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(54) Modular tabletop system for connecting metal pieces by flanging

(57) Modular tabletop system for connecting metal pieces by flanging, of the type that carries out a flanging operation separated into a first folding of the flange, called pre-flanging, and a second and final folding, called final flanging, suitable for sealing the flange of the outside panel over the inside panel, and which comprises a structure (6), a table (9), a cradle (3) suitable to support a sheet or outside panel (1), a treader (18) and flanging units (24).

At least one of the flanging units (24) is made up of a tipping part (25) and a sliding part (31), the sliding part being linked to the tipping part (25) such that it can perform a sliding movement with regard to said tipping part (25). The system includes flanging means associated with the sliding part (31).

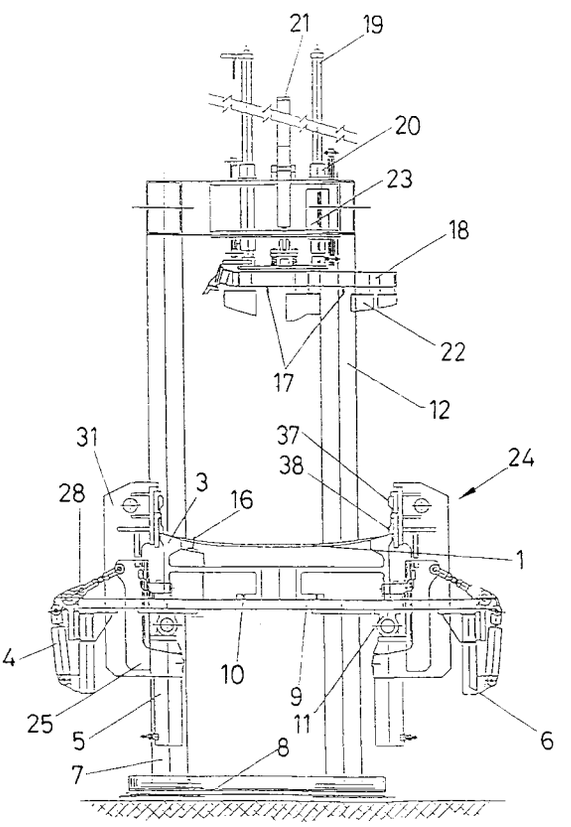

Fig. 2

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Description

As indicated in its title, the object of the present invention, refers to a modular tabletop system for connecting metal pieces by flanging, of the type of those that carry out a flanging operation, understood as being the operation of folding the contour flange of a sheet, or outside panel, over the edge of another sheet, or inside panel, by plastic mechanical deformation, for the purpose of connecting both sheets entirely or partly on their outside and/or inside perimeter, that has some important advantages over the means presently used for this purpose.

The flanging systems presently used nowadays are based on two concepts: press flanging system and movable tabletop flanging system.

The press flanging system (either a mechanical press or a hydraulic press)is carried out by means of a die, that has some pawls that, duly operated, achieve the folding of the flange. This flanging system has several disadvantages with regard to the system object of the present invention. Its arduous adjustment, requires large physical space, the loading and unloading of parts is troublesome, the installation of this type of press normally requires civil engineering work to be done and the maintenance of the equipment is complex. Likewise, the press flanging system is costly and it is difficult to control the thickness of the package after flanging, it only being possible to attack the flange from one direction.

On its part, the movable tabletop flanging system is based on the flanging units being placed in the work position and waiting for the arrival of the pieces to be flanged loaded on the cradle, which reaches the working position by means of a vertical operation system. This flanging system has certain inconveniences such as the fact that the place where the pieces are loaded and unloaded is located at a considerable height, which limits the possibilities of certain loading and unloading systems. The cost of hydraulic operation is generally very high and requires a very large energy consumption and the weight of the machine is great. Likewise, the flanging forces make the flanging units tend to come out of their working position. The maintenance of the hydraulic cylinder that moves the cradle is complicated due to the difficult access to it from the outside and this system is only capable of attacking the flange in one direction.

For the purpose of effectively overcoming the deficiencies that the presently existing flanging system have, the modular tabletop system for connecting metal pieces by flanging, object of the present invention has been developed.

The modular tabletop system for connecting metal pieces by flanging, object of the present invention generically consists of a system that is comprised of a structure, a table, a cradle, a treader, as well as flanging units, in which a sheet or outside panel rests in a fixed manner on said cradle, whose support surface reproduces the shape of said outside panel, proceeding with the loading of another sheet or inside panel on said outside panel, to then proceed with the flanging operation by means of the combination of movements of said flanging unit, separating said flanging operation into two stages, such as a first folding of the flange, called pre-flanging, and a second and final folding, called final flanging, suitable to seal the flange of the outside panel on the inside panel.

At least one of the flanging units is made up by a tipping part arranged such that it can perform a tipping movement with regard to the cradle or the table, and a sliding part which is linked to the tipping part such that it can perform a sliding movement with regard to said tipping part. The system includes tipping means for tipping the tipping part, and sliding means for sliding the sliding part with regard to the tipping part. The system also includes flanging means associated with the sliding part. The sliding means for sliding the sliding part with regard the the tipping part can include a hydraulic flanging cylinder. According to a preferred embodiment, the flanging means can include, in the sliding part, a blade holder in which at least one pre-flanging blade and one final flanging blade are attached.

The sliding parte can be made up of one single piece, or by a first piece and a second piece, to which the flanging means are attached. In the latter case, the system includes means for fixing the second piece to the first piece and means for modifying the position of the second piece with regard to the first piece.

The flanging units of the modular tabletop system for connecting metal pieces by flanging, object of the present invention, consist of replaceable and interchangeable modular moveable elements, each one of them having operating means preferably comprised of two hydraulic cylinders, the first one a hydraulic tipping cylinder, suitable for carrying out the approach and withdrawal of the flanging unit to the working area, the second one a flanging cylinder, suitable to carry out the movements to effect the pre-flanging and final flanging operations.

Each flanging unit is preferably comprised of a part linked to the table, or tipping part, comprised of a group of supports of the tipping shaft, means to anchor the guide means of the blade holder slide, means to connect to the hydraulic tipping cylinder, preferably by rods, and means to anchor to a mechanical stop in the table for pre-flanging and final flanging operations, and a part linked to the front part, or sliding part, with means to connect to the hydraulic flanging cylinder, sliding means with respect to the tipping part and flanging parts to carry out the flanging operations.

Said mechanical stops of each on table flanging unit for pre-flanging and final flanging operations are preferably comprised of a steel rivet-dolly, suitable to allow the rotation axis of the flanging unit to rest.

The tipping part has means to adjust its position preferably comprised of a fine pitch nut in the rod transmitting said tipping movement.

Said sliding means of the sliding part with respect to the tipping part are preferably comprised of symmetric tempered ground steel strips that have means to anchor to the sliding part of the flanging unit, as well as means for parallel sliding between them preferably comprised of a screw-type adjustment system.

Said flanging means of the sliding part are preferably comprised of a blade holder with means to house and fasten the pre-flanging and final flanging blades, preferably manufactured with CAM systems, their work area having a shape in accordance with the contour of the final piece. Said pre-flanging blades have shapes suitable to carry out the pre-flanging operation of a flanging angle higher than 90º.

Optionally, said pre-flanging and final flanging blades are complemented, for the corner areas of the outside and inside panels, by means of detachable elements suitable to be connected to the corresponding blade in a straight flanging area.

Optionally, the loading process of the outside panel and of the inside panel can be done together, arranging both pieces together by means of some connecting system, such as, preferably welding, after preparation of flanges, etc.

More concretely, the structure of the modular tabletop system for connecting metal pieces by flanging, object of the present invention can consist of a preferably mechanowelded structure, that is comprised of structural tube of several rectangular sections, upon which the machine assembly is mounted, forming in this way the skeleton of the same. Said structure additionally has means for fastening to the floor, preferably comprised of stiffened legs that are connected together, preferably by means of a plate.

The table of the modular tabletop system for connecting metal pieces by flanging, object of the invention is preferably comprised of a plate with fastening means of the remaining elements comprising the system object of the present invention, preferably, such as, some suitable centering devices to ensure placement of the cradle in coordinates, fastening means of the cradle itself, preferably comprised of screws, as well as supports of the flanging units, of the treader and of the supports of the centering device suitable to place said treader in coordinates.

Additionally, the table can have two mechanical stops for the flanging operation, such as one for the pre-flanging stage, and another one for the final flanging stage, placed on said plate of the table, for the purpose of acting as slide stroke finishing devices of the flanging units that the modular tabletop system object of the present invention has, ensuring in this way that said stroke always ends in the same place, and, consequently, in the same position, ensuring the quality of the final flanging upon always managing to repeat the thickness of the package comprised of the folded flange of the outside panel, the inside panel and the outside panel, acting in turn as a control system of the structural adhesive-mastic deposition, preventing the flow thereof towards the outside of the piece.

The cradle of the modular tabletop system for connecting metal pieces by flanging, object of the present invention, can consist of that part of the machine on which the outside panel sits along with the inside panel, and is comprised of means for fastening to the table, preferably made of screws, of means for reference on said table, preferably comprised of the respective centering devices of said table, as well as centering means to ensure the position in coordinates of the outside panel. The surface of said cradle, that serves as a support of said outside panel, reproduces the exact shape of the piece to be flanged, and is preferably manufactured by computer assisted manufacturing systems. (CAM systems)

The treader of the modular tabletop system for connecting metal pieces by flanging, object of the present invention consists of that part of the machine that ensures the relative positioning of the inside panel with the outside panel, and can be made of a mechanowelded structure with means for fastening to said table, preferably consisting of structural diagonal portal-shape or throat tube columns, guide means of said treader, preferably consisting of rectified columns that preferably slide on bushings preferably made out of bronze with graphite inserts, and operating means of said treader, preferably consisting of a hydraulic cylinder.

The reference of the inside panel with respect to the outside panel is preferably done by means of two centering devices included in the treader frame.

Contact of the pieces to be flanged is preferably done indirectly by means of hard resin blocks that reproduce the shape of the contact areas.

Additionally or optionally, said treader has a preferably hydraulic blocking safety system in said guide means, suitable for blocking these means in the event of free fall of the treader on any point of its stroke.

Additionally or optionally, the modular tabletop system for connecting metal pieces by flanging, object of the present invention is complemented with a series of auxiliary subsystems such as a hydraulic unit and an electric connection box.

More specifically, the hydraulic unit is responsible for supplying the equipment (hydraulic cylinders) operators with flowing oil and enough pressure to manage to carry out the necessary movements with the required speed and force.

On their part, the electric connection boxes preferably installed upon the structure of the machine, connect the electric elements of the machine with the outside power supply and with the outside relay control.

From all that which has been described above, the advantages provided by the modular tabletop system for connecting metal pieces by flanging, object of the present invention, are easily inferred. Hence, this equipment, classified within modular tabletop systems provide important advantages over conventional fixed or

movable table systems, that imply a heavy large volume structure, reaching some parameters of a reduction of space in plant of up to 20% and a reduction of weight up to 50%.

Likewise, the presence of said mechanical pre-flanging and final flanging stops ensure the quality of the final flanging upon managing to always repeat the thickness of the package comprised of the flange of the folded outside panel, the inside panel and the outside panel, likewise acting as a control system of the structural adhesive-mastic deposition, preventing the flow thereof towards the outside of the piece.

The fastening means of the different structural elements comprising the modular tabletop system for connecting metal pieces by flanging, object of the present invention allow the independence of the plate of the table, the cradle and the flanging units, permitting their independent assembly and disassembly, while their physical arrangement allows said elements to be removed by releasing the described connecting and fastening means, facilitating the tasks of independent assembly, maintenance and repair.

This final aspect is reinforced by the modular nature of the elements within their standard definition, allowing their rapid and safe interchangeability, even in production, consequently reducing the production costs.

The existence of a mechanical stop of each table flanging unit for the pre-flanging and final flanging operations preferably comprised of a steel rivet-dolly, allows the rotation axis of the flanging unit to rest, increasing in this way the life of said axis, as well as the reliability of the machine.

