Fig. 23

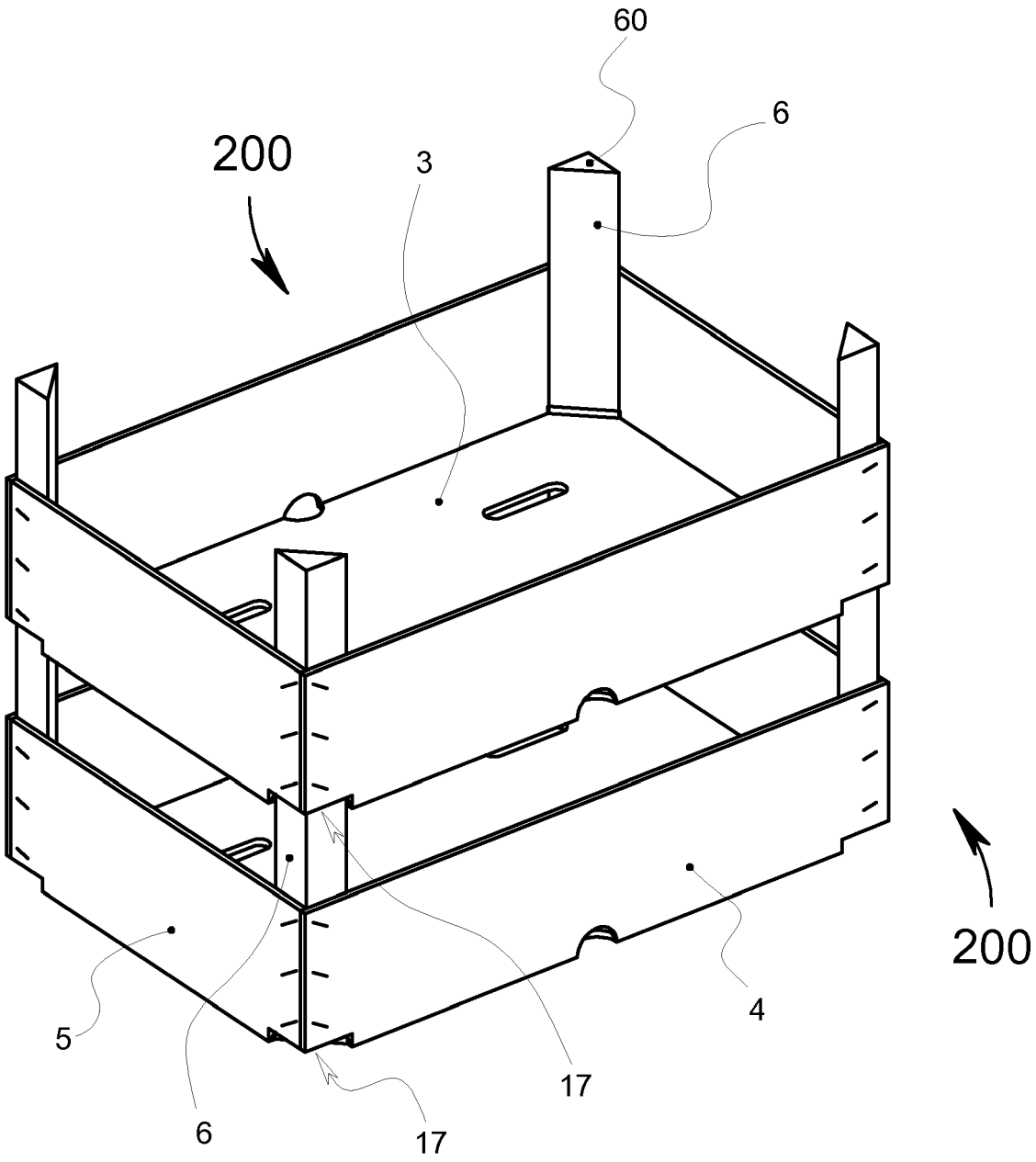


Fig. 24

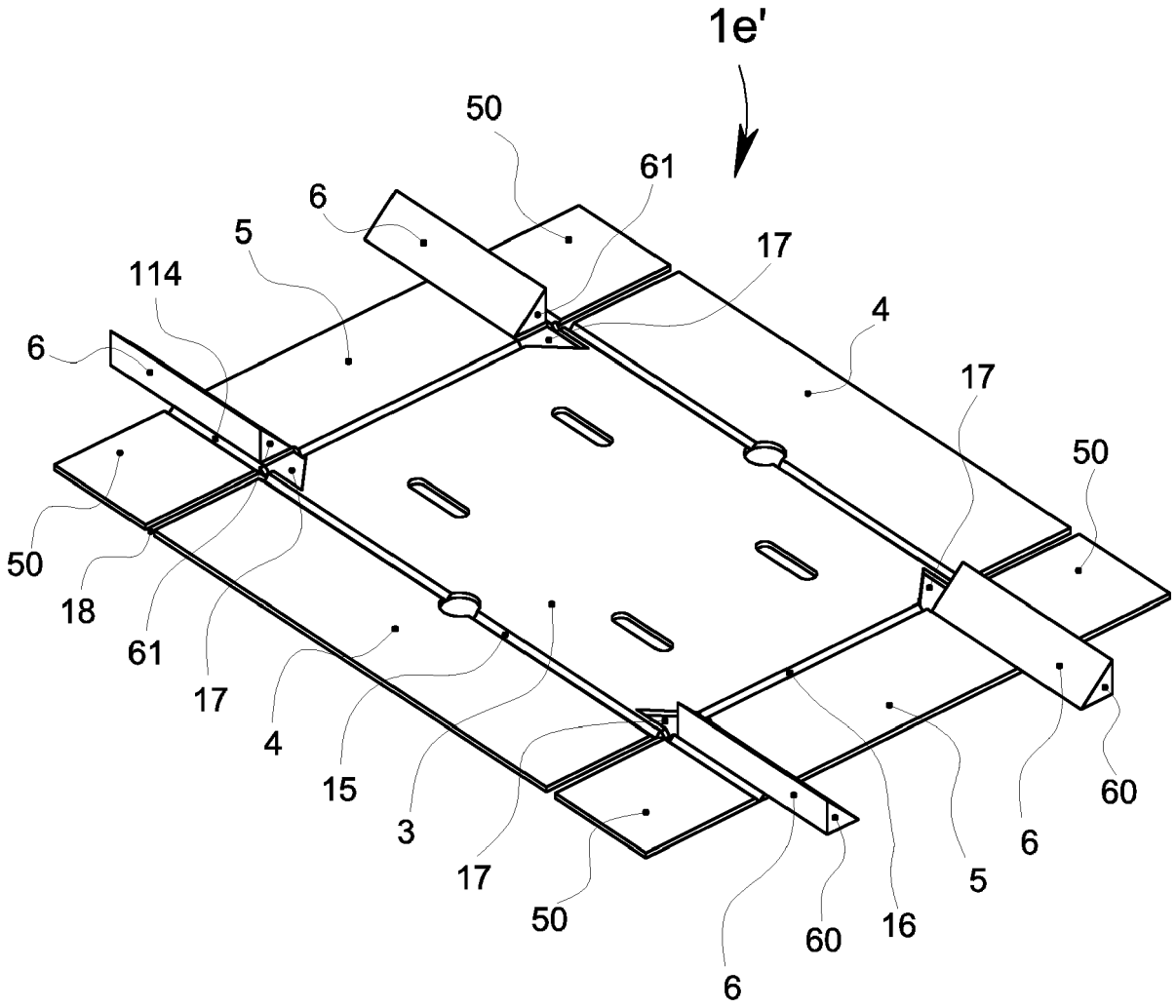


Fig. 25

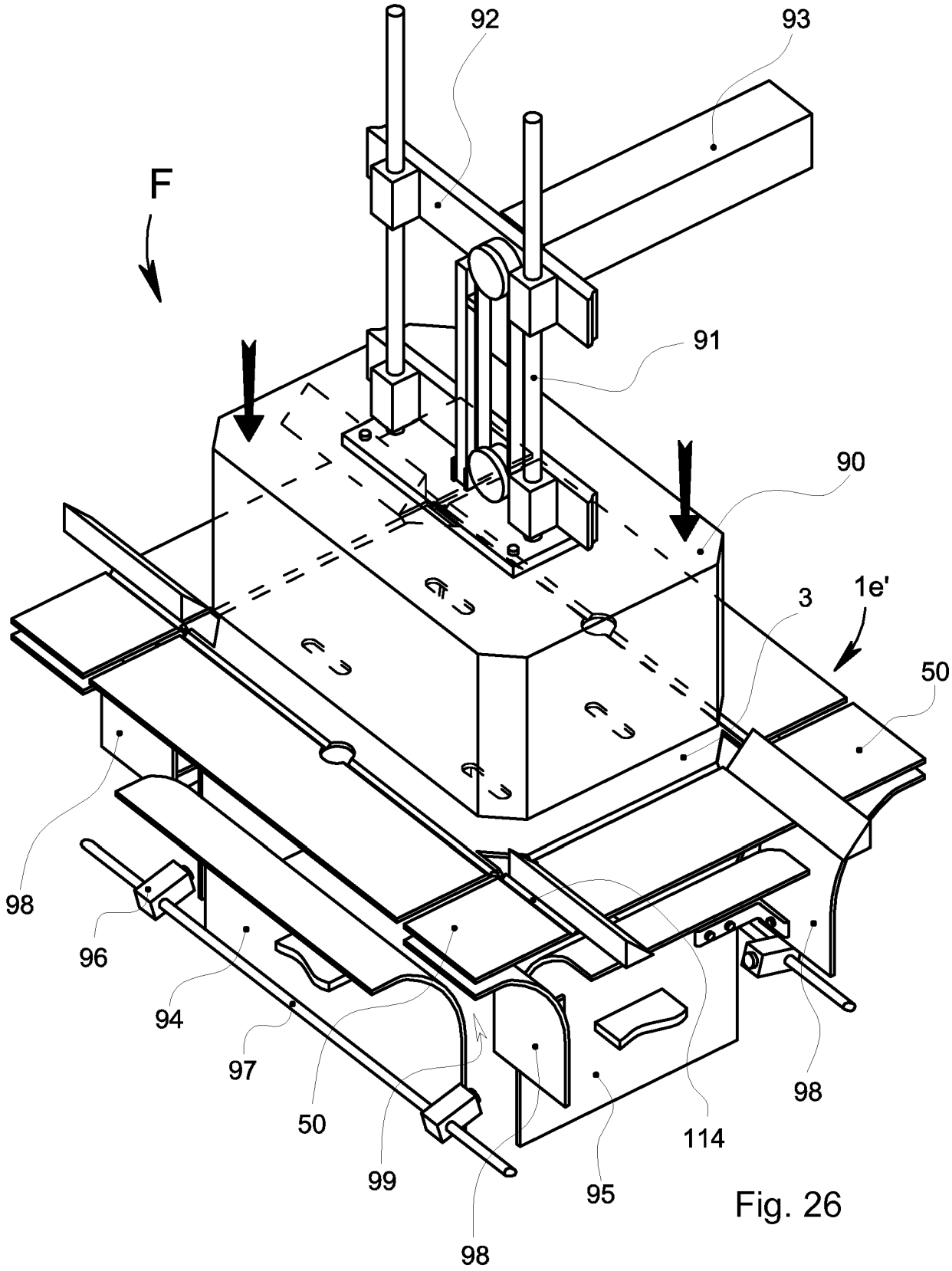


Fig. 26

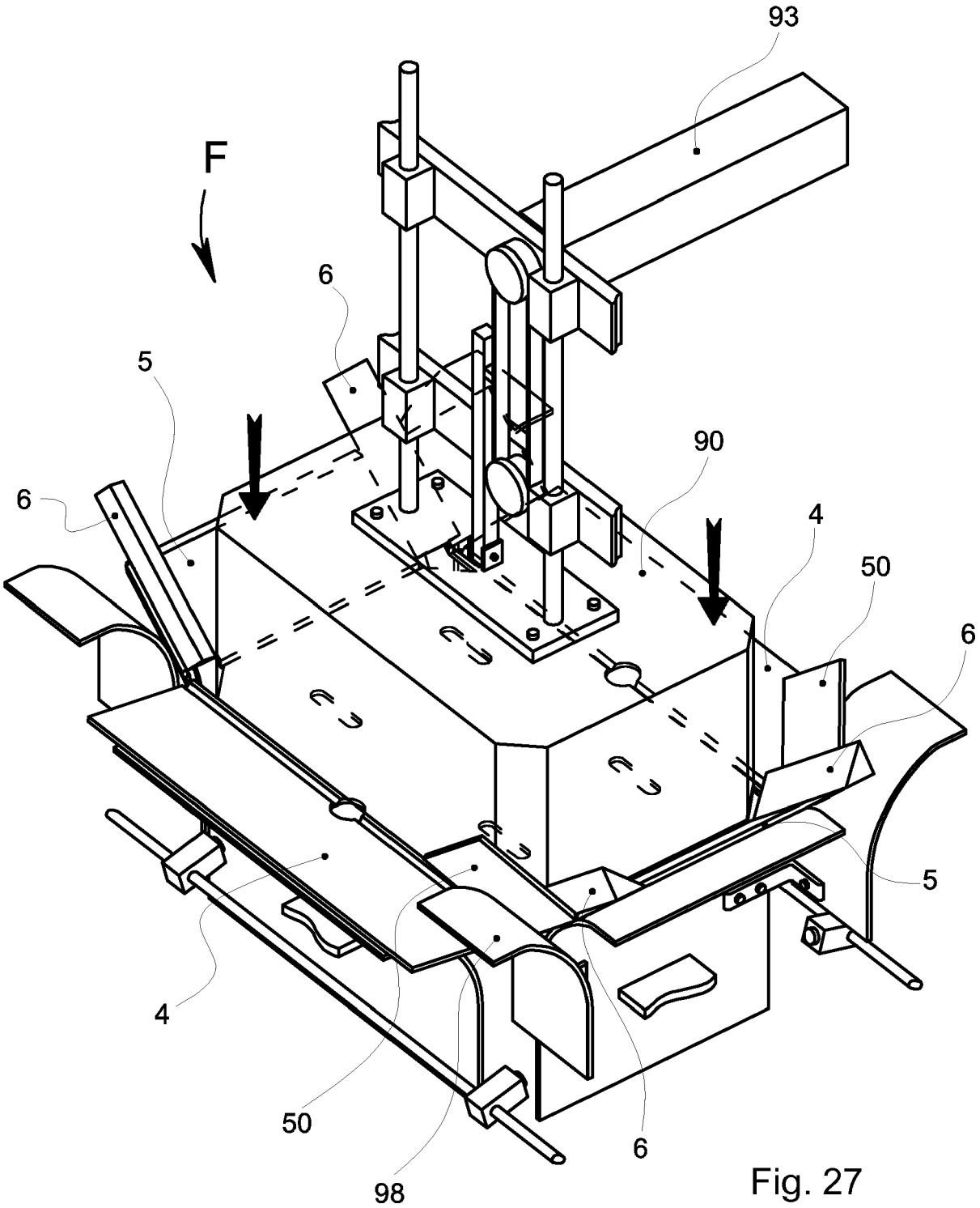


Fig. 27

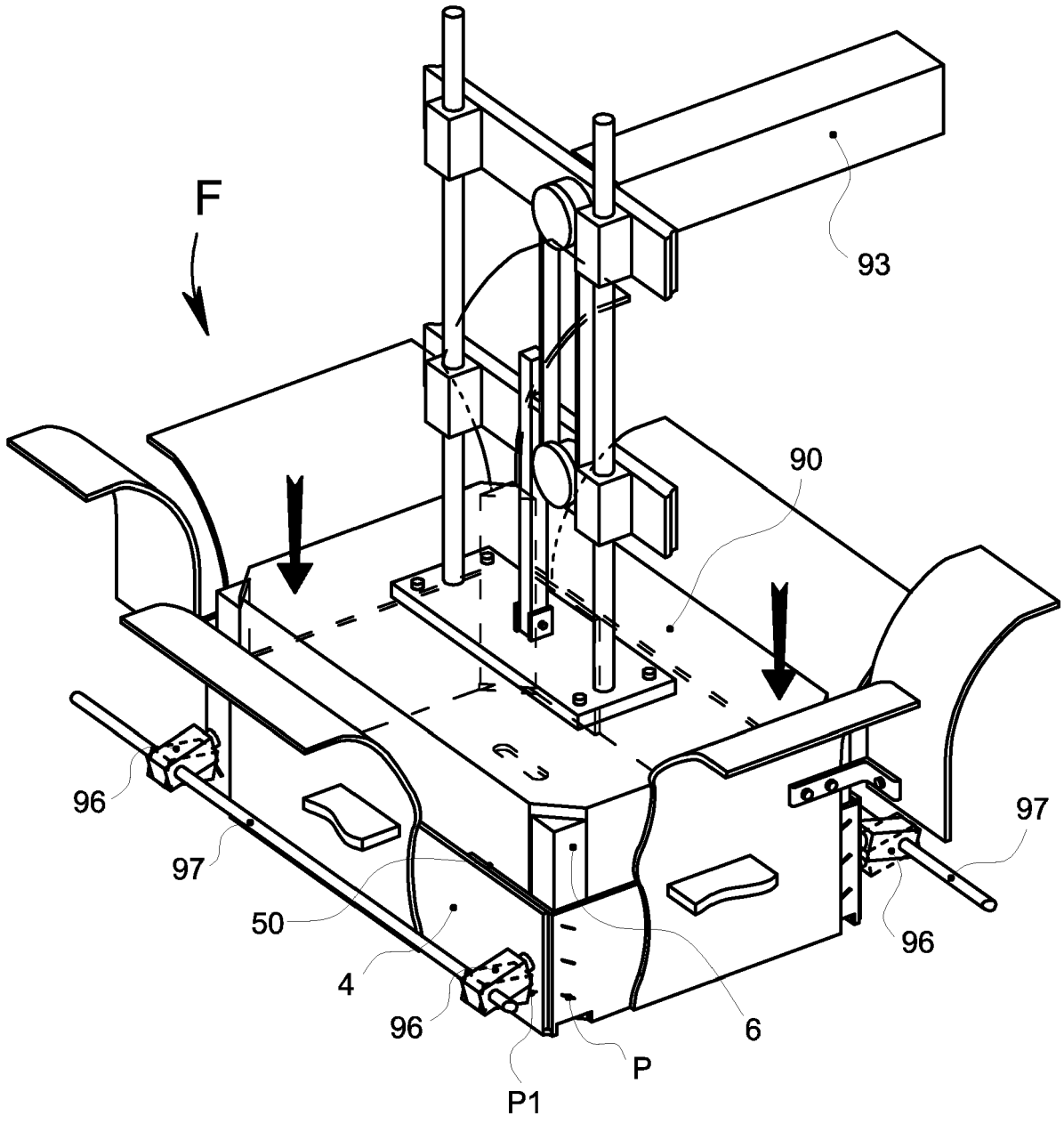


Fig. 28

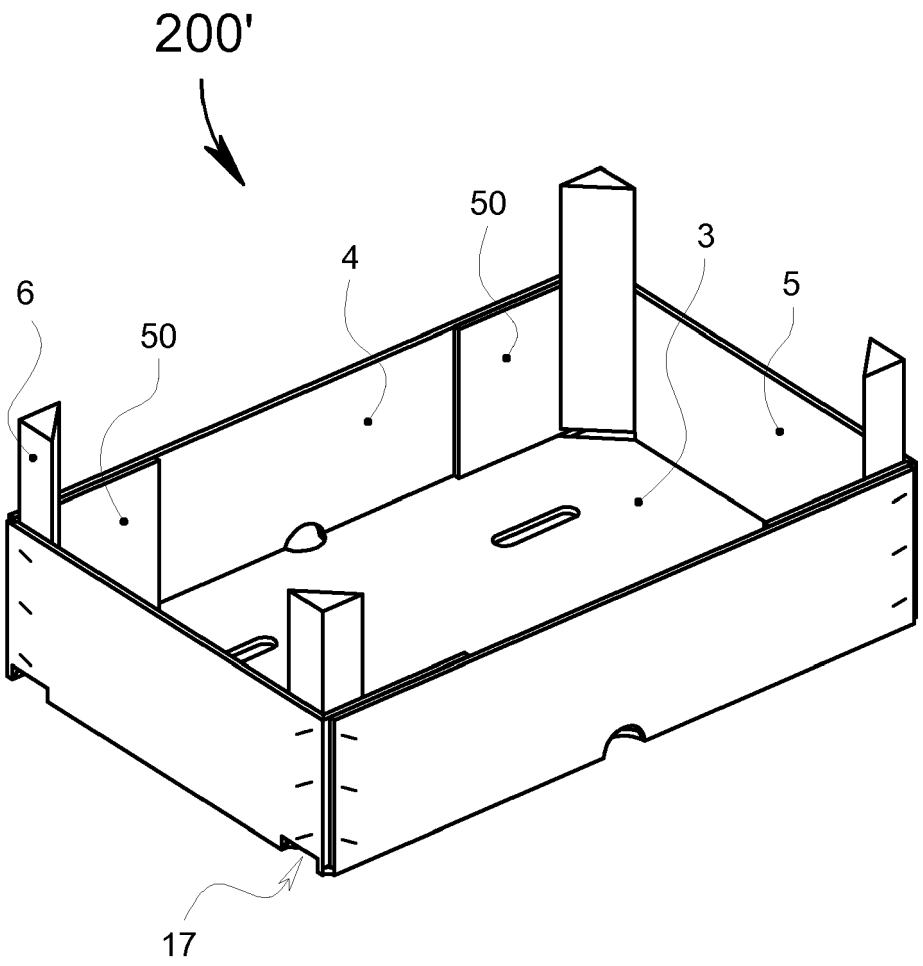


