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(54) **Panel-bending machine tool with improved movement of the sheet-pressing device and of the blade-holder device**

(57) Panel-bending machine (4) for processing sheets (12), comprising a support plane (8), at least one sheet-blocking device (28), at least one blade-holder device (32) fitted with blades (36) suitable to perform bending operations of said sheet (12). The panel-bending machine (4) comprises hydraulic and/or pneumatic operating devices (40) operatively connected both to the sheet-blocking device (28) and the blade-holder device (32). Said operating devices (40) comprise a single device body (42), an internal piston (43) operatively connected to the sheet-blocking device (28) and an external piston (44) operatively connected to the blade-holder device (32), the two pistons (43, 44) being independently operable.

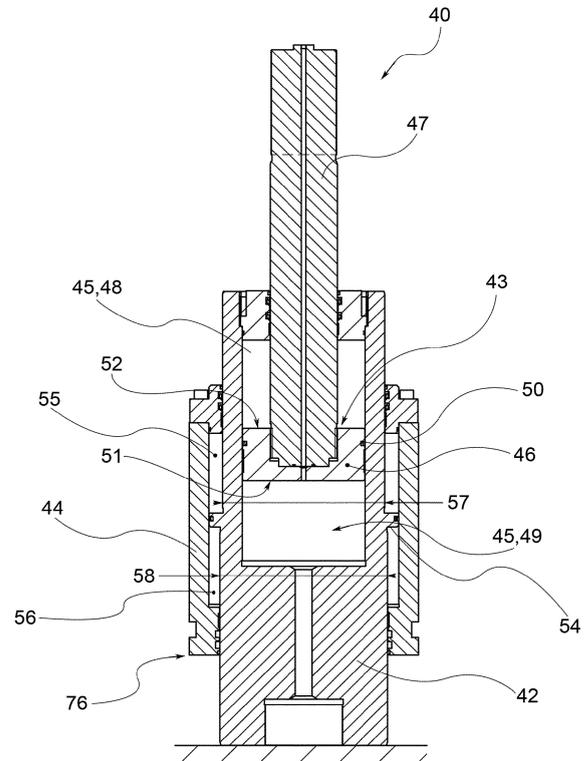


Fig. 5

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Description

[0001] The present invention relates to a panel-bending machine tool, suitable to perform mechanical bending of metal sheets.

[0002] In particular, the panel-bending machine tools, hereinafter panel-bending machines, are suitable to perform bending operations of metal sheets, having elevated axial extensions and reduced thicknesses.

[0003] Such panel-bending machines usually comprise a bench structure having a horizontal support shelf to support the sheet to be processed.

[0004] The sheet which a sheet-pressing device and blade-holder device act on is laid on said support shelf.

[0005] The sheet-pressing device is used to block the sheet firmly to the support shelf to prevent unwanted deformation of the same during the relative stages of bending.

[0006] The blade-holder device supports the blades, or in general tools of various forms, depending on the mechanical processing to be performed on said sheet, which are pressed against the sheet after this has been firmly blocked to the support plane.

[0007] The movement of the sheet-pressing and blade-holder devices must be synchronised so as to achieve accurate, fast and efficient processing.

[0008] In addition, the need is also felt to reduce the overall size and thereby production costs of the panel-bending machine.

[0009] In the prior art, to ensure the movement of the sheet-pressing and blade-holder devices, multiple mechanisms are required which make the panel-bending machine cumbersome and complicated.

[0010] The high costs of such panel-bending machine derive as a consequence of this.

[0011] The purpose of the present invention is to make a panel-bending machine which overcomes the drawbacks mentioned with reference to the prior art.

[0012] Such drawbacks and limitations are resolved by a panel-bending machine according to claim 1.

[0013] Other embodiments of the panel-bending machine tool according to the invention are described in the subsequent claims.

[0014] Further characteristics and advantages of the present invention will be more clearly comprehensible from the description given below of its preferred and non-limiting embodiments, wherein:

[0015] figure 1a shows a perspective view of a panel-bending machine according to one embodiment of the present invention;

[0016] figure 1b shows a side view of the panel-bending machine in figure 1a;

[0017] figures 2a-2b show enlarged views of the detail II in figure 1, in different operating conditions;

[0018] figure 3 shows a perspective view of the component III in figure 1a;

[0019] figure 4 shows a side view of the component in figure 3;

[0020] figure 5 shows a cross-section view of the component in figure 3, along the section plane V-V in figure 4;

[0021] figures 6-9 show cross-section views of the component in figure 3, in different functioning configurations, as described further below.

[0022] The elements or parts of elements common to the embodiments described below will be indicated using the same reference numerals.