The easy disassembly of the hydraulic flanging cylinder, due to the design of the pieces of the flanging unit with regard to said hydraulic flanging cylinder, allows the easy disassembly and removal thereof, facilitating in this way the assembly of the different flanging units of the machine.

The design and modular nature of the blade holder facilitates the mechanization and the assembly of the pre-flanging and final flanging blades, as well as the adjustment of the flanging operations, likewise allowing simple assembly and disassembly, which avoids the need to carry out new adjustments after possible repairs of the blades that it contains.

Likewise, the design of the pre-flanging blades makes it possible to attack the flanges at more than 90º of slant with regard to the outside panel, with the subsequent saving, in some cases, of flange preparation operations.

Likewise, the tipping tendency of the flange unit that comes about with the shape of the modular tabletop system for connecting metal pieces by flanging, object of present invention, is noteworthy. The decomposition of the force that is transmitted upon the sheet upon carrying out the flanging operations vertically and horizontally, makes the tendency of the flanging unit tip over towards the center of the machine, and not run out. The decomposition of the force is done by taking as the origin of said decomposition the contact position between the final flanging blade located upon the blade holder and the cradle, considering the vertical component as the one that extends from said point towards the tipping shaft, in such a way that the horizontal component of the force is always towards the center of the machine.

This is achieved by the suitable location of the rotation axis and the thrust line of the hydraulic flanging cylinder with respect to the point of origin of applying the force.

In order to better understand the object of the present invention, hereinafter a preferred practical embodiment of the modular tabletop system for connecting metal pieces by flanging, based on the attached figures, is described. Said figures show:

Figures 1a and 1b are a section view of the folding operation of the flange of the contour of one sheet upon the edge of another sheet by plastic mechanical deformation with the adhesive.

Figure 2 is a raised view of tabletop machine for connecting metal pieces by flanging.

Figures 3a, 3b and 3c show, respectively, a raised view, a plan view and a detail of the practical embodiment of the pre-flanging and final flanging system object of the present invention.

Figure 3d shows a view similar to the one of figure 3b, but with some details shown more clearly.

Figures 4a and 4b show, respectively, a plan view and a detail of the practical embodiment of the modular tabletop system for connecting metal pieces by flanging, object of the present invention, representing the supports of the centering devices, the hydraulic unit and the electric connection box.

Figure 5 shows a raised view of the mechanical stops upon the pre-flanging and final flanging table.

Figure 6 shows a raised view of the table, cradle and of the flanging units, representing the independence of their easy assembly and disassembly.

Figure 7 shows a raised view of the columns of the treader and of the hydraulic blocking.

Figure 8 shows a section view of the tipping shaft and of the rivet-dolly.

Figures 9a and 9b show views of the removal of the cylinder from the flanging unit.

Figures 10a and 10b show a view of the flanging unit.

Figure 11 is a view of the hydraulic tipping unit.

Figure 12 is a representation of the system of forces between the tipping axis, the blade holder and the cradle.

Figures 13a and 13b are, respectively, a plan view and a raised view of the pre-flanging and final flanging blades.

Figures 14a, 14b, 14c and 14d are a series of sectioned views of the pre-flanging and final flanging operations, for the case of a flange with an initial slant higher than 90º.

Figure 15 is a view of the location of the detachable element between the blades in the corner areas.

Figures 16a, 16b and 16c are sectioned views of the operations in the execution of the edge of the finished piece, with a thickness greater than the flanged sheets together.

Figure 17 is a raised view of a flanging unit wherein the sliding part is made up of two interconnected pieces.

The reference numerals used in the following description and claims are defined as follows:

1 - outside panel
2 - inside panel
3 - cradle
4 - tipping cylinder
5 - cylinder
6 - structure
7 - legs
8 - plate
9 - table
10 - centering elements
11 - tipping shaft
12 - columns
13 - centering devices
14 - mechanical stop
15 - mechanical stop
16 - centering means
17 - centering devices
18 - treader
19 - guide columns
20 - bushings
21 - cylinder
22 - blocks
23 - safety blocking system
24 - flanging unit

24A - right-hand flanging means
24B - left-hand flanging means

25 - tipping part
26 - guides
27 - strips
28 - rod
29 - mechanical stop (rivet-dolly)
30 - tipping shaft
31 - sliding part

31a - lower or first piece of the sliding part
31b - upper or second piece of the sliding part
31c - top of first piece of the sliding part
31d - base of second piece of the sliding part

32 - sleeve
33 - seat
34 - adjustment screw
35 - blade holder
36 - nut
37 - pre-flanging blade
38 - final flanging blade
39 - detachable element
40 - blade
41 - hydraulic unit
42 - connection box
51 - adhesive
60 - screw
61 - bolt

Just as it is represented in the attached figures, particularly in figure 2, the modular tabletop system for connecting metal pieces by flanging, object of the present invention generically consists of a system that is comprised of a structure (6), a table (9), a cradle (3), a treader (18), as well as flanging units (24), in which a sheet or outside panel (1) rests in a fixed manner on a cradle (3), whose support surface reproduces the shape of said outside panel (1), proceeding with the loading of another sheet or inside panel (2) upon said outside panel (1), then proceeding with the flanging operation by means of the combination of movements of the flanging units (24).

Figures 1a and 1b schematically show in more detail the flanging operation, understood as the folding operation of the flange of the contour of a sheet or outside panel (1) upon the edge of another sheet or inside panel (2) by plastic mechanical deformation, in such a way that the inside panel (2) remains collected on the outside panel (1) and connected to it entirely or partially on its outside and/or inside perimeter. Said flanging operation is separated into two stages such as, a first folding of the flange called pre-flanging (see figure la), that folds the flange from its original position (1.1), drawn with dash lines in figure la, up to a intermediate position (1.2), and a second and final folding, called final flanging (figure 1b), that folds the flange from the final position (1.2) of the pre-flanging stage, shown in dash lines in figure 1b, until its final position (1.3). To carry out the flanging, a structural mastic-adhesive (51) is deposited, preventing the its flow towards the outside of the piece.

Optionally, the loading process of the outside panel (1) and of the inside panel (2) can be done together, placing both pieces together by means of some connecting system, such as, preferably, welding, after preparing the flanges, etc.

More specifically, and just as it is represented in figures 2 and 6, the structure of the practical embodiment of the modular tabletop system for connecting metal pieces by flanging, object of present invention consists of a preferably mechanowelded structure (6), that consists of a structural tube of several rectangular sections, upon which the machine assembly is mounted, forming in this way the skeleton of the same. Said structure has legs (7) for fastening to the ground, that are stiffened and connected to each other by means of a plate (8).

According to that which is particularly represented in figures 2 and 6, the table (9) of the present practical embodiment of the modular tabletop system for con-

necting metal pieces by flanging, object of the present invention is comprised of a plate (8) with fastening means of the remaining elements comprising the system object of the present invention, such as, preferably, some centering elements (10) suitable to ensure the placement of the cradle (3) in coordinates, fastening means of the cradle itself, preferably comprised of screws, as well as supports of the flanging units (24), of the treader (18) and of the supports of the suitable centering devices (13) (cf. figure 4a) to place said treader (18) in coordinates.

Additionally, just as it is represented in figure 5, the table has two mechanical stops (14, 15) for the flanging operation, such as one for the pre-flanging stage (14) and the other one for the final flanging stage (15), placed upon said plate (8) of the table (9), for the purpose of acting as slide stroke finishing devices of the flanging units (24) that the modular tabletop system for connecting metal pieces by flanging, object of present invention, has, ensuring in this way that said stroke always ends in the same place, and, consequently, in the same position, assuring the quality of the final flanging upon managing to always repeat the thickness of the package comprised of the folded flange of the outside panel, the inside panel (2) and the outside panel (1), acting in turn as a control system of the structural adhesive-mastic deposition (51), preventing the flow thereof towards the outside of the piece.

Just as it is represented in figures 2 and 6, the cradle (3) of the present practical embodiment of the modular tabletop system for connecting metal pieces by flanging, object of the present invention consists of that part of the machine upon which the outside panel (1) sits along with the inside panel (2) comprised of means for fastening to the table, preferably comprised of screws, means for reference on said table, preferably comprised of respective centering devices (10) of said table (9), as well as centering means (16) to ensure the position in coordinates of the outside panel (1). The surface of said cradle (3), that services as a support of said outside panel (1), reproduces the exact shape of the piece to be flanged and is preferably manufactured by computer assisted manufacturing systems (CAM systems.)

The treader (18) of the present practical embodiment modular tabletop system for connecting metal pieces by flanging, object of the present invention consists of, just as it is basically represented in figure 2, that part of the machine that ensures the relative positioning of the inside panel (2) with the outside panel (1), by means of two centering devices (17) included in the frame of the treader (18), and is comprised of a mechanowelded structure with means for fastening to said table (9), consisting of structural diagonal portal-shape or throat tube columns (12), guide means of said treader, consisting of rectified columns (19) that preferably slide over bronze bushings with graphite inserts (20), and operating means of said treader, consisting of a hydraulic cylinder (21). The physical contact with the pieces to be flanged is carried out by means of hard resin blocks (22) that reproduce the shape of the contact areas.

Additionally or optionally, said treader has, just as it is represented in figure 7, a hydraulic safety blocking system (23) in said guide means (19) that carries out the blocking of these guide means in the case of free fall of the treader (18) in any point of its stroke.

The flanging units (24), schematically represented in figures 3a, 3b, 3c, 5, 6, 8, 9a, 9b 10a, 10b, 11, 12, 13a, 13b and 17 of the preferred practical embodiment of modular tabletop system for connecting metal pieces by flanging, object of the present invention, consist of replaceable and interchangeable modular movable elements, each one of them having operating means preferably comprised of two hydraulic cylinders, the first one a hydraulic tipping cylinder (4), suitable to carry out the approach and withdrawal of the flanging unit to the work area, the second one a hydraulic flanging cylinder (5), suitable to carry out the movements to execute the pre-flanging and final flanging operations.

Each flanging unit is preferably comprised of a part linked to the table (9), or tipping part (25) and of another part linked to the front, or sliding part (31) of the flanging unit (24).

Said tipping part (25) is comprised of a group of supports (11) of the tipping shaft. The symmetric bronze guides with graphite inserts (26) are anchored in said tipping part. The symmetric tempered and ground steel strips (27) anchored to the sliding part (31) of the flanging unit (24), will slide over the guides to the right and to the left of the flanging unit (24). This tipping part (25) is connected to the hydraulic tipping cylinder (4) by means of a system of rods (28). Likewise, a steel rivet-dolly (29) that acts as a mechanical stop against the table (9) when the pre-flanging and final flanging operations are being carried out, is also anchored to this part of the unit. The force that the rivet-dolly receives allows the tipping shaft (30) not to receive any force when the pre-flanging and final flanging are taking place, increasing in this way the life of the shaft, and, therefor, of reliability of the machine.

The tipping part (25) has position adjustment means preferably comprised of a fine pitch nut (36) in the rod (28) transmitting said tipping movement.

The sliding part (31) is connected to the tipping part (25) by means of the hydraulic flanging cylinder (5). The rod of the tipping cylinder (4) is anchored to the tipping part (25) and the sleeve (32) of the hydraulic flanging cylinder (5) is anchored to the sliding part (31). The sliding part (31) slides with regard to said tipping part (25) by means of the previously described guide system. This cylinder is easy to remove thanks to the play and to the seat (33) placed in this part of the flanging unit (24).

Said sliding means of the sliding part with regard to the tipping part are preferably comprised of symmetric tempered and ground steel strips (27) of each flanging unit (24) upon the bronze guides with graphite inserts

(26), that have means for anchoring to the sliding part of the flanging unit, as well as means for the parallel sliding between them comprised of a screw-type adjustment system (34), that pushes the cited strips (27) at will.