Fig. 29

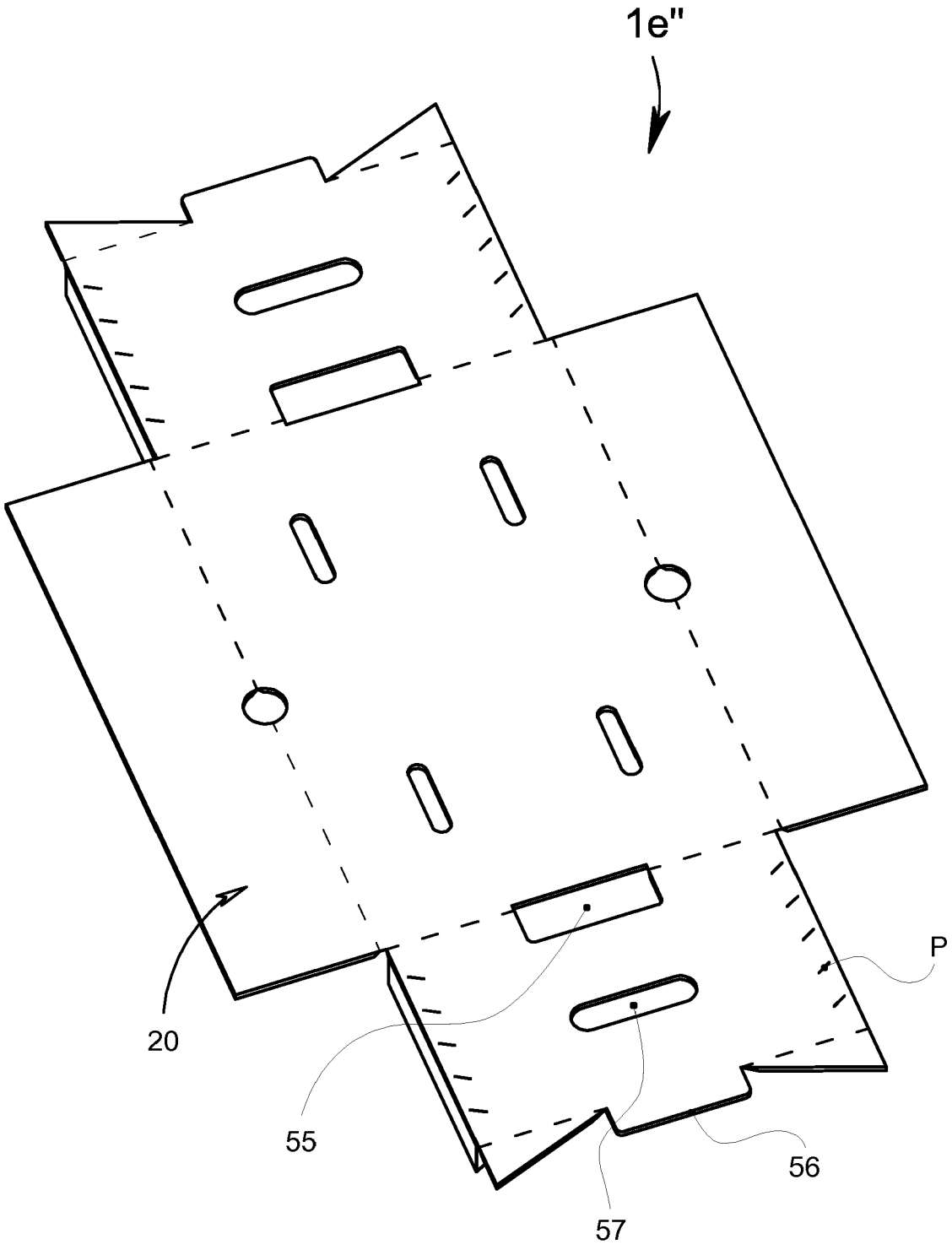


Fig. 30

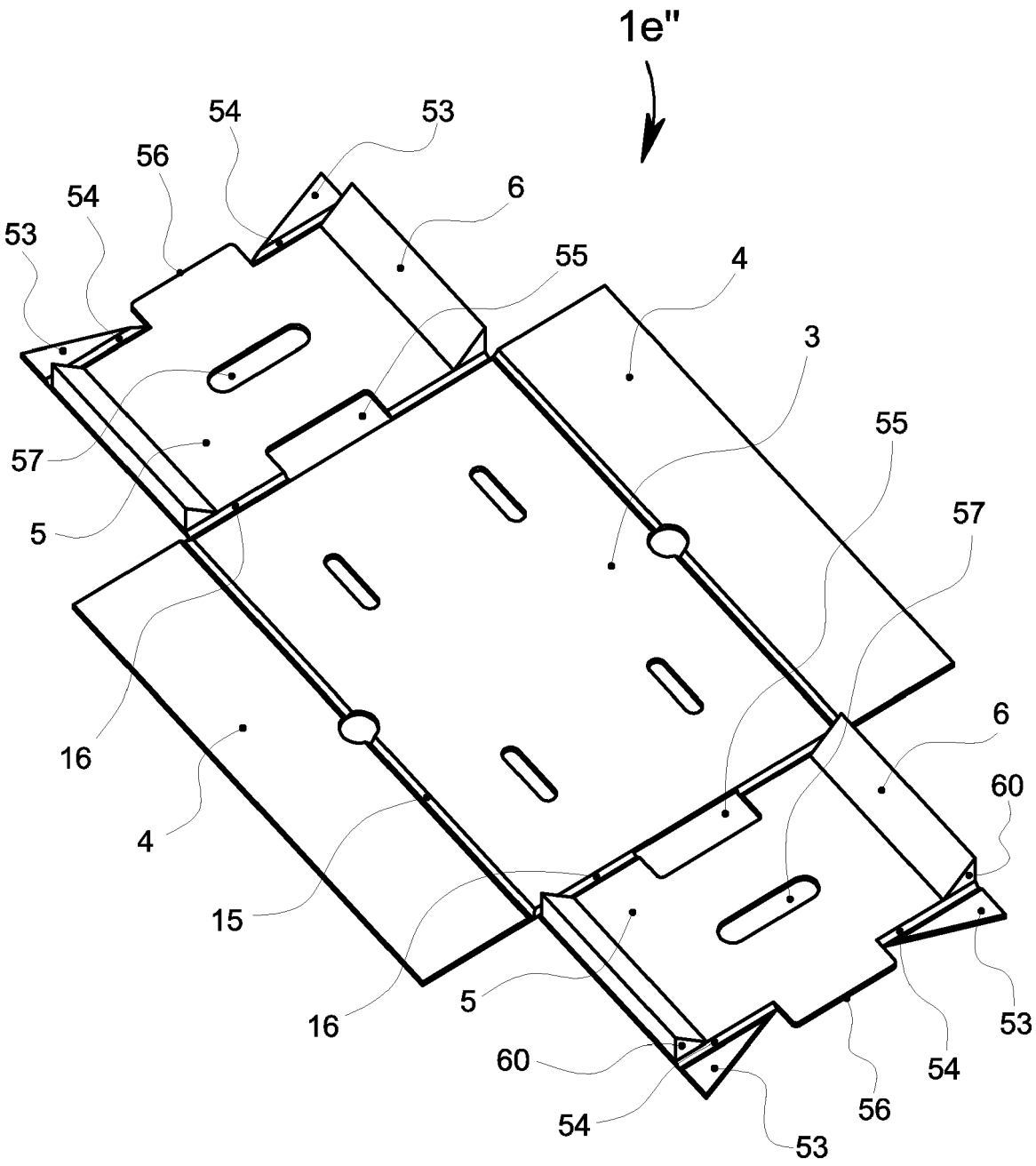


Fig. 31

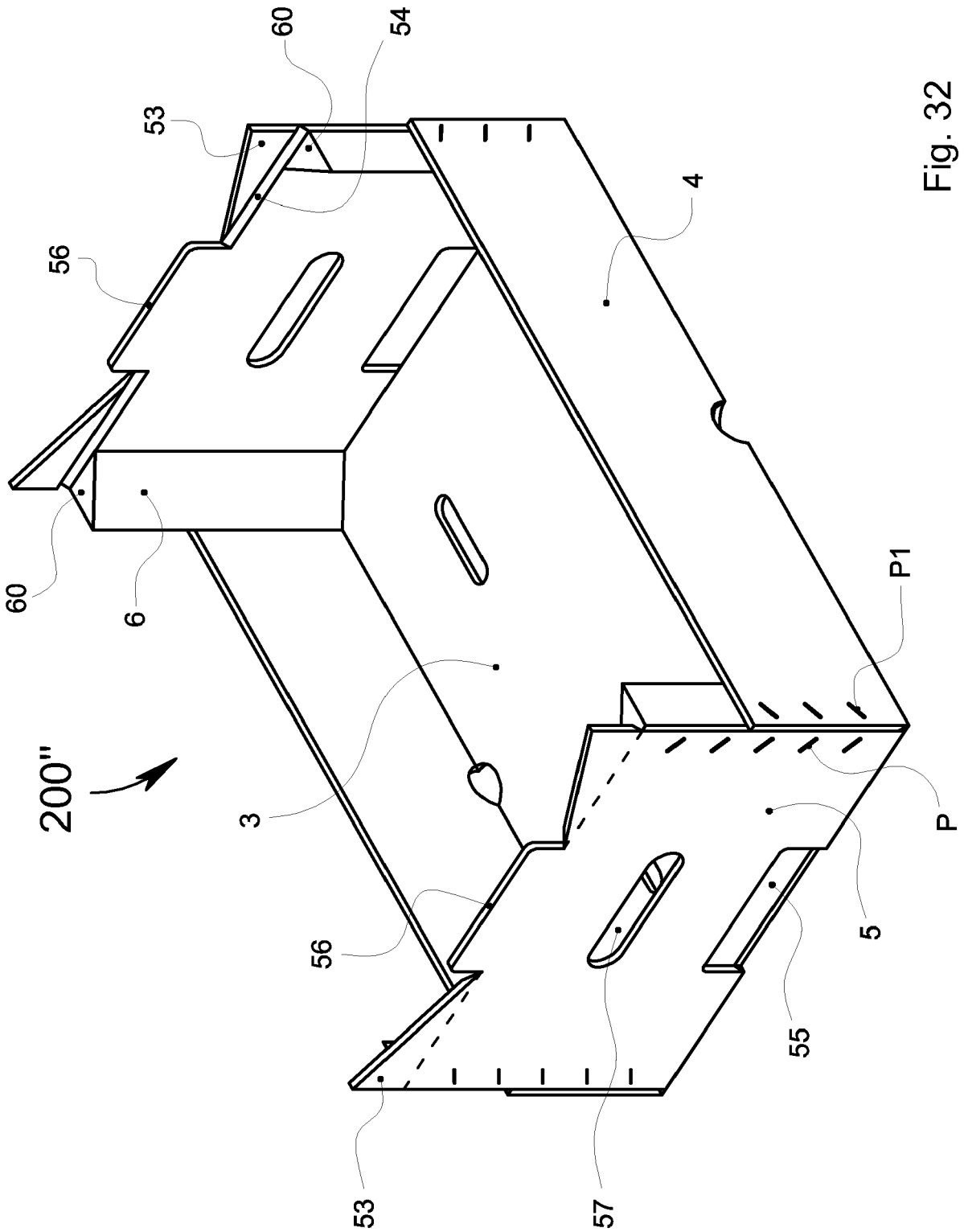


Fig. 32

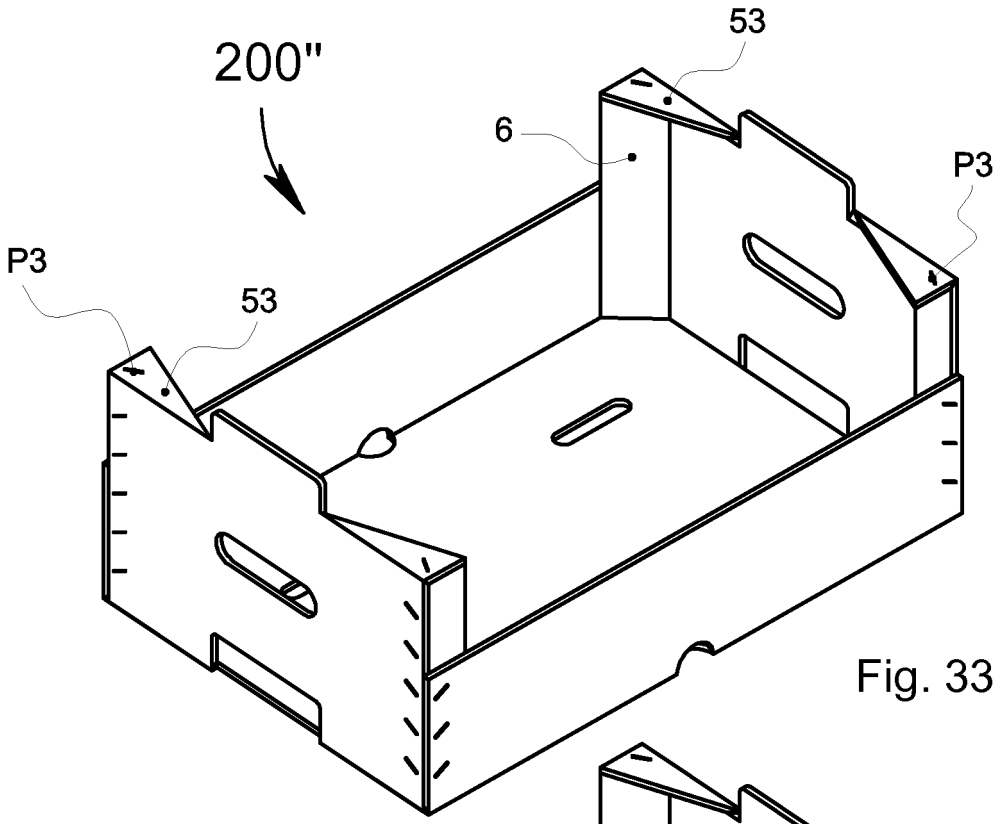


Fig. 33

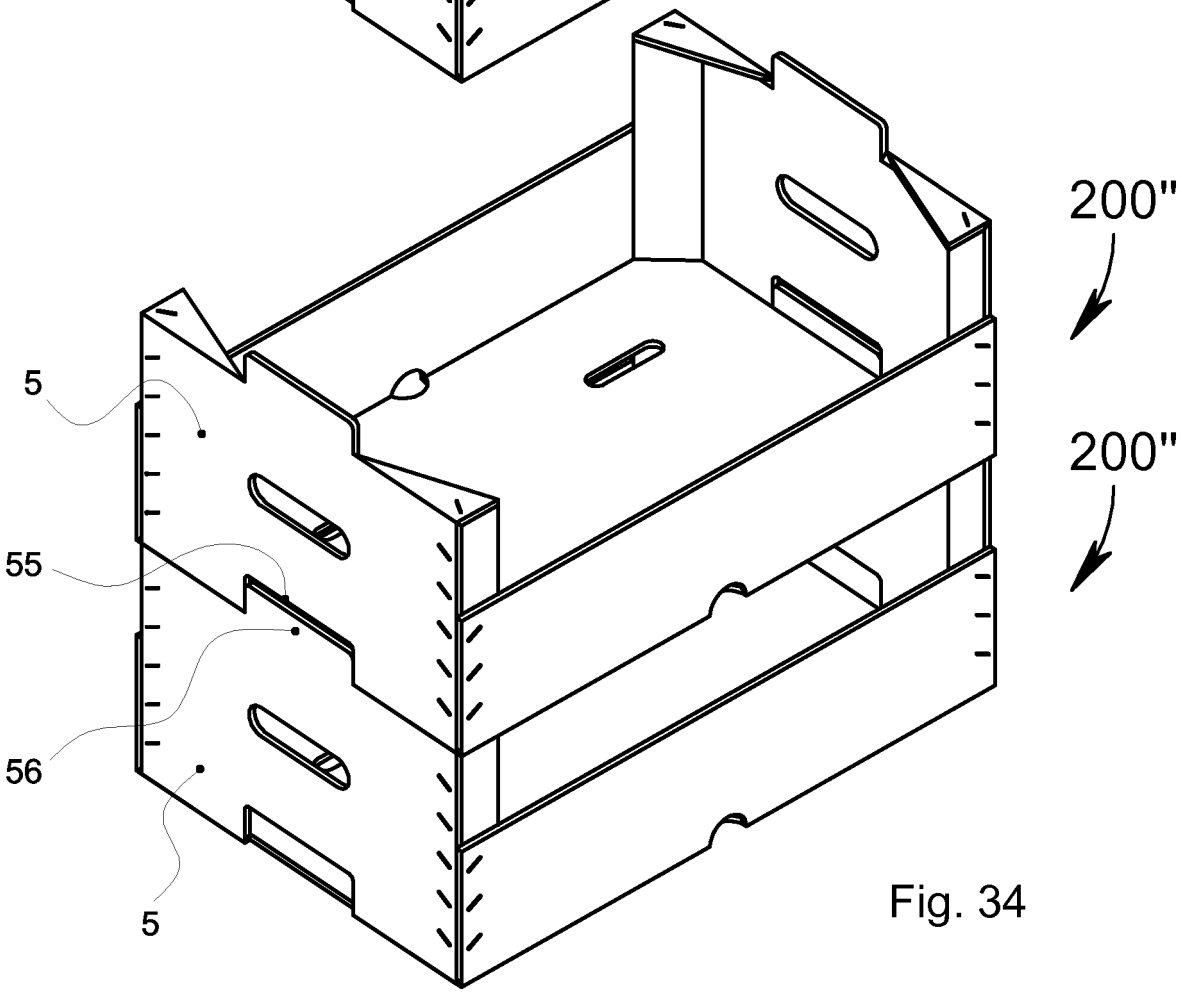


Fig. 34