[0023] With reference to the aforementioned figures, reference numeral 4 globally denotes a panel-bending machine tool, hereinafter panel-bending machine, suitable to perform bending of sheets, such as metal sheets using in the furnishing and household appliances sectors, and the like.

[0024] Such applications should be considered merely as examples and not as exhaustive.

[0025] In other words, the panel-bending machine according to the present invention may also be used to bend non-metal sheets, moreover the concept of sheet should be understood broadly, including for example elements having quite a squat shape, that is to say sheets of elevated thickness.

[0026] The panel-bending machine 4 comprises a support plane 8 able to support a sheet 12 during the various processing phases.

[0027] Preferably, the support plane 8 comprises a plurality of support beams 16 positioned alongside each other so as to form gaps 20 so as to permit the support of the sheet at least partially overhanging said gaps 20.

[0028] The panel-bending machine 4 further comprises an upright structure 24 which extends perpendicular to said support plane 8 so as to tower over said support plane at least partially overhanging it.

[0029] The panel-bending machine 4 comprises at least one sheet-blocking device 28 able to constrain the sheet 12 in relation to said support plane 8 during the processing phases of the sheet 12 and at least one blade-holder device 32 fitted with blades 36 suitable to perform bending operations of said sheet 12.

[0030] Preferably, the sheet-blocking device 28 and/or the blade-holder device 32 are mechanically constrained to the upright structure 24.

[0031] Advantageously, the panel-bending machine 4 comprises hydraulic and/or pneumatic operating devices 40 operatively connected both to the sheet-blocking device 28 and the blade-holder device 32. In particular, said hydraulic and/or pneumatic operating devices 40 comprise a single device body 42, fixed in relation to the upright structure 24, an internal piston 43 and an external piston 44 being operatively connected to such device body 42, as described further below.

[0032] Preferably, the device body 42 is firmly attached to the upright structure 24, while the internal piston and the external piston 43, 44 are mobile in relation to the device body 42 and to the upright structure 24.

[0033] The internal piston 43 is positioned coaxially and inside the device body 42, and in particular is housed in an inner chamber 45 defined by the device body 42.

[0034] The internal piston 43 comprises a head 46 and a relative stem 47 to which the head 46 is mechanically connected. During its stroke, the internal piston 43 moves inside said inner chamber 45; in particular both the head 46 and the stem 47 traverse the inner chamber 45. The head 46 divides the inner chamber 45 into a first and a second inner volume 48, 49 variable in relation to the stroke of the internal piston 43 and fluidically separated from each other by means of seals 50 positioned on the head 46 of the internal piston 43. The head 46 comprises a roof 51, opposite the associable stem 47, and a bottom 52, directly facing the stem 47. The surface area of the bottom 52 is less than that of the roof 51, on account of the presence of the stem 47 which reduces the surface area of the bottom 52 suitable to be influenced by the fluid sent under pressure into the inner chamber 45.

[0035] Consequently, the pressure of the fluid sent into the first and second inner volume 48, 49 being equal, the thrust force exerted on the roof 51 of the internal piston 43 will prevail.

[0036] According to one embodiment, the internal piston 43 is operatively connected to the blade-holder device 28 and fluidically connected to said inner chamber 45.

[0037] The device body 42 has a main extension axis X-X.

[0038] The inner chamber 45 does not necessarily have a circular geometry, in other words, does not necessarily present a circular cross-section in relation to a section plane perpendicular to said main extension axis X-X.

[0039] For example, said inner chamber 45 may even have a square or rectangular cross-section in relation to said main extension axis X-X.

[0040] The external piston 44 is positioned coaxially and outside the device body 42, and in particular identifies an outer chamber 53 with the device body 42.

[0041] The device body 42 has an outer ring 54 which acts as a limit stop for the external piston 44. The outer ring 54 divides the outer chamber 53 into a first and second outer volume 55, 56 suitable to receive pressurised fluid as a result of operation of the external piston 44.

[0042] The device body 42 has differing diameters at the outer ring 54. for example a lower diameter 57 and an upper diameter 58: this way, the pressurised fluid sent to the first and second outer volume 55, 56 being equal, the thrust resulting for example on the first outer volume 55 will prove greater.

[0043] According to one embodiment, the external piston 44 is operatively connected to the blade-holder device 32 and fluidically connected to said outer chamber 53.

[0044] Obviously the respective mechanical connections between the internal and external pistons 43, 44 and the sheet-blocking 28 and blade-holder devices 32 are indicative and may be inverted according to the user's requirements.

[0045] The two internal and external pistons 43, 44 can

be operated independently of each other so as to translate axially in a vertical direction Z-Z, parallel to said main extension axis X-X.