Figure 12 represents the tipping tendency of the flanging unit due to the shape of the modular tabletop system for connecting metal pieces by flanging, object of the present invention. The decomposition of the force (F) that is transmitted to the sheet upon carrying out the flanging operations horizontally (F_1) and vertically (F_2), makes the tendency of the flanging unit tip towards the center of the machine and not run out, taking as the origin of the decomposition the position of contact between the final flanging blade (38) located upon the blade holder (35) and the cradle (3). The vertical component (F_2) is defined as the one that extends from said point of direction towards the tipping shaft (30), in such a way that the horizontal component (F_1) of the force is always towards the center of the machine. Said tipping tendency towards the center of the machine is achieved by the suitable position of the rotation axis and the thrust line of the hydraulic flanging cylinder with regard to the point of origin applying the force.

Figures 13a and 13b show the flanging means of the sliding part (31) that are preferably comprised of a blade holder (35) with means to house and fasten the pre-flanging (37) and final flanging (38) blades, preferably manufactured by CAM systems, having in their work area a shape in accordance with the figure of the contour of the final piece. Said pre-flanging blades have shapes suitable to carry out the pre-flanging operation of an angle higher than 90º.

Optionally, said pre-flanging and final flanging blades are complemented, for the corner areas of the outside (1) and inside (2) panels, by means of detachable elements (39) suitable to be connected to the corresponding blade (40) adjacent in a straight flanging area (cf. figure 15).

Additionally or optionally, the modular tabletop system for connecting metal pieces by flanging, object of the present invention is complemented with a series of auxiliary subsystems such as a hydraulic unit (41) and an electric connection box (42) (cf. figures 4a and 4b).

More specifically, the hydraulic unit (41) is responsible for supplying the equipment (hydraulic cylinders) operators with flowing oil and enough pressure to manage to carry out the necessary movements with the required speed and force.

On their part, the electric connection boxes (42) preferably installed upon the structure of the machine, connect the electric elements of the machine with the outside power supply and with the outside relay control.

The sliding part of the flanging unit (24) can be made up by one single piece.

However, in order to make it easier to adjust the position of the blades, the sliding part can be made up by two separate parts or pieces, a lower of first piece (31a) and an upper or second piece (31b) to which the flanging means (including the blade holder (35)) are attached. The system includes means for joining the second piece to the first piece and means for modifying the position of the second piece (31b) with regard to the first piece (31a).

That is, the position of said second piece (31b) can be modified, in order to adjust the blades (37,38) with regard to the cradle (3).

The upper or second piece (31b) can, according to a preferred embodiment, include two different flanging means (24A, 24B) corresponding to two different shapes of the work-piece. The second piece is (31b) arranged such that it can be turned, for example, by 180°, in order to allow for the different shapes of the work-piece. Once a work-piece has been treated by flanging by the first flanging means (24A), the second piece (31b) can be turned by 180° in order to apply the second flanging means (24B); if necessary, the cradle can also be modified.

Figure 17 shows this embodiment schematically. According to the embodiment shown in this figure, the upper or second piece (31b) has a broad and flat base (31d) and the lower or first piece (31a) has a broad and flat top (31c). The connection between the first piece (31a) and the second piece (31b) can be carried out by means of attaching said base (31d) to said top (31c) by means of some anchoring screws and some centering pin elements or bolts (61), in a conventional manner that allows the second piece to be fixed in a desired position with regard to the plane of said top (31c).

The flanging units (24) function in the following manner:

First, the tipping part (25) is tipped to an "operating position" of the flanging unit (in the embodiments of the figures, the "operating position" is the vertical position of said tipping part (25)). During its way to said operating position, a first actuation of the flanging unit (24) on the flange of the outside panel (1) can occur, if said flange, in its original position, has a slant of more that 90º with regard to the surface of the outside panel (cf. figures 14a and 14b). During this initial phase or step, the sliding piece is positioned such that the pre-flanging blade (37) is in a suitable position in order to subsequently act on the flange.

Next, once the tipping part (25) has reached to "operating position" (cf. figure 14b), the sliding part is made to slide (downwards, in the embodiments illustrated in the drawings), such that the pre-flanging blade (37) will execute the pre-flanging of the flange of the sheet (cf. figures 14c and 16b).

Once the pre-flanging has been accomplished, the sliding part (31) is displaced (slid) towards a position in which the flanging unit can be tipped "outwards" from the operating position. Once the tipping part (25) has been tipped "outwards", the sliding part (31) is displaced such that the final flanging blade (38) will be in a suitable position in order to subsequently act on the flange of the

sheet.

Next, the tipping part (25) is again tipped to the "operating position" (the vertical position in the figures) and the sliding part is again displaced (slid), such that the final flanging blade (38) will act on the flange, whereby the final flanging is accomplished.

Thereafter, the tipping and sliding parts are moved to a suitable position in order to perform the next operation cycle.

Once the nature of the present invention has been adequately described, as well as the way to put it into practice, we need only add that to the whole and to the parts that comprise it is possible to introduce changes of shape, materials and arrangement, as long as said modifications do not substantially vary the features of the invention that are claimed hereinafter.

Claims

1. Modular tabletop system for connecting metal pieces by flanging, of the type that carries out a flanging operation separated into a first folding of the flange, called pre-flanging, and a second and final folding, called final flanging, suitable for sealing the flange of the outside panel over the inside panel, and which comprises a structure (6), a table (9), a cradle (3) suitable to support a sheet or outside panel (1), a treader (18) and flanging units (24);
   characterized in that

   at least one of the flanging units (24) is made up of a tipping part (25) arranged such that it can perform a tipping movement with regard to the cradle (3) or the table (9), and a sliding part (31) which is linked to the tipping part (25) such that it can perform a sliding movement with regard to said tipping part (25);
   in that
   it includes tipping means for tipping the tipping part (25), and sliding means for sliding the sliding part (31) with regard to the tipping part (25);
   and in that
   it includes flanging means associated with the sliding part (31).

2. System according to claim 1, wherein the flanging means include a blade holder (35) in which at least one pre-flanging blade (37) and at least one final flanging blade (38) are held.

3. System according to claim 1, wherein the sliding part (31) is made up of one single piece.

4. System according to claim 3, wherein the sliding part (31) is made up by a first piece (31a) and a second piece (31b), the flanging means being attached to said second piece (31b), and wherein the system includes means for joining the second piece (31b) to the first piece (31a) and means for modifying the position of the second piece (31b) with regard to the first piece (31a).

5. System according to claim 1, characterized in that said table (9) is comprised of a plate (8) with fastening means of the remaining elements constituting the system, preferably comprised of some centering devices (10) suitable to ensure the placement of said cradle in coordinates, fastening means of the cradle (3) itself, preferably comprised of screws, as well as supports of said flanging units (24), of said treader (18) and of the supports of said centering devices (13) suitable to place said treader in coordinates.

6. System according to claim 5, characterized in that said table has a first mechanical stop (14) for the pre-flanging operation and a second mechanical stop (15) for the final flanging operation, placed upon said plate of the table, suitable to act as finishing devices of the stroke of said flanging units (24).

7. System according to claim 1, characterized in that said cradle has means for fastening to said table, preferably comprised of screws, of means for reference on said table, preferably comprised of respective centering devices (10) of said table, as well as centering means (16) to ensure the position in coordinates of the outside panel.

8. System according to claim 7, characterized in that the surface of said cradle (3) reproduces the exact shape of the piece to be flanged.

9. System according to claim 1, characterized in that said treader (18) is comprised of a mechanowelded structure with means for fastening to said table (9), preferably comprised of structural diagonal portal-shape or throat tube columns (12), guide means of said treader (18), preferably consisting of rectified columns (19) that preferably slide over bushings (20) preferably made out of bronze with graphite inserts, and operating means of said treader, preferably comprised of a hydraulic cylinder (21).

10. System according to claim 9, characterized in that said treader (18) has a preferably hydraulic safety blocking system (23) in said guide means, suitable to block these means in the case of the free fall of said treader in any point of its stroke.

11. System according to claim 1, characterized in that each one of said flanging units (24) consists of replaceable and interchangeable modular movable elements, each one of them having operating means preferably comprised of two hydraulic cylin-

ders, the first one a hydraulic tipping cylinder (4), suitable to effect the approach and withdrawal of said flanging unit to the work area, the second one a hydraulic flanging cylinder (5), suitable to effect the movements to execute the pre-flanging and final flanging operations.

12. System according to claim 11, characterized in that each one of the flanging units is comprised of a part linked to said table, or tipping part (25), constituted by a group of supports of the tipping shaft (11), by anchoring to the rod of the flanging cylinder (5), means for connection to the hydraulic tipping cylinder (4), preferably by rods (28), and means for anchoring to a mechanical stop (29) in the table (9) during the operations of pre-flanging and final flanging, as well as means for regulating the guiding system of the sliding part (31), and of a part linked to the sliding part (31), with means for connection to the sleeve of the hydraulic flanging cylinder (5), sliding means with regard to the tipping part and flanging means for performing the flanging operations.

13. System according to claim 12, characterized in that said mechanical stop (29) of each flanging unit (24) on said table (9) for the pre-flanging and final flanging operations are preferably comprised of a steel rivet-dolly, suitable to allow the rotation axis of the flanging cylinder (5) to rest.

14. System according to claim 12, characterized in that said tipping part (25) has position adjustment means, preferably comprised of a fine pitch nut (36) in the rod (28) transmitting said tipping movement.

15. System according to claim 12, characterized in that said sliding means of the sliding part (31) with regard to the tipping part (25) are preferably comprised of symmetric tempered and ground steel strips (27) that have means for anchoring to said sliding part of the flanging unit, as well as means suitable to effect the parallelism between them preferably comprised of a system for adjustment by means of screws (34).

16. System according to claim 12, characterized in that said flanging means of the sliding part (31) are preferably comprised of a blade holder (35) with means to house and fasten the pre-flanging (37) and final flanging (38) blades, whose work area has a shape in accordance with the figure of the contour of the final piece.

17. System according to the preceding claim, characterized in that said pre-flanging blades (37) have shapes suitable to carry out the pre-flanging operation of at angle more than 90º.

18. System according to claim 12, characterized in that said pre-flanging (37) and final flanging (38) blades are complemented for the area of corners of the outside and inside panels, by means of detachable elements (39) suitable to be connected to the corresponding blade (40) in a straight flanging area.

19. System according to any of the above claims, characterized in that the fastening means of the inside panel (2) with regard to the outside panel (1) consist of two centering devices (17) included in the frame of the treader (18).

20. System according to any of the above claims, characterized in that the means of contact with the outside and inside panels consist of indirect contact means, preferably comprised of hard resin blocks (22), whose shape reproducers the contact areas.

21. System according to any of the above claims, characterized in that said system has an auxiliary subsystem consisting of a hydraulic unit (41) operating the machine, preferably comprised of a hydraulic unit that provides the hydraulic cylinders of the machine with pressurized oil.

22. System according to any of the above claims, characterized in that said system has an auxiliary system consisting of electric connection boxes (42) preferably installed on the structure (6) of the machine, suitable to connect the electric elements of the machine with the outside power supplies and with an outside relay control.