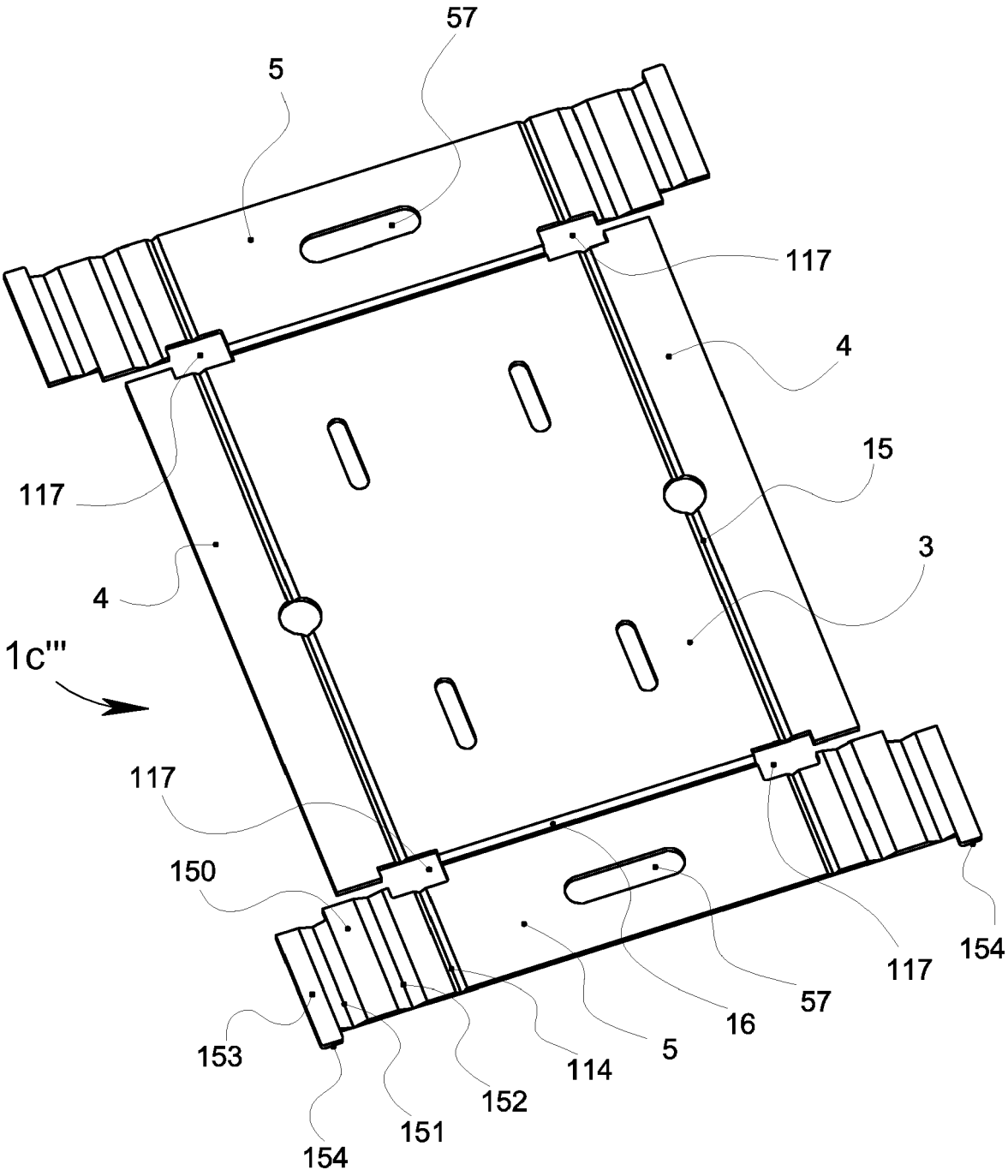


Fig. 35

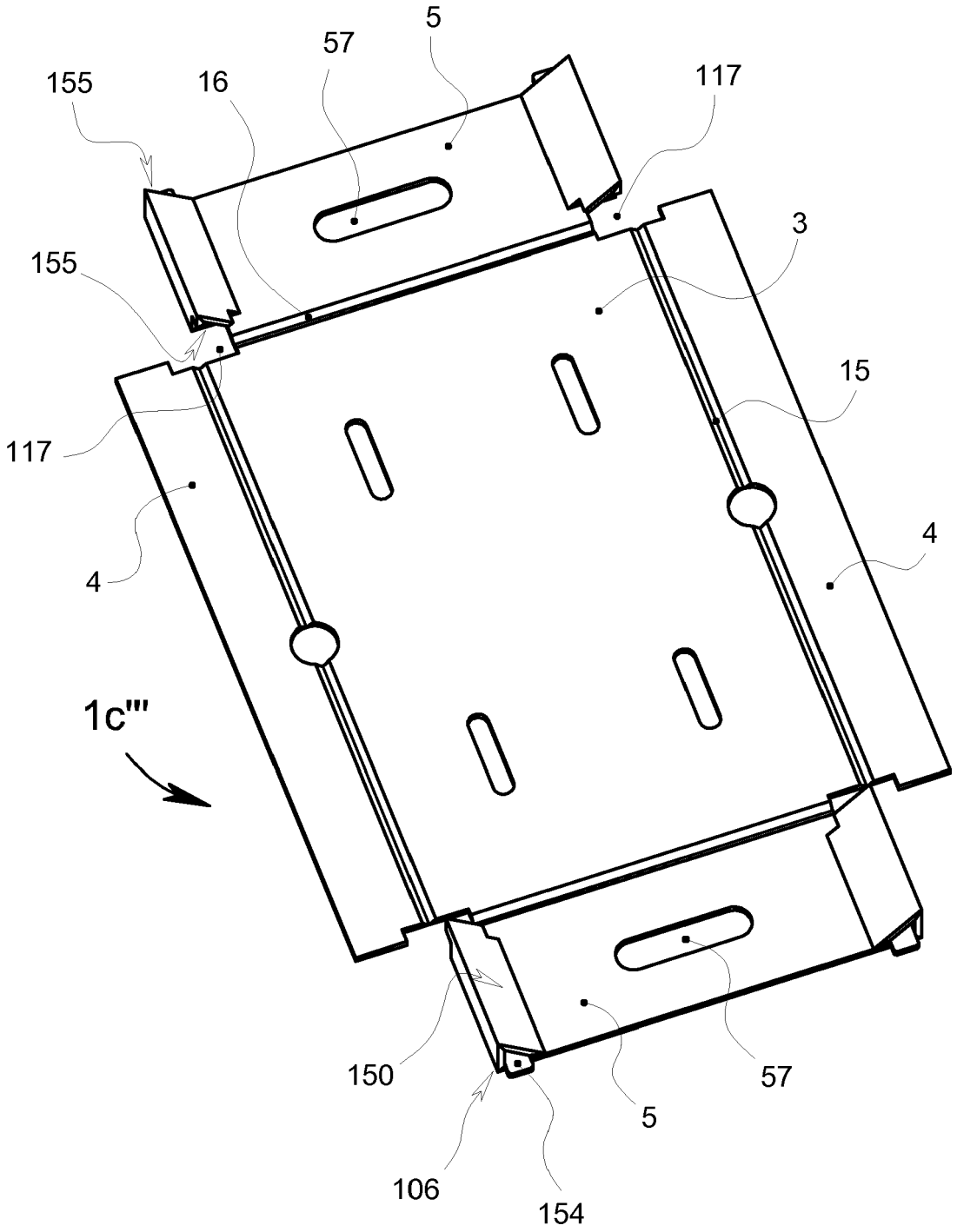


Fig. 36

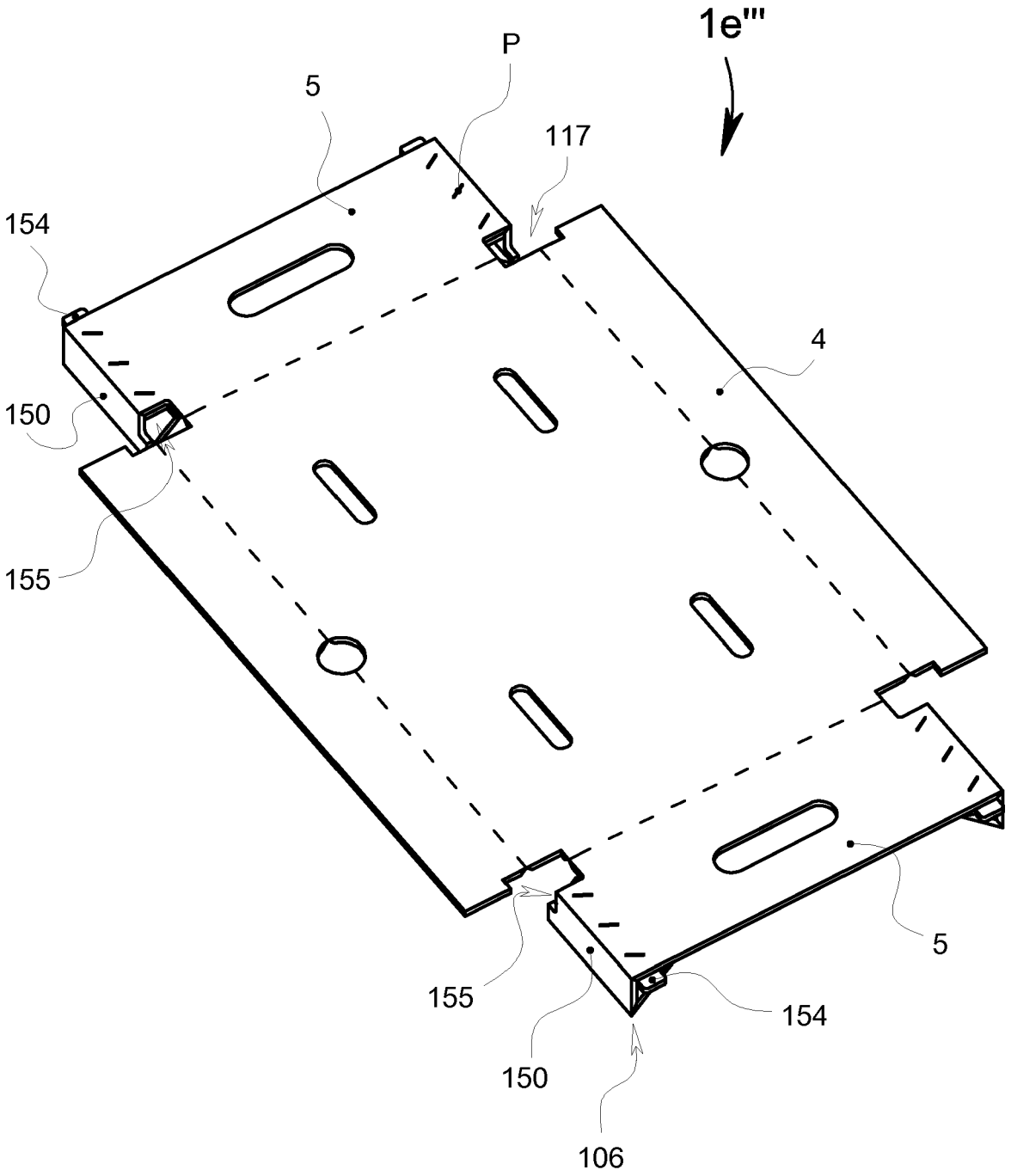


Fig. 37

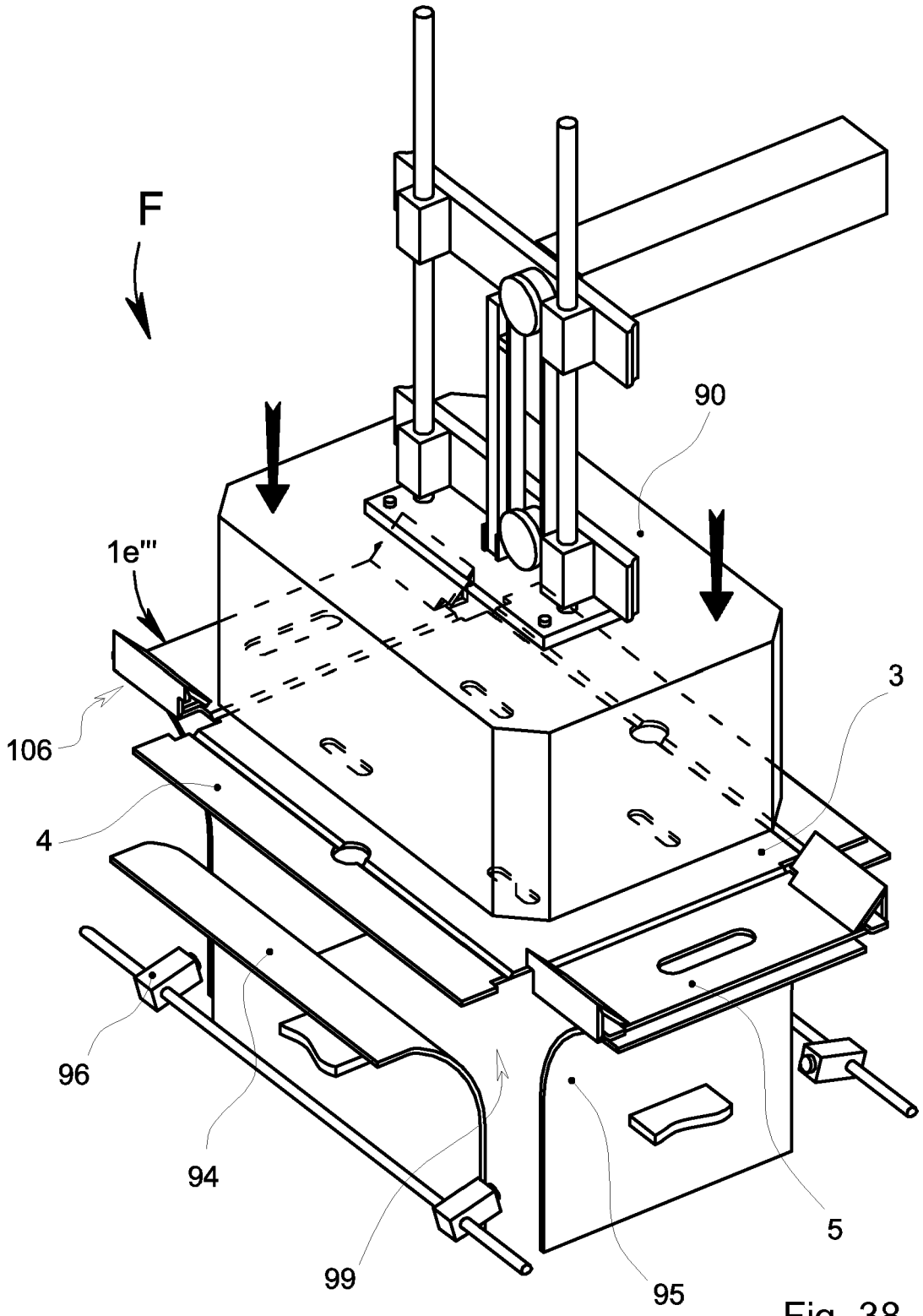


Fig. 38

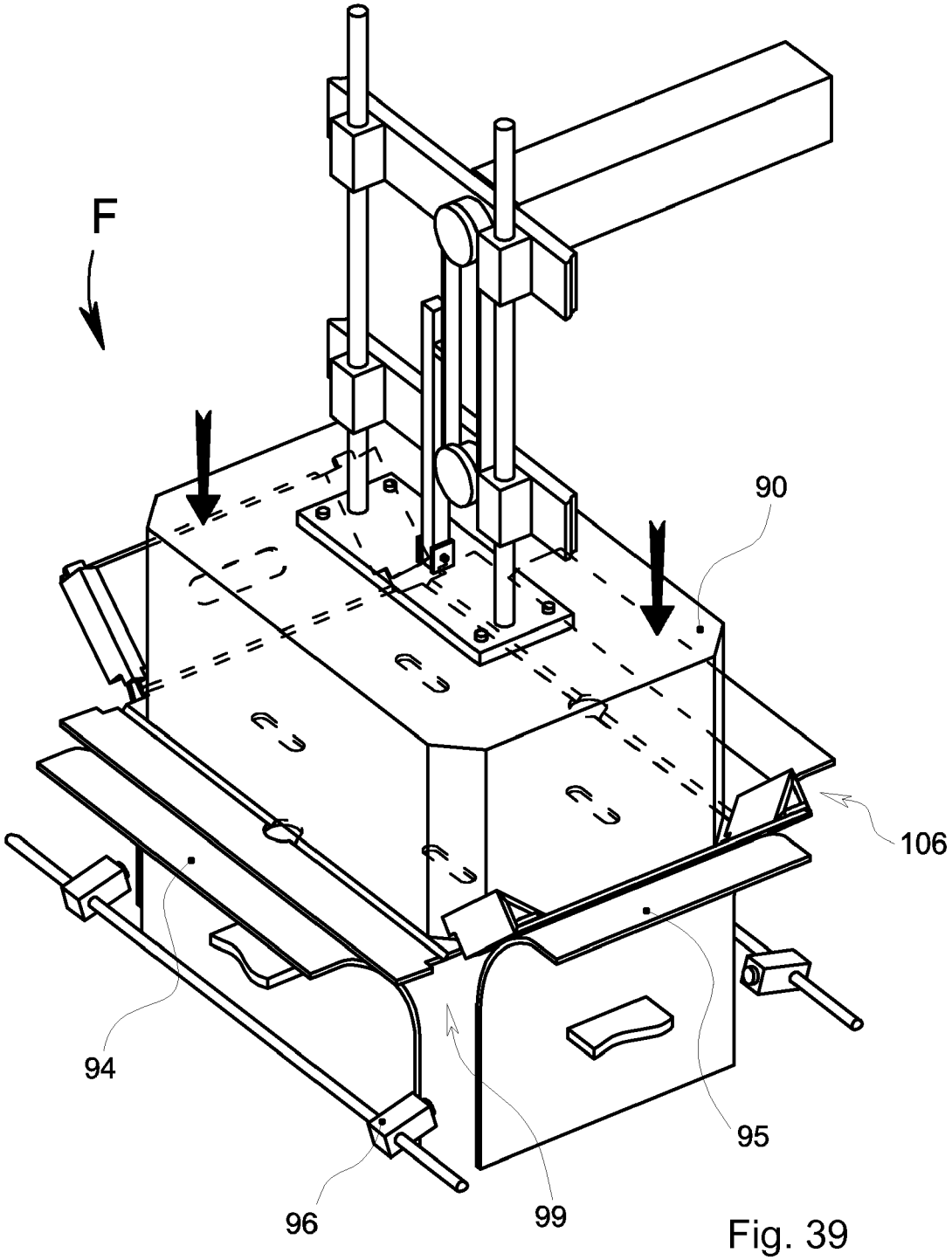


Fig. 39

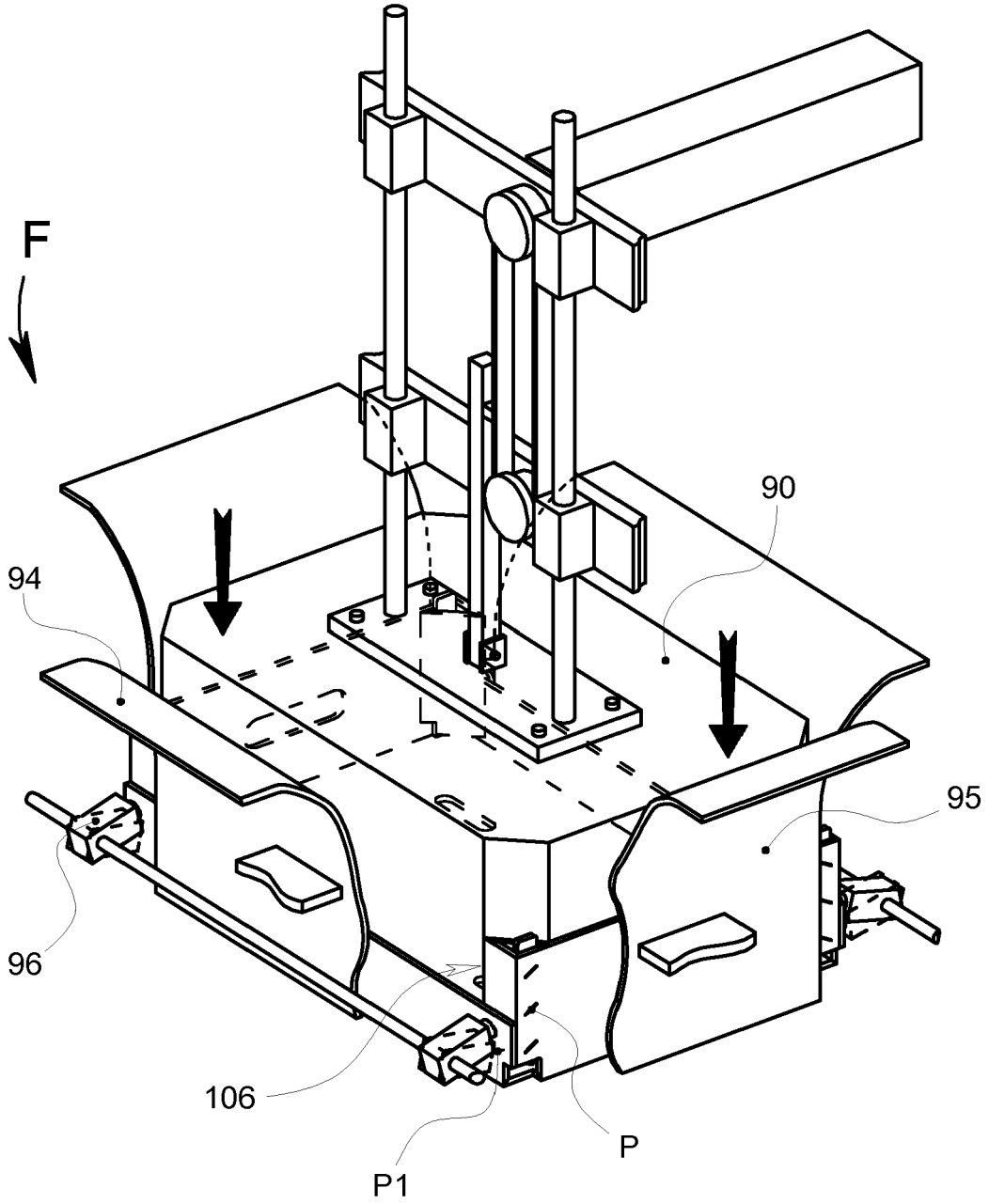