[0046] Preferably, each of the two internal and external pistons 43, 44 is a dual effect piston: in other words, each of the two pistons 43, 44 is mobile parallel to said main extension axis X-X, in a vertical direction Z-Z, in the two opposite directions (shown in the drawings by the arrows 'D' and 'U'), that is to say respectively towards and away from said support plane 8.

[0047] Preferably, the internal and external pistons 43, 44 are coaxial to each other and to said device body 42 having a main extension axis X-X, said pistons 43, 44 moving parallel to the vertical direction Z-Z parallel to the main extension axis X-X.

[0048] According to one embodiment, the sheet-blocking device 28 comprises a blocking portion 59 of the sheet 12 mechanically connected to the internal piston 43 by means of a connection arm 60, external to said device body 42 and substantially parallel to said main extension axis X-X.

[0049] For example, the blocking portion 59 comprises at least one jaw 64 able to press at least a portion of the sheet 12 to be processed against a corresponding abutment 68 of the support plane 8.

[0050] Said abutment 68 may be of the fixed or mobile type.

[0051] Preferably, the sheet-blocking device 28 is of the sheet-pressing type: in other words, the blocking portion 59 comprises a jaw 64 which presses and compresses the sheet 12 against the support plane 8 so as to block it firmly to it.

[0052] Preferably, the abutment 68 is situated near a lateral rim 72 of the support plane 8 so as to permit easy bending of the sheet in correspondence with a portion of the same overhanging said lateral rim 72.

[0053] According to one embodiment, the sheet-blocking device 28 comprises a plurality of shaping tools, able to perform deformations on the sheet 12.

[0054] The blade-holder device 32 preferably comprises a fastening portion 76 external and coaxial to said device body 42, the fastening portion 76 being operatively connected to the external piston 44 and being mobile parallel to said main extension axis X-X.

[0055] According to one embodiment, the blade-holder device 32 comprises a blade-holder head 80 mechanically connected by means of at least one skate 84 which forms a mobile coupling in a transversal direction Y-Y, perpendicular to said vertical direction Z-Z.

[0056] Preferably, the skate 84 is inserted between the blade-holder head 80 and the fastening portion 76.

[0057] The coupling made by the skate 84 is a prismatic type coupling which allows a relative transition of the blade-holder head 80 and the fastening portion 76 in a transversal direction Y-Y and prevents a relative movement between the blade-holder head 80 and the fastening portion 76 in a direction perpendicular to said transversal direction Y-Y.

[0058] The blade-holder head 80 comprises at least one blade 36 suitable to perform bending operations of said sheet 12.

[0059] Preferably, the blade-holder head 80 comprises a pair of blades 36 opposite each other, for example in a vertical direction Z-Z, so as to perform opposite bending movements of the sheet 12 depending on the direction of operation 'U' or 'P' of the blade-holder head 80 operated by the relative external piston 44.

[0060] The functioning of the panel-bending machine according to the present invention will now be described.

[0061] In particular, the functioning of the panel-bending machine is related to the operation of the hydraulic and/or pneumatic operating devices 40.

[0062] To bend the sheet 12 previously laid on the support plane 8, first of all it needs to be blocked to said support plane 8. Assuming an intermediate configuration of the pistons 43, 44 (figure 5) to start with, the internal piston 43 operatively connected to the sheet-blocking device 28, in the direction 'D' is lowered. The configuration of maximum pressure of the sheet 12, that is of maximum lowering of the internal piston 43 and of the sheet-blocking device 28 with the relative jaw 64, is shown schematically in figure 9.

[0063] If necessary, during the phase of lowering the sheet-blocking device 28 it is possible to contemporarily perform blocking of the sheet 12 and its deformation by means of the shaping tools present, if any, on the sheet-blocking device 28.

[0064] The plastic deformation of the sheet 12 may, for example, take place by means of a bending downwards, pushing the blade-holder device 32 in the direction 'D', as shown for example in figure 2a, and/or by means of a bending upwards, pushing the blade-holder device 32 in the direction 'U', as shown for example in figure 2b.

[0065] The subsequent unblocking of the sheet 12 takes place by raising the internal piston 43 and then the sheet-blocking device 28 in the upward direction 'U', until the configuration of maximum raising is achieved, schematically illustrated in figure 7.

[0066] When the sheet 12 is blocked on the support plane 8, it can be processed by moving the blade-holder device 32, fitted with the respective blades 36. The configurations of maximum lowering and maximum raising of the blade-holder device 32 are illustrated schematically in figures 6 and 8 respectively.

[0067] As may be seen from the description, the panel-bending machine according to the invention makes it possible to overcome the drawbacks mentioned with reference to the prior art.

[0068] In particular, the use of a single cylinder having a fixed central body makes it possible to significantly reduce the overall dimensions of the operating devices of the panel-bending machine with particular reference to the operation and movement of the sheet-blocking device and the blade-holder device.