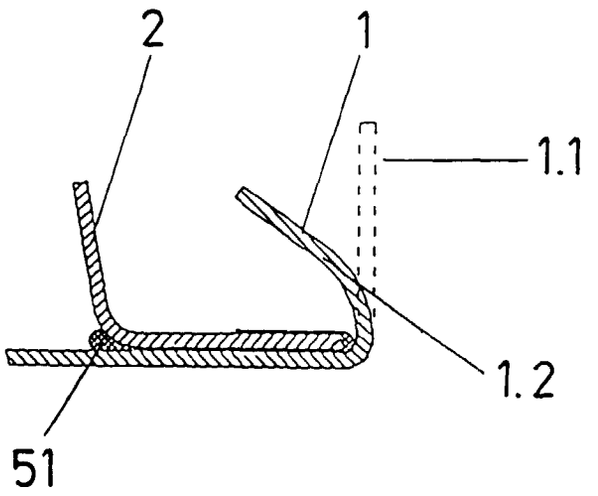

Fig. 1a

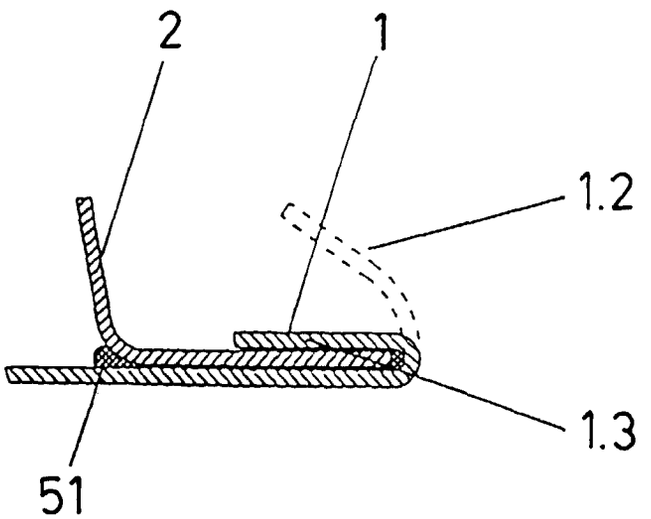

Fig. 1b

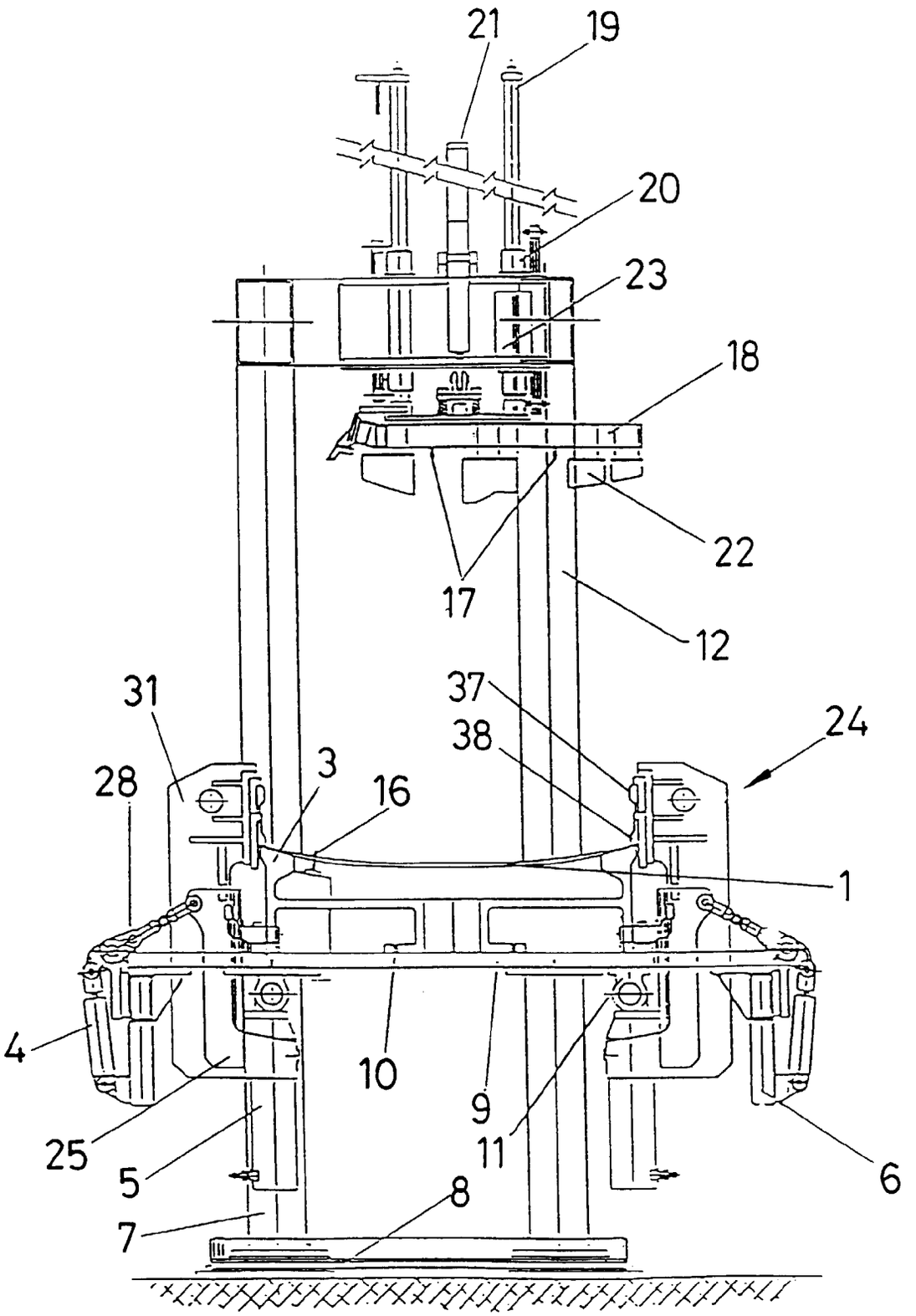

Fig. 2

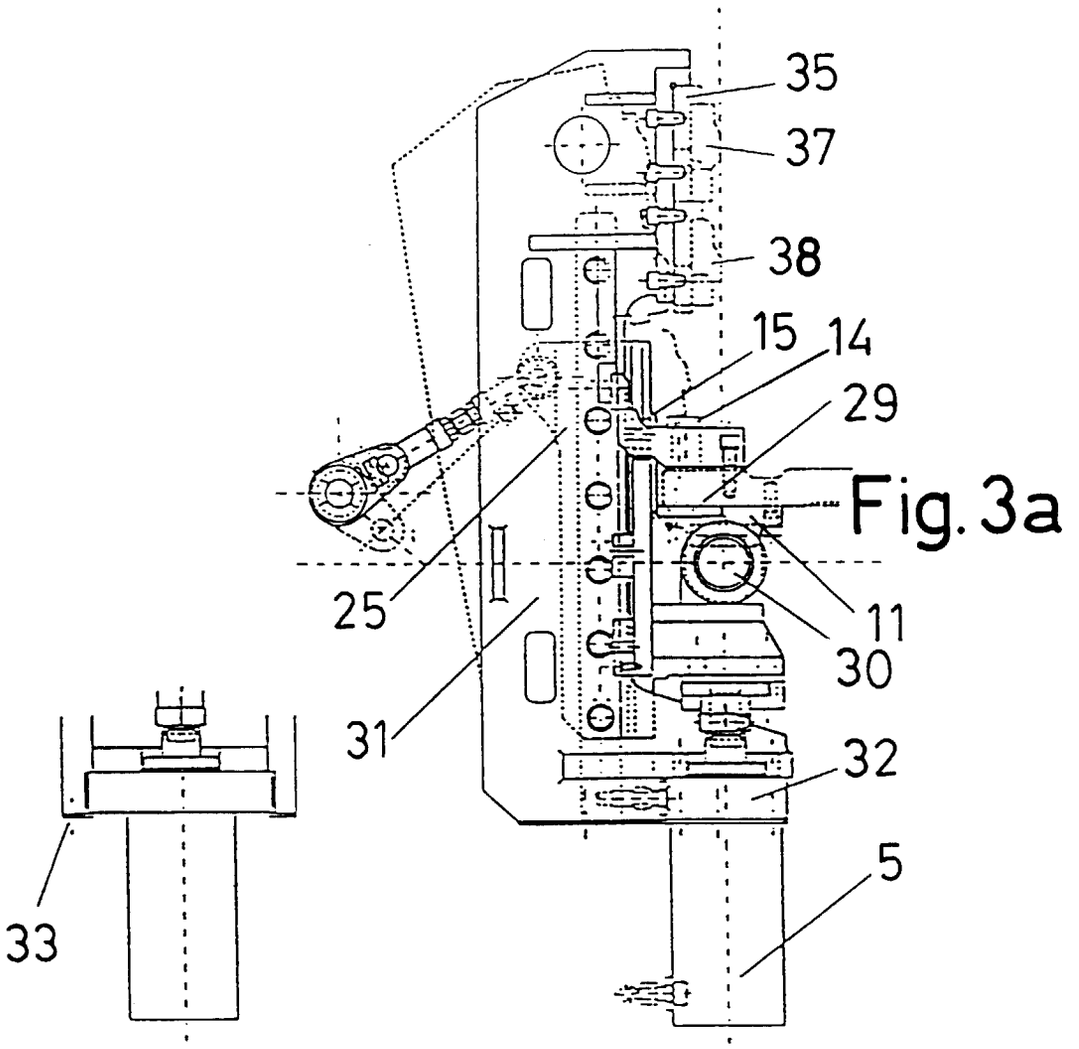

Fig. 3a

Fig. 3c

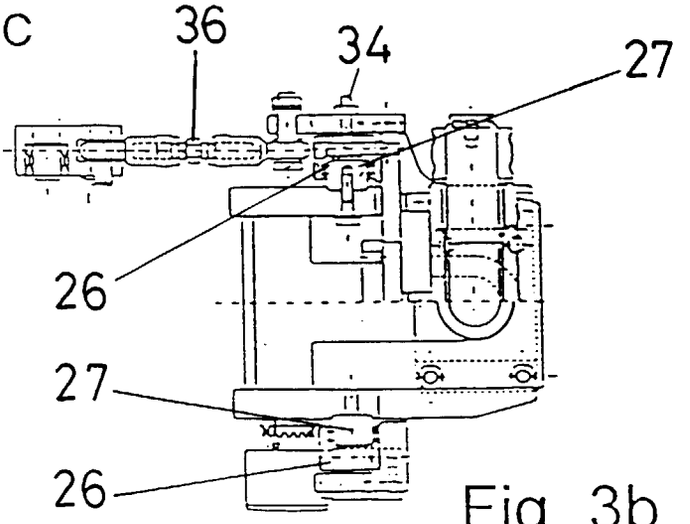

Fig. 3b

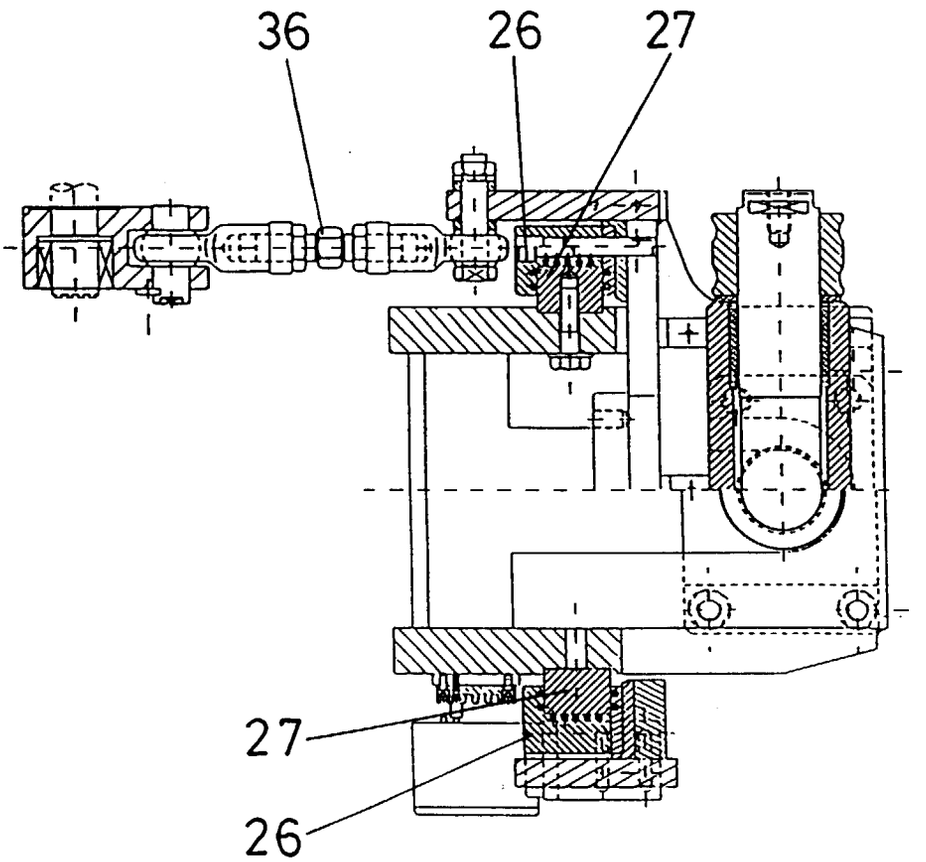

Fig. 3d

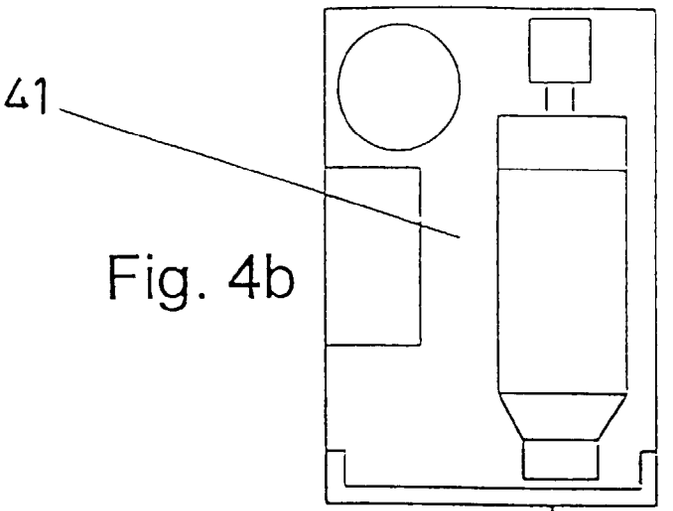

Fig. 4b

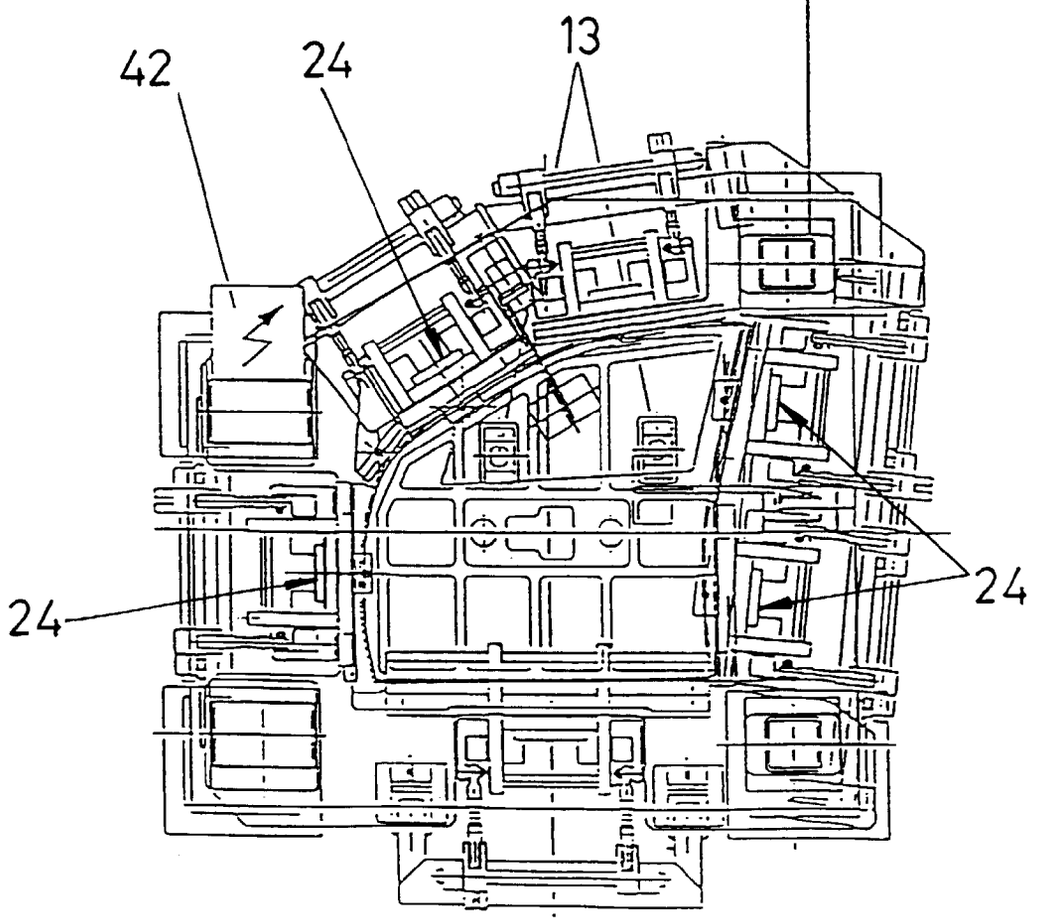