Fig. 40

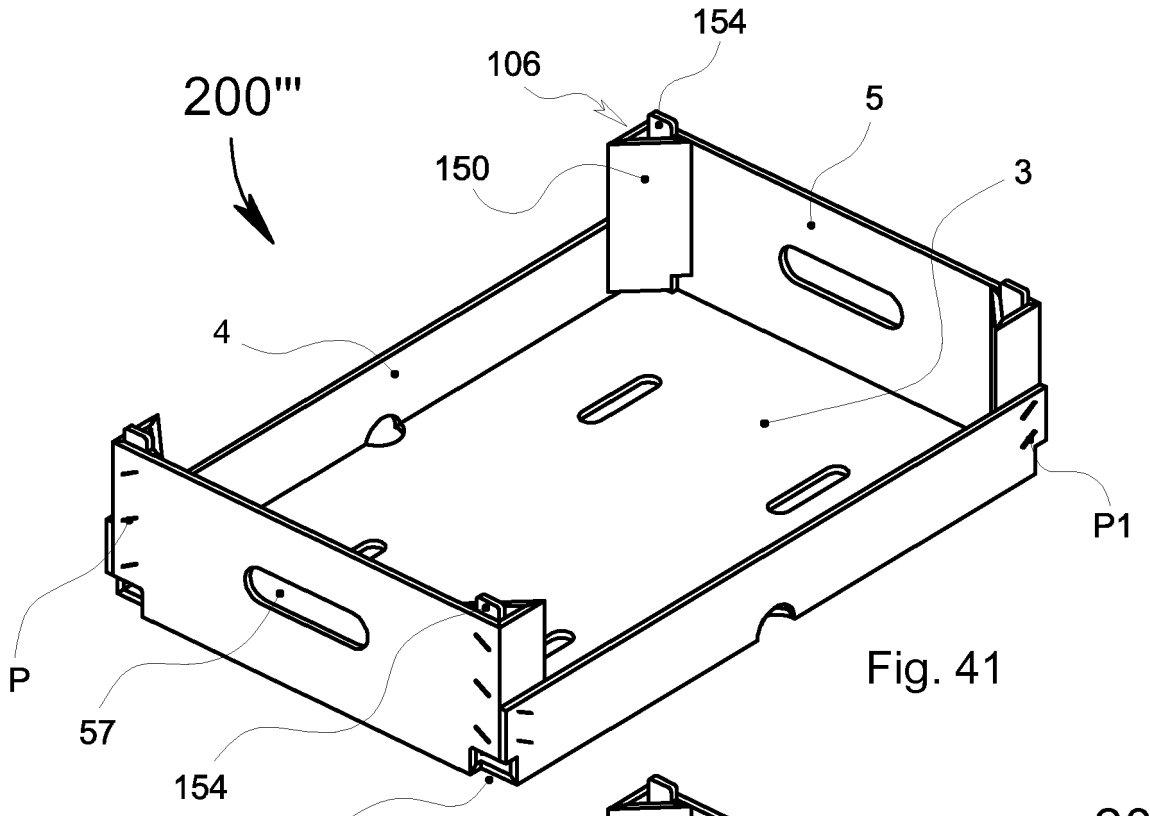


Fig. 41

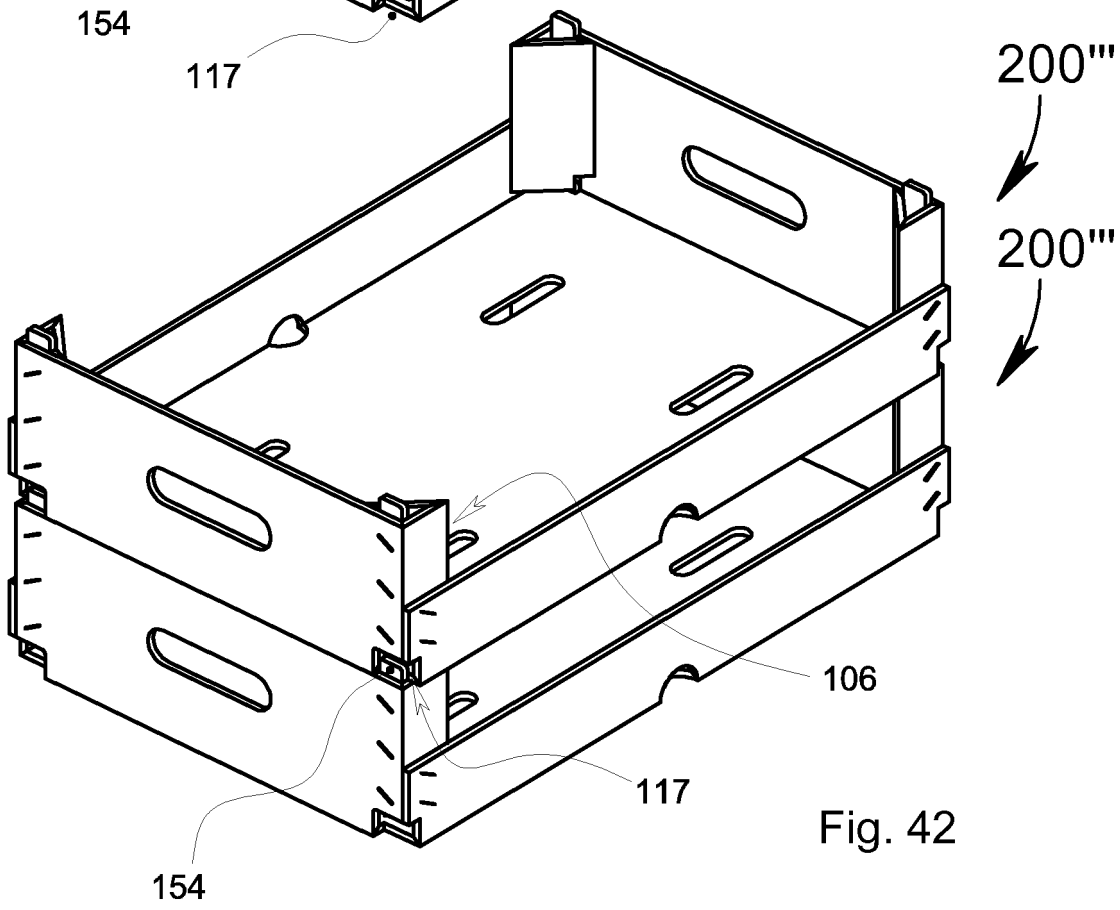


Fig. 42

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European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 16 6270

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 5 