[0069] In fact, the solutions of the prior art which com-

prises 3 or 4 cylinders significantly complicate the functioning of the machine and increase its weight and size.

[0070] On the whole, the panel bending machine according to the present invention has reduced dimensions, weight and costs compared to the panel-bending machines of the prior art.

[0071] Improved efficiency of the machine itself follows.

[0072] A person skilled in the art may make numerous modifications and variations to the panel-bending machines described above so as to satisfy contingent and specific requirements, while remaining within the sphere of protection of the invention as defined by the following claims.

Claims

1. Panel-bending machine (4) able to perform bending of sheets (12), comprising

- a support plane (8) able to support a sheet (12) during the various processing phases,
- an upright structure (24) which extends perpendicular to said support plane (8) so as to at least partially overhang the support plane (8),
- at least one sheet-blocking device (28) able to constrain the sheet (12) in relation to said support plane (8) during the processing phases of the sheet (12) itself,
- at least one blade-holder device (32) fitted with blades (36) suitable to perform bending operations of said sheet (12),

characterised by the fact that

- the panel bending machine (4) comprises hydraulic and/or pneumatic operating devices (40) operatively connected both to the sheet-blocking device (28) and the blade-holder device (32), wherein said hydraulic and/or pneumatic operating devices (40) comprise a single device body (42), fixed in relation to the upright structure (24), an internal piston (43) and an external piston (44), said internal and external pistons (43,44) being operatively connected to the device body (42), mobile in relation to the device body (42) and to the upright structure (24), and being independently operable, wherein said internal and external pistons (43, 44) are operatively connected to the sheet-blocking device (28) and the blade holder (32).

2. Panel-bending machine (4) according to claim 1, wherein the internal and external pistons (43,44) are coaxial to each other and in relation to said device body (42) having a main extension axis (X-X), said internal and external pistons (43,44) moving parallel

to a vertical axial direction (Z-Z) parallel to said main extension axis (X-X).

3. Panel-bending machine (4) according to claim 2, wherein each of the two internal and external pistons (43,44) is a dual effect piston, mobile parallel to said main extension axis (X-X), in a vertical direction (Z-Z), in two opposite directions (D,U), in other words respectively towards and away from said support plane (8). 5
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4. Panel-bending machine (4) according to any of the previous claims, wherein the sheet-blocking device (28) comprises a blocking portion (59) of the sheet (12) mechanically connected to the internal piston (43) by means of a connection arm (60), external to said device body (42) and substantially parallel to said main extension axis (X-X). 15

5. Panel-bending machine (4) according to claim 4, wherein the sheet-blocking device (28) is of the sheet-pressing type wherein said blocking portion (59) comprises at least one jaw (64) able to press at least a portion of the sheet (12) to be processed against a corresponding abutment (68) of the support plane (8). 20
25

6. Panel-bending machine (4) according to any of the previous claims, wherein the sheet-blocking device (28) comprises a plurality of shaping tools, able to perform deformations on the sheet (12). 30

7. Panel-bending machine (4) according to any of the previous claims, wherein the blade-holder device (32) comprises a fastening portion (76) external and coaxial to said device body (42), the fastening portion (76) being operatively connected to the external piston (44) and being mobile parallel to said main extension axis (X-X). 35
40

8. Panel-bending machine (4) according to claim 7, wherein the blade holder device (32) comprises a blade-holder head (80) mechanically connected to the external collar (76) by at least one skate (84) which forms a mobile coupling in a transversal direction (Y-Y), perpendicular to said main extension axis (X-X). 45

9. Panel-bending machine (4) according to claim 8, wherein said coupling made by the skate (84) is a prismatic type coupling which allows a relative transition of the blade-holder head (80) and the fastening portion (76) in a transversal direction (Y-Y) and prevents a relative movement between the blade-holder head (80) and the fastening portion (76) in a direction perpendicular to said transversal direction (Y-Y). 50
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10. Panel-bending machine (4) according to any of the

previous claims, wherein the blade-holder head (80) comprises a pair of blades(36) opposite each other, in a vertical direction (Z-Z), so as to perform opposite bending movements of the sheet (12) depending on the direction of operation (U,P) of the blade-holder head (80).