Fig. 4a

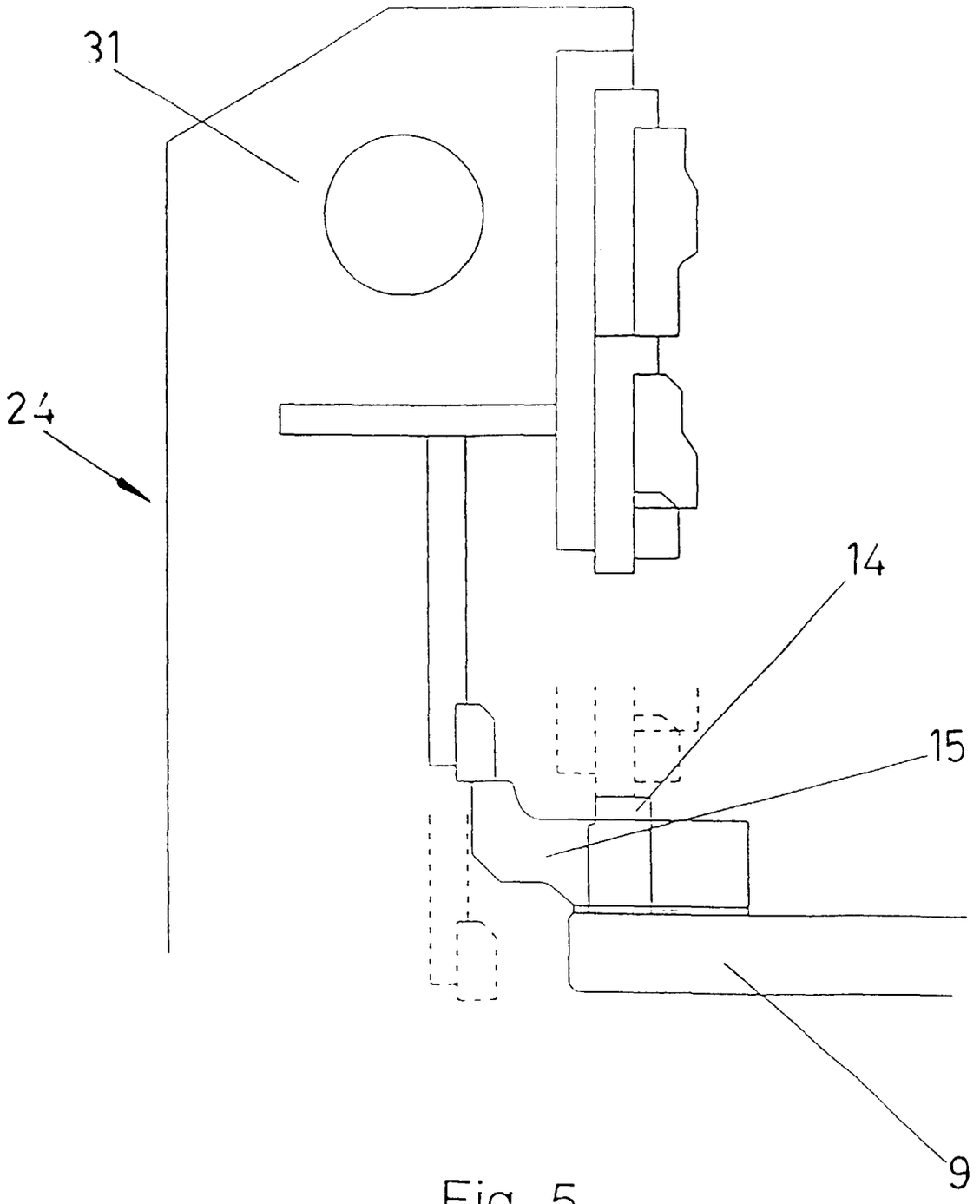

Fig. 5

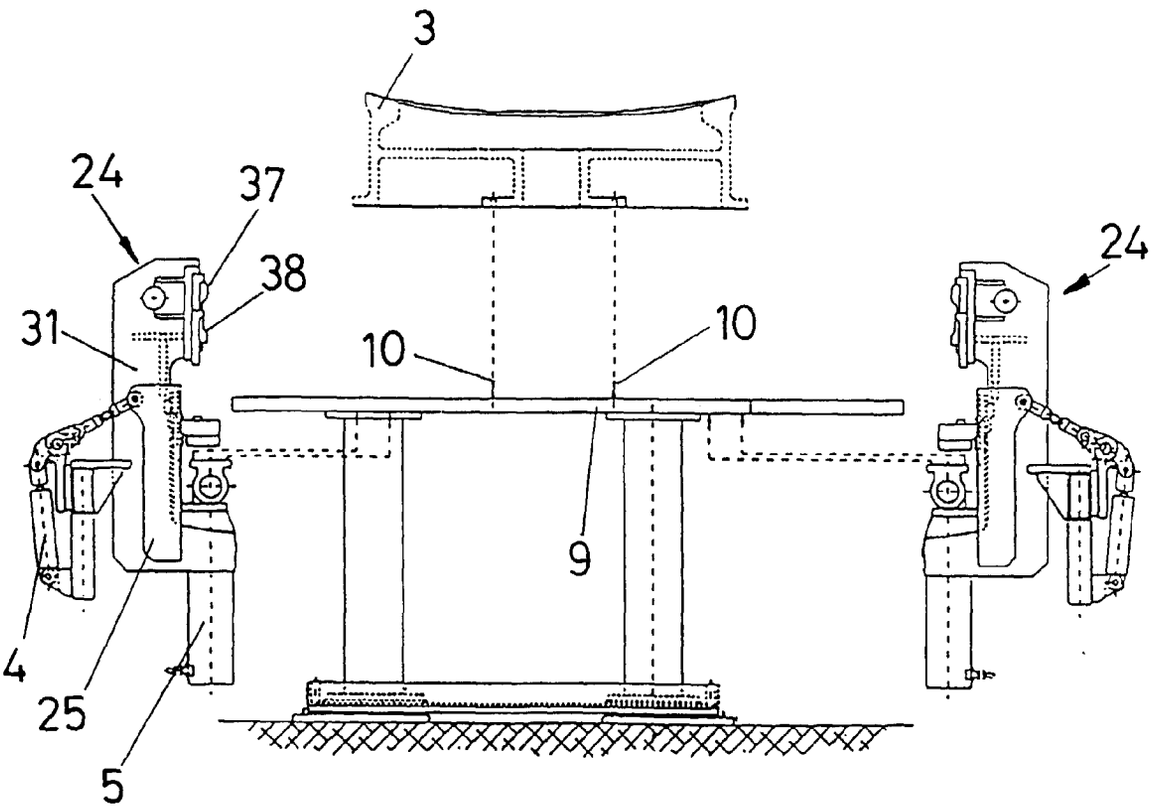

Fig. 6

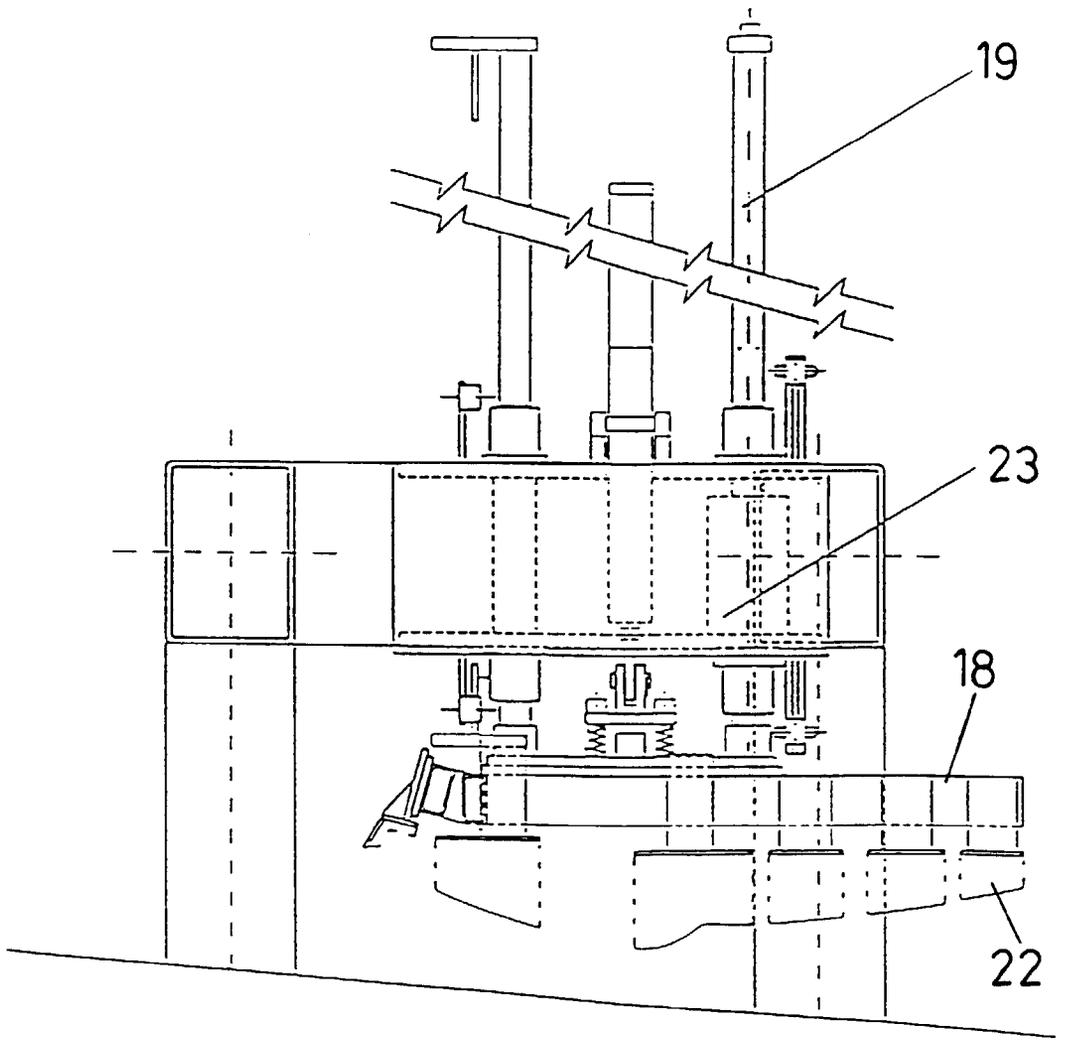

Fig. 7

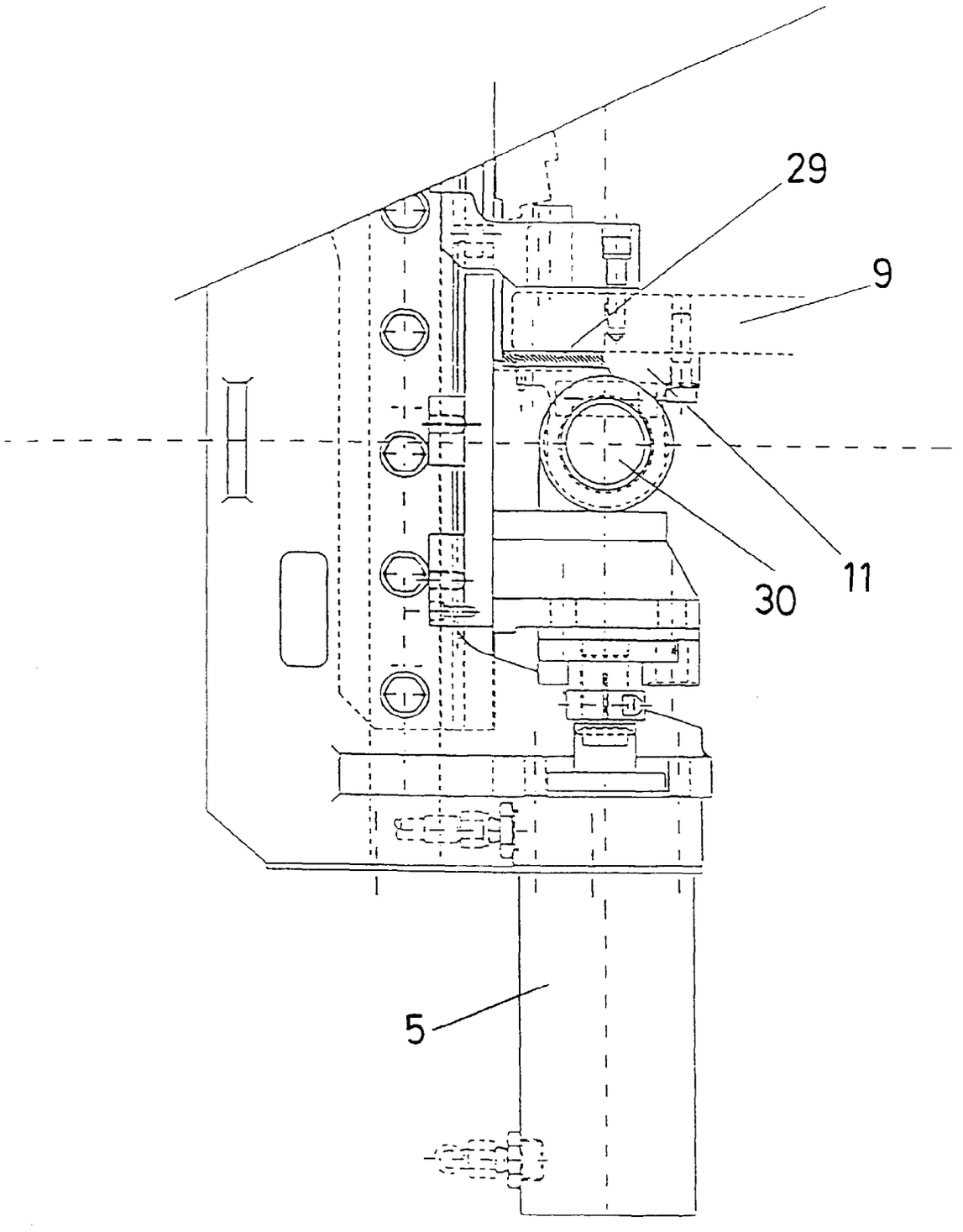

Fig. 8

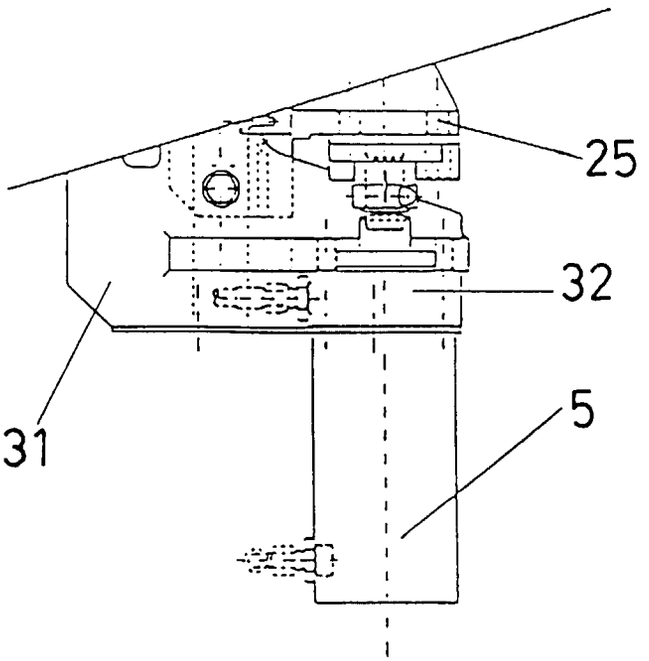

Fig. 9a

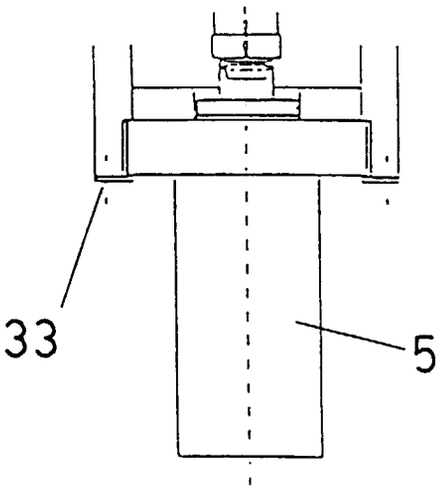

Fig. 9b

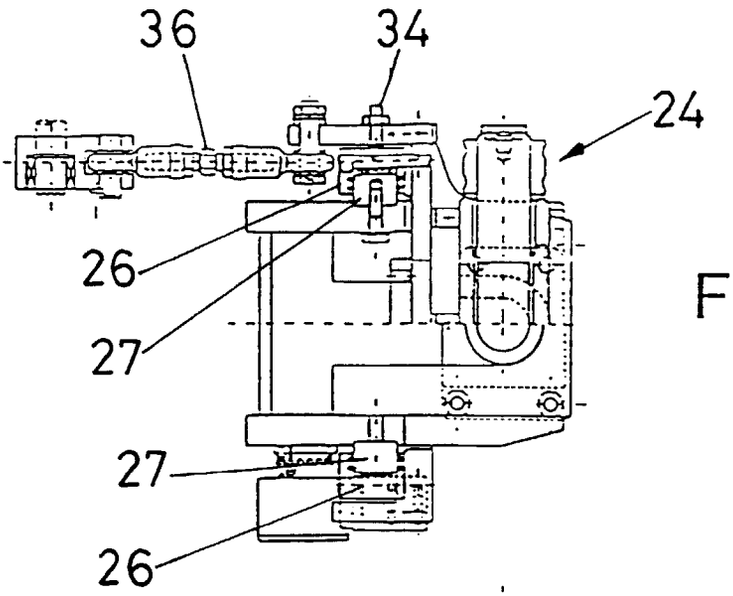

Fig. 10a

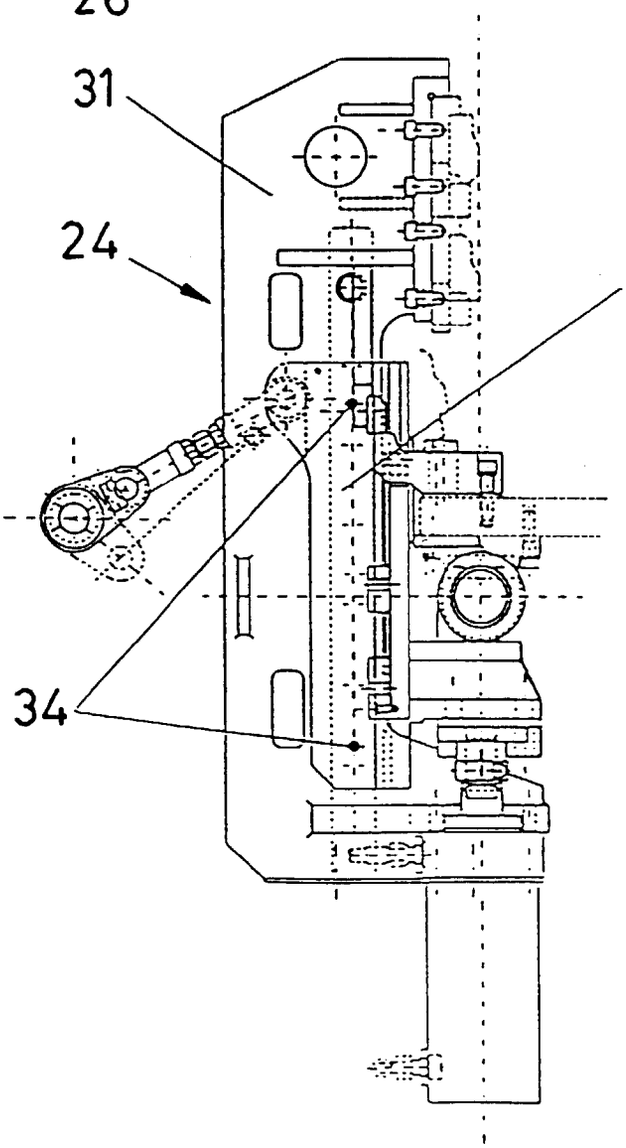