673 848 A (GARZA JUAN RAMON [MX]) 7 October 1997 (1997-10-07) * the whole document *	14,15	INV. B65D5/00 B65D5/42 B31B50/25
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Y	FR 2 985 504 A3 (PAPELES Y CARTONES DE EUROPA S A [ES]) 12 July 2013 (2013-07-12) * the whole document *	14,15	
Y	DE 24 50 702 A1 (VERBOORD HENDRIKUS PETRUS) 7 May 1975 (1975-05-07) * the whole document *	14,15	
A	EP 2 228 206 A1 (MITSUBISHI HEAVY IND LTD [JP]) 15 September 2010 (2010-09-15) * paragraph [0003] - paragraph [0005]; figures 1,2,4,5 * * paragraph [0040] - paragraph [0051] *	1-13	TECHNICAL FIELDS SEARCHED (IPC) B31B B65D B31F
A	US 3 583 295 A (ELDER STANLEY C ET AL) 8 June 1971 (1971-06-08) * column 6, line 36 - column 9, line 54; figures 1-11 *	2,8,11, 12	
Y	EP 2 366 633 A1 (CINTIO MARIA TERESA [IT]) 21 September 2011 (2011-09-21) * paragraph [0035] - paragraph [0041]; figure 4 *	1-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 September 2017	Johne, Olaf

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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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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