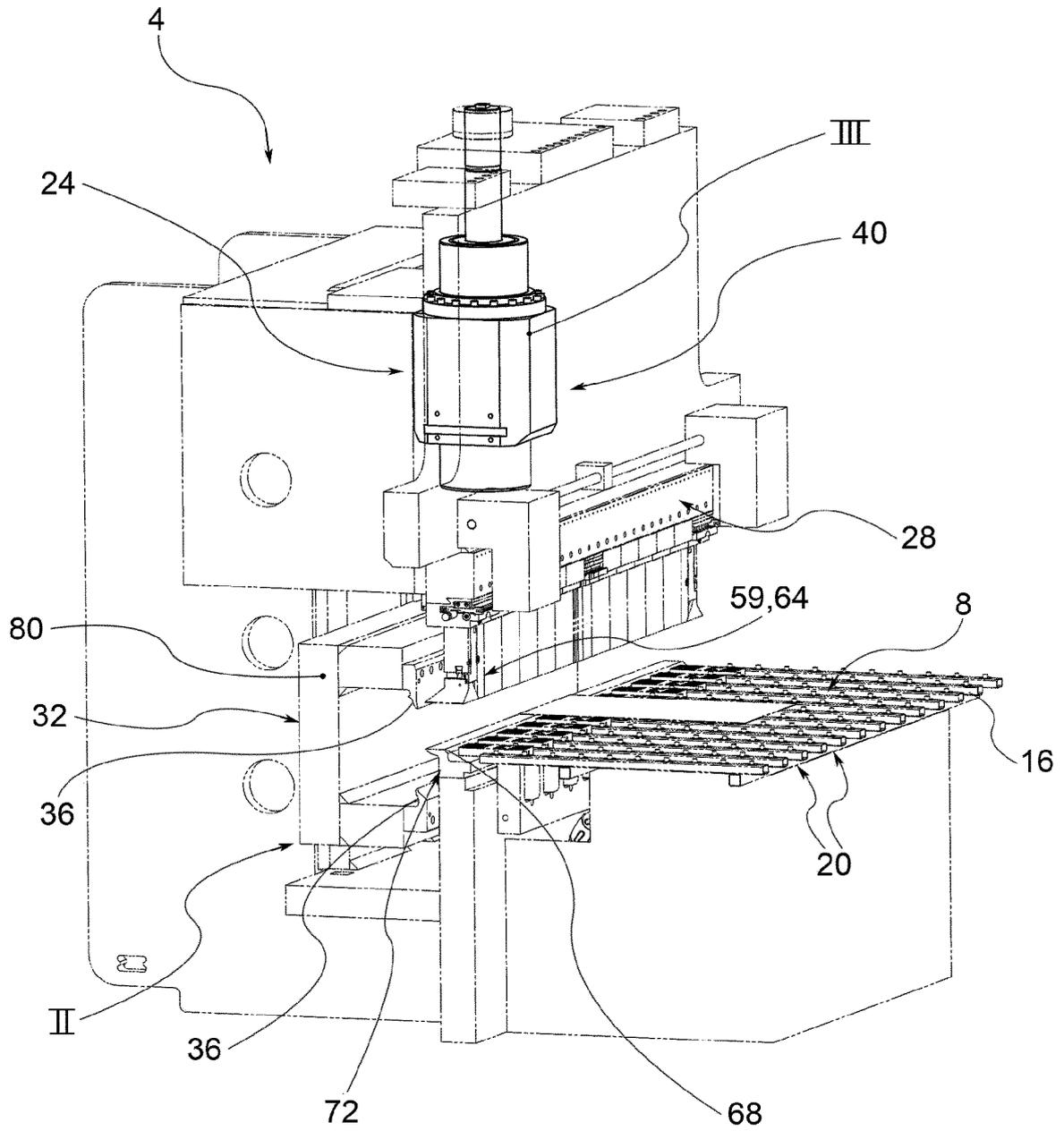


Fig. 1 a