Fig. 10b

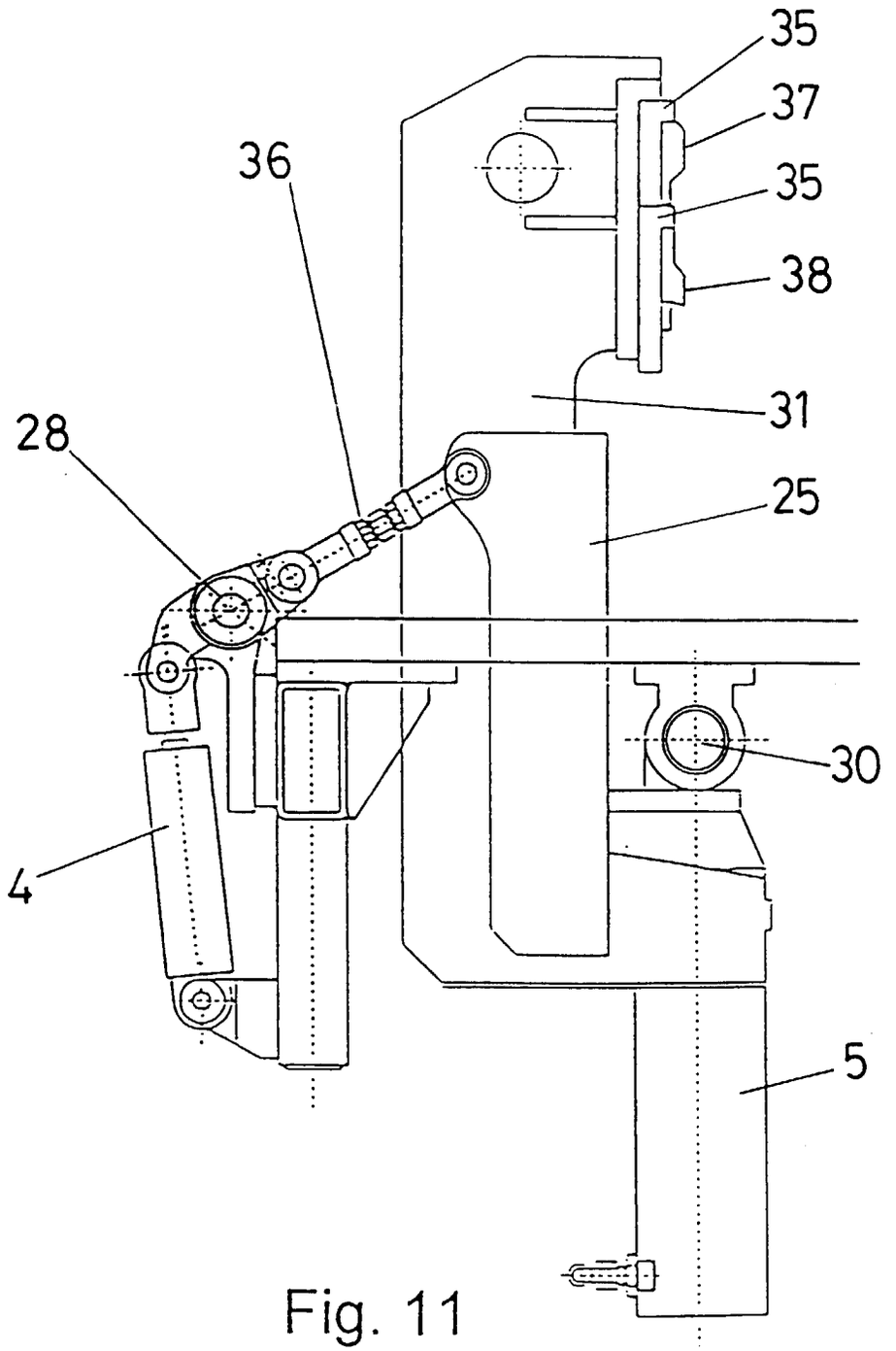

Fig. 11

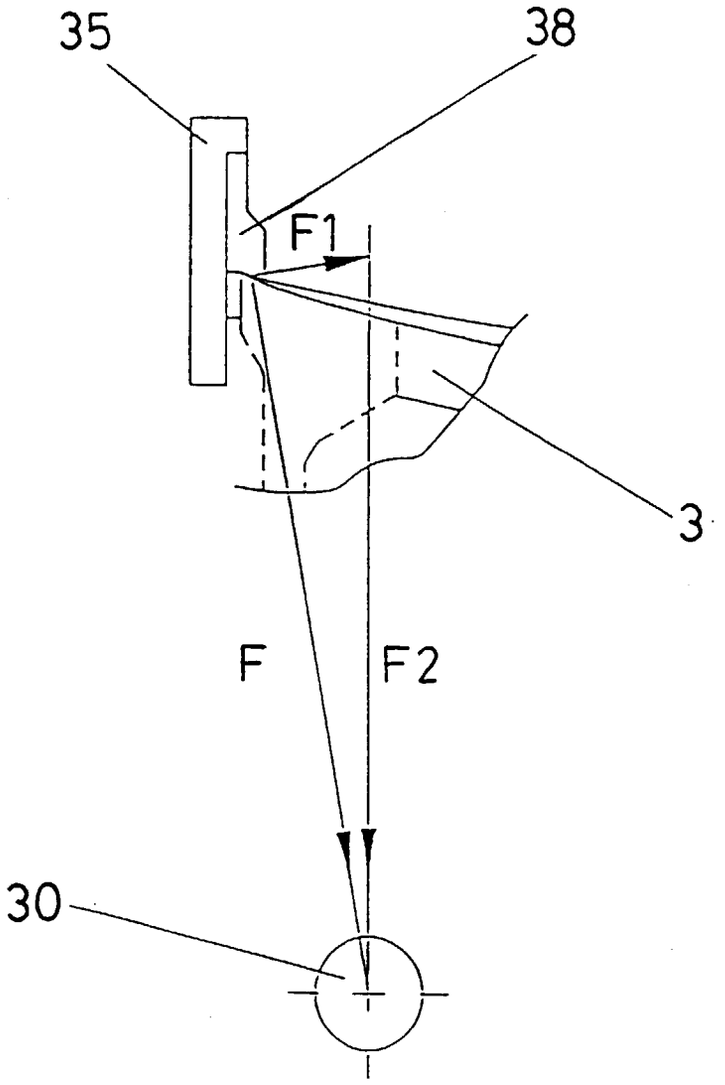

Fig. 12

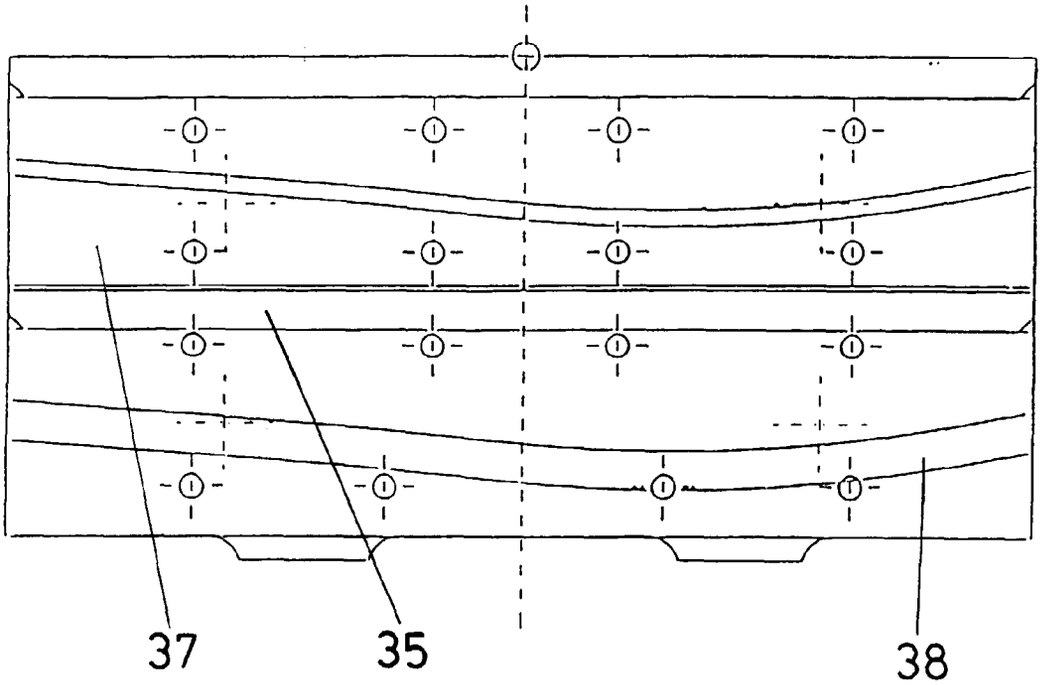

Fig. 13a

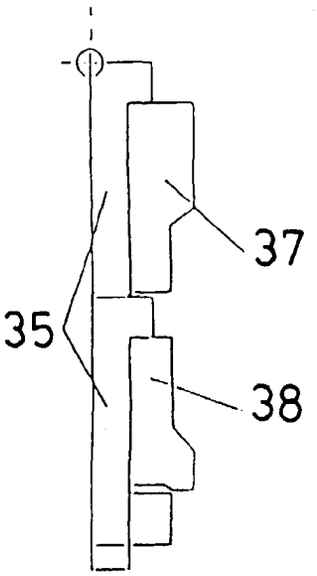

Fig. 13b

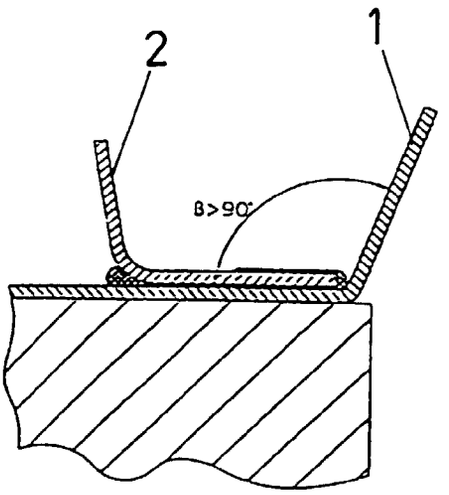

Fig. 14a

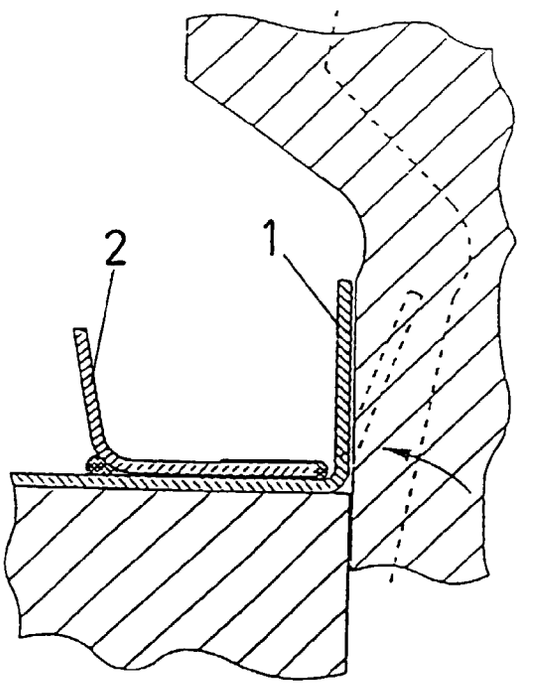

Fig. 14b

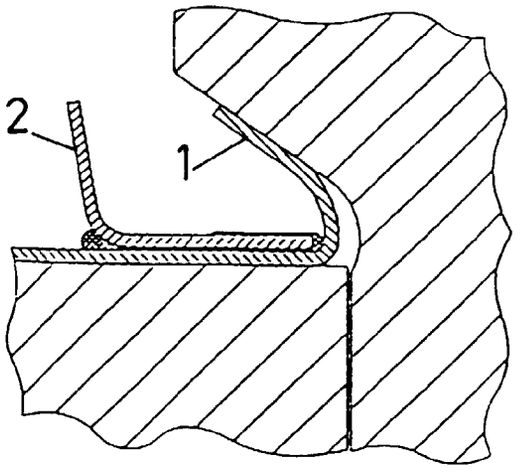

Fig. 14c

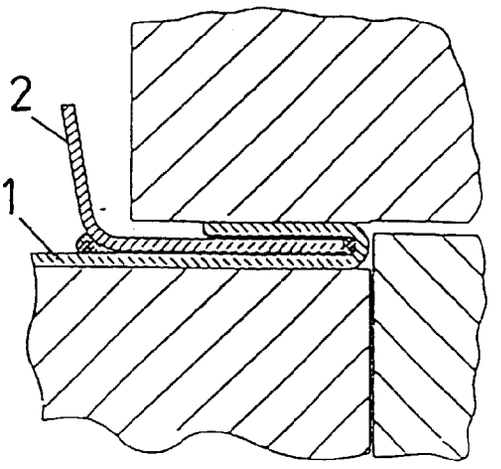