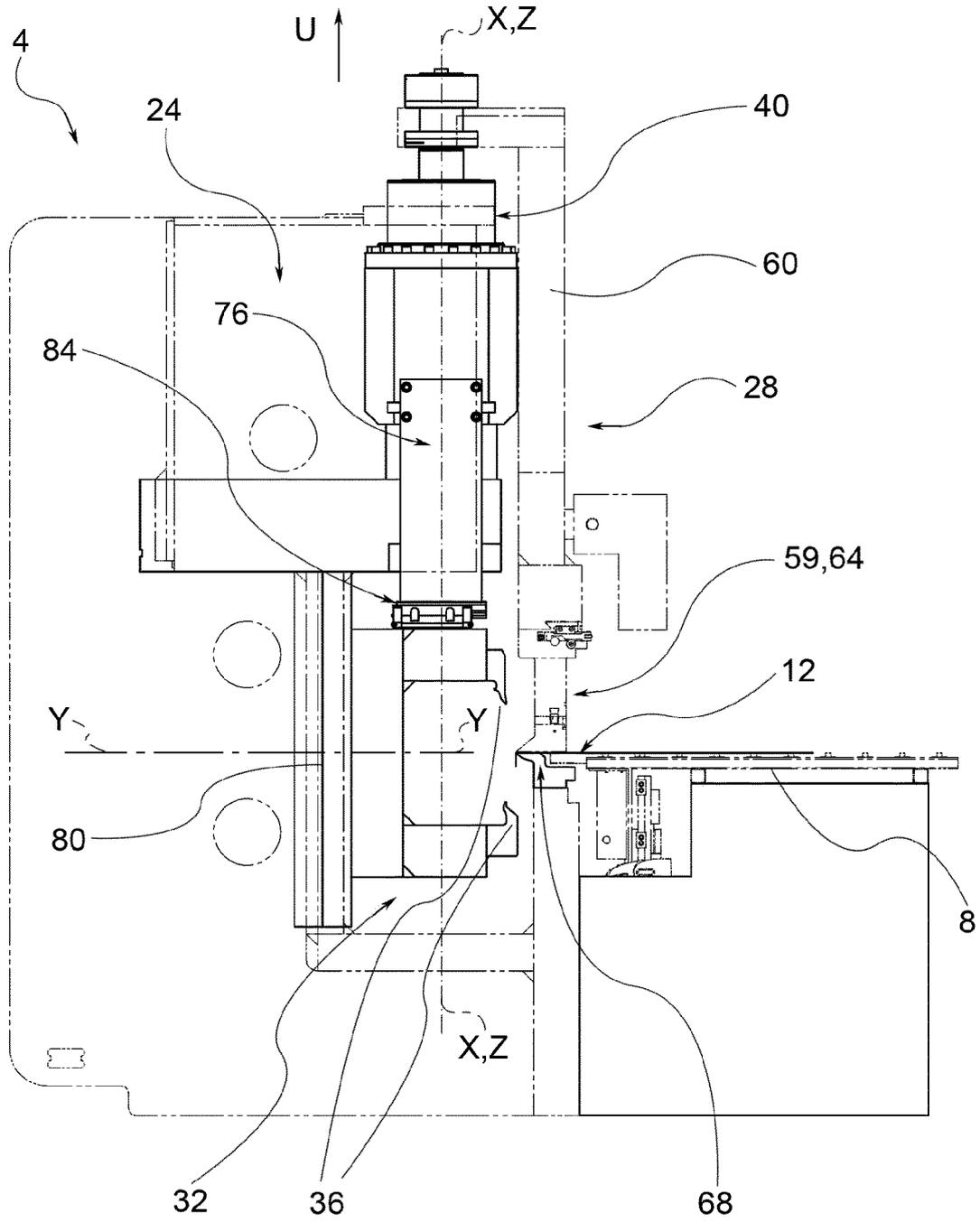


Fig. 1 b

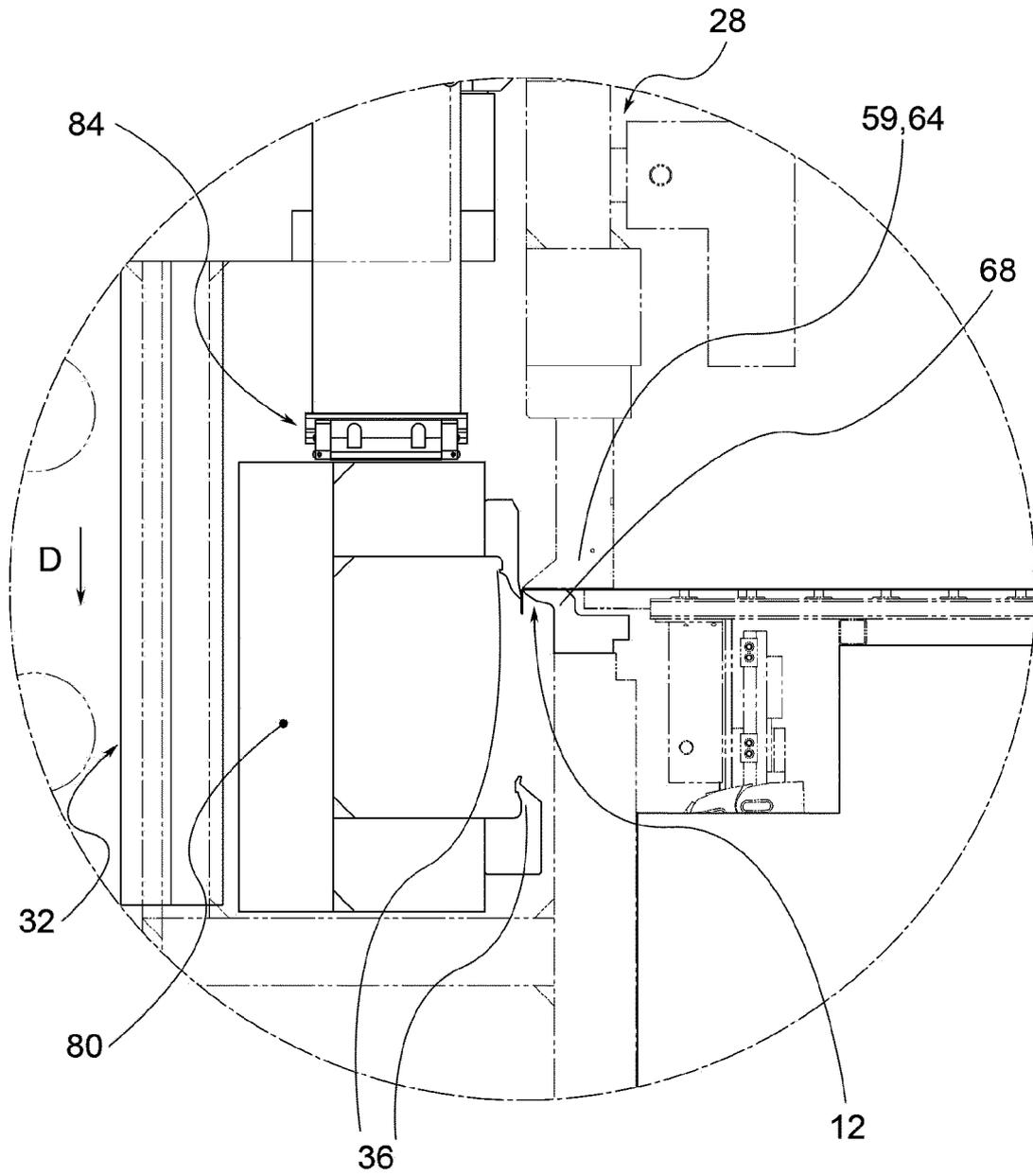


Fig. 2a

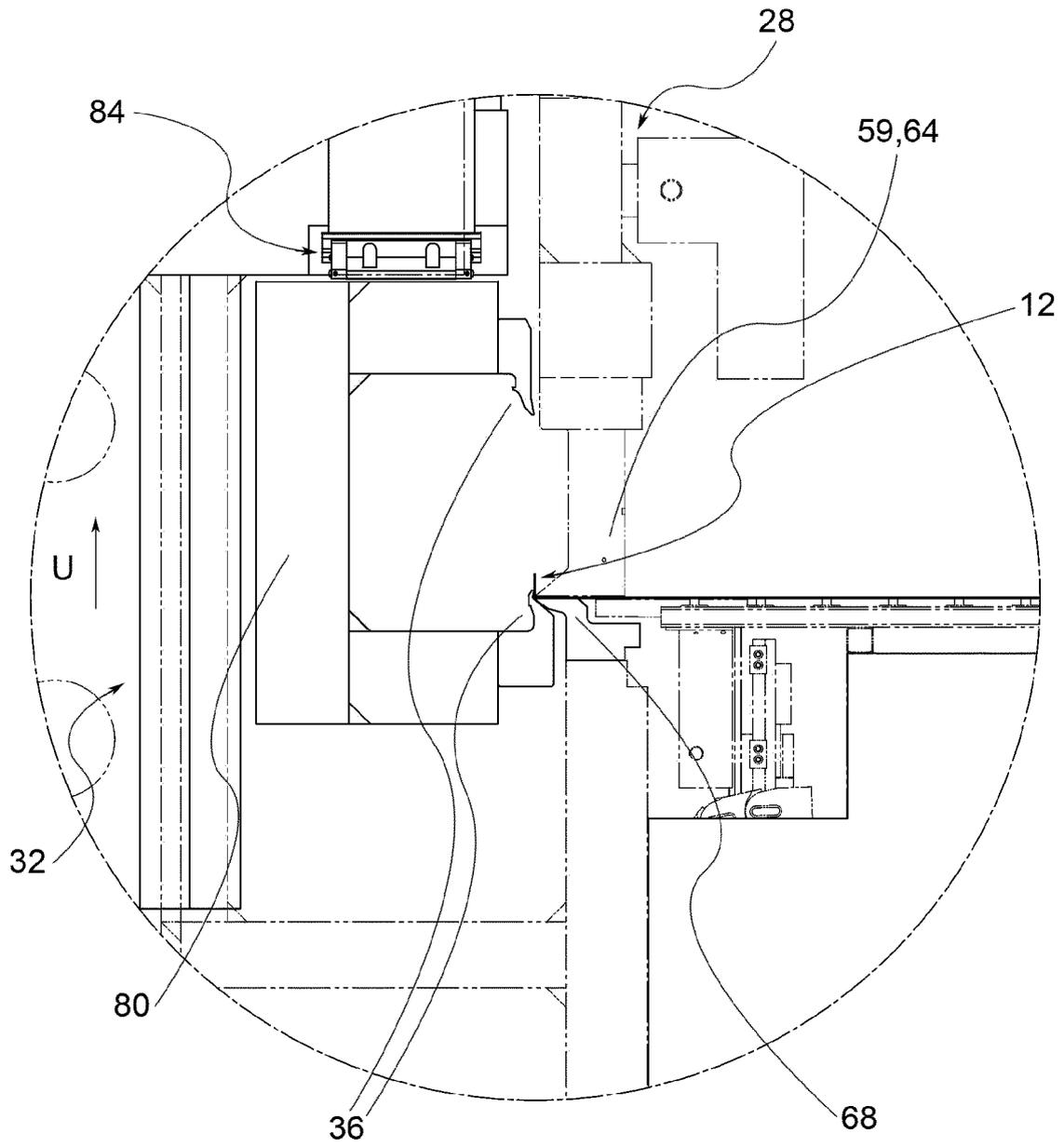


Fig. 2b

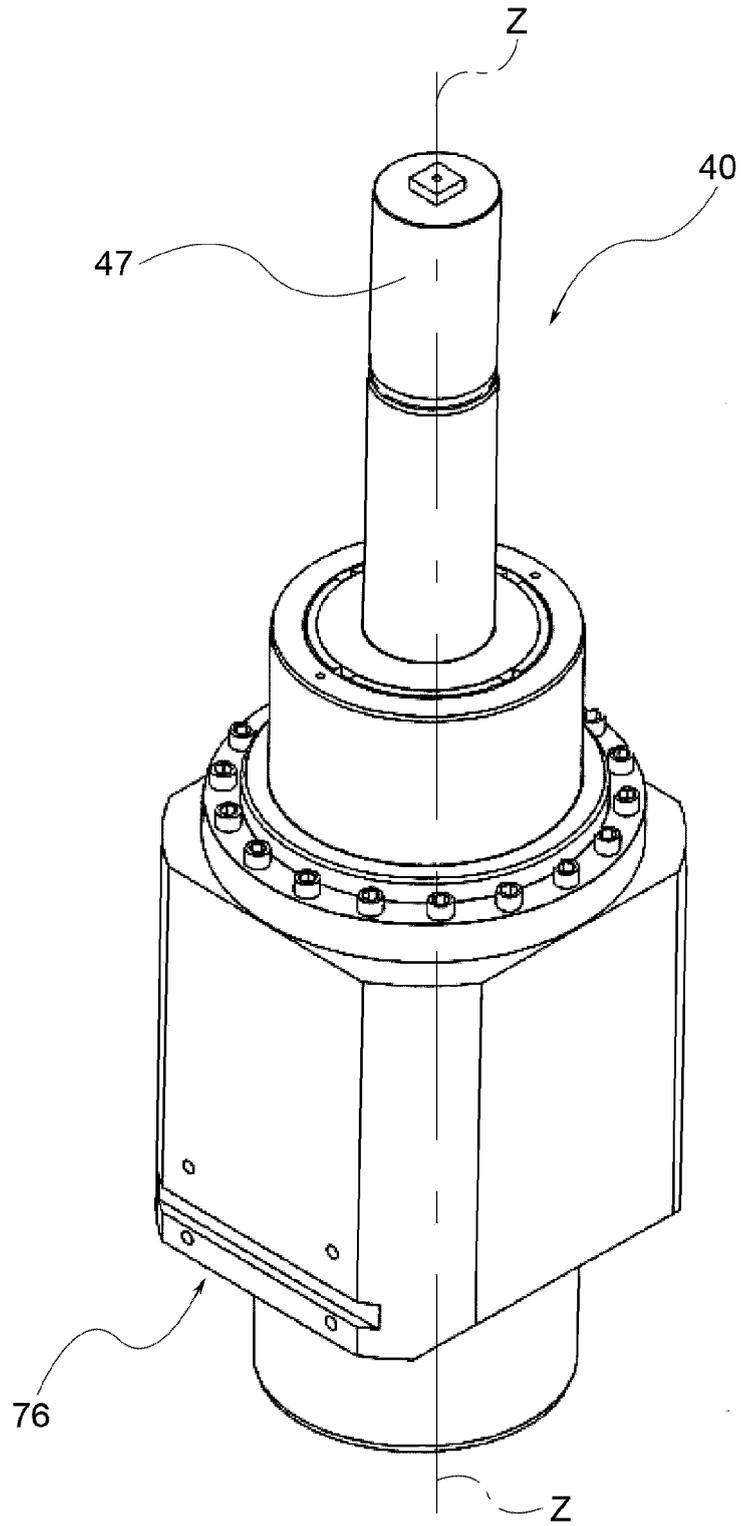


Fig. 3