Fig. 14d

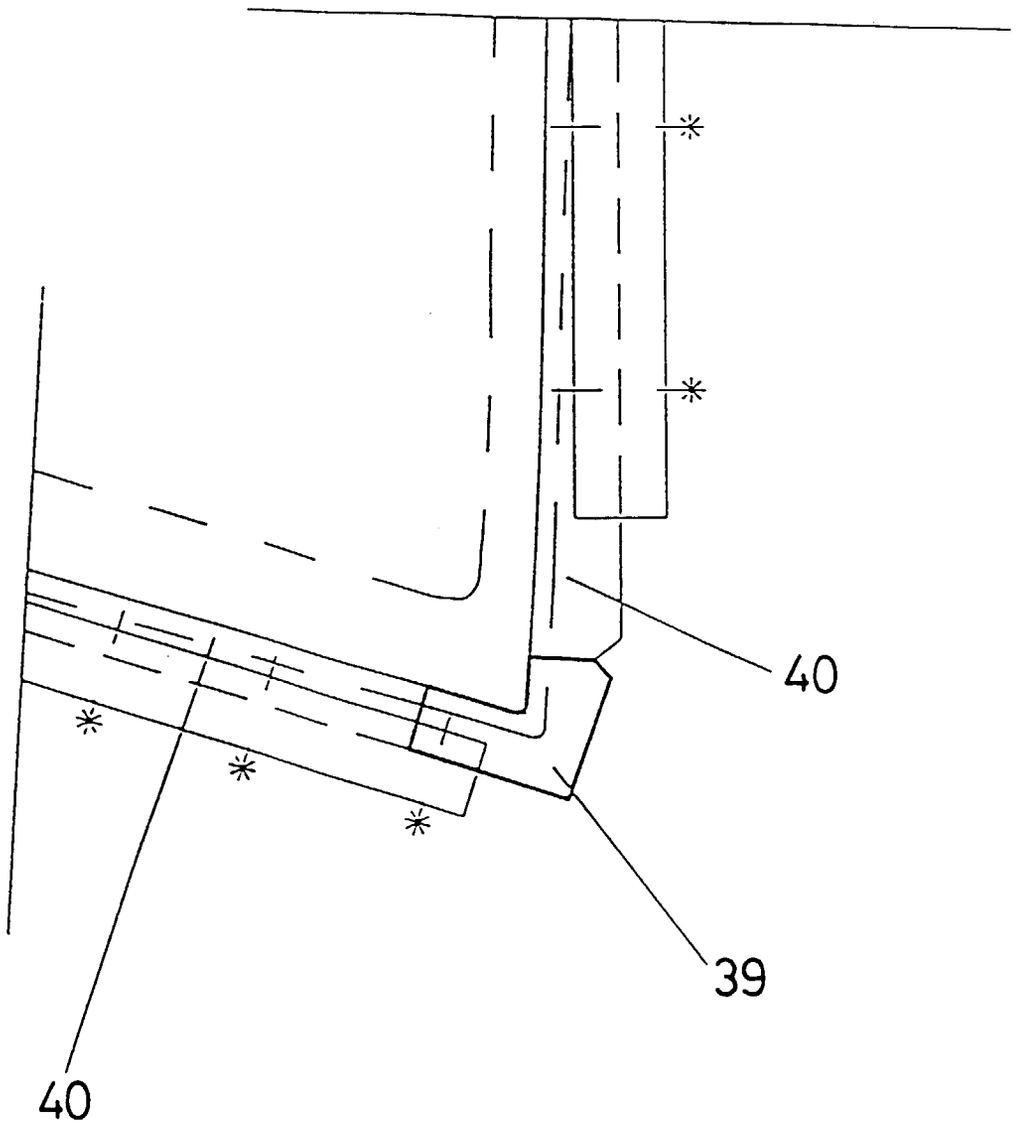

Fig. 15

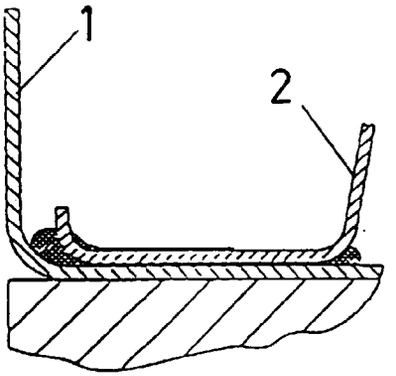

Fig. 16a

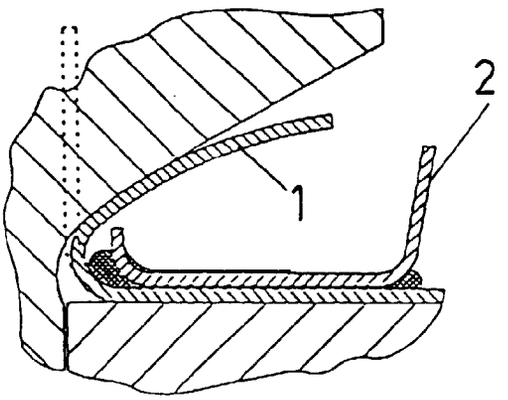

Fig. 16b

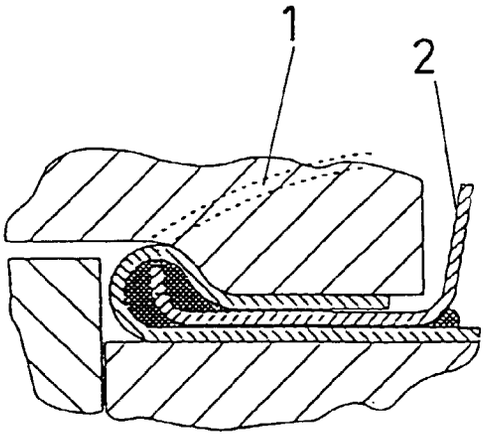

Fig. 16c

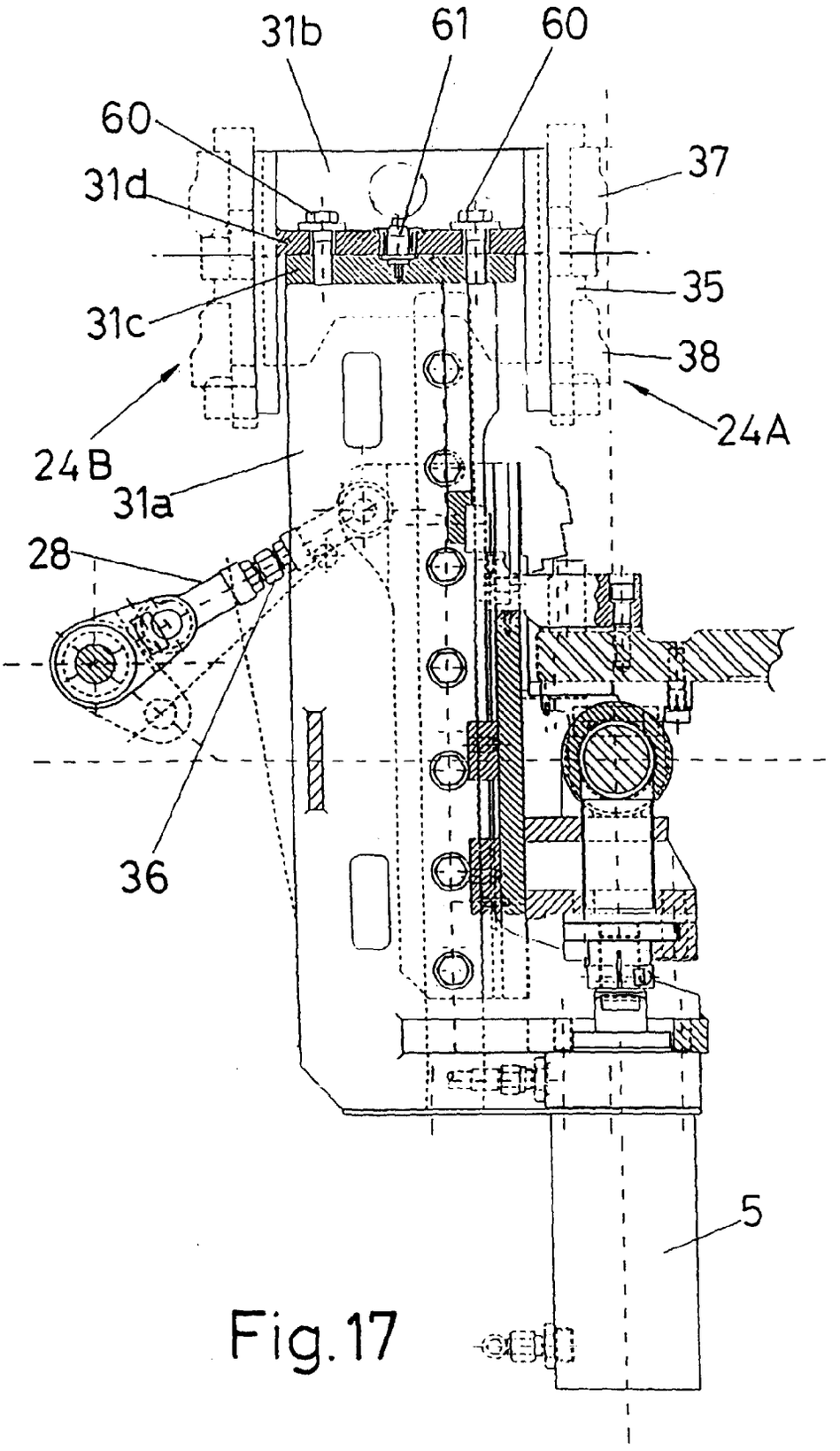

Fig.17

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 20 2294

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 3 130 770 A (TRIBE) 28 April 1964 * the whole document *	1	B21D39/02
A	US 1 961 582 A (EKSERGIAN) * the whole document *	1	
A	US 3 142 329 A (TRIBE)		
A	FR 2 651 699 A (STEELWELD FRANCE) 15 March 1991		
A	DE 14 52 618 A (WINDSOR) 10 April 1969		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 November 1997	Peeters, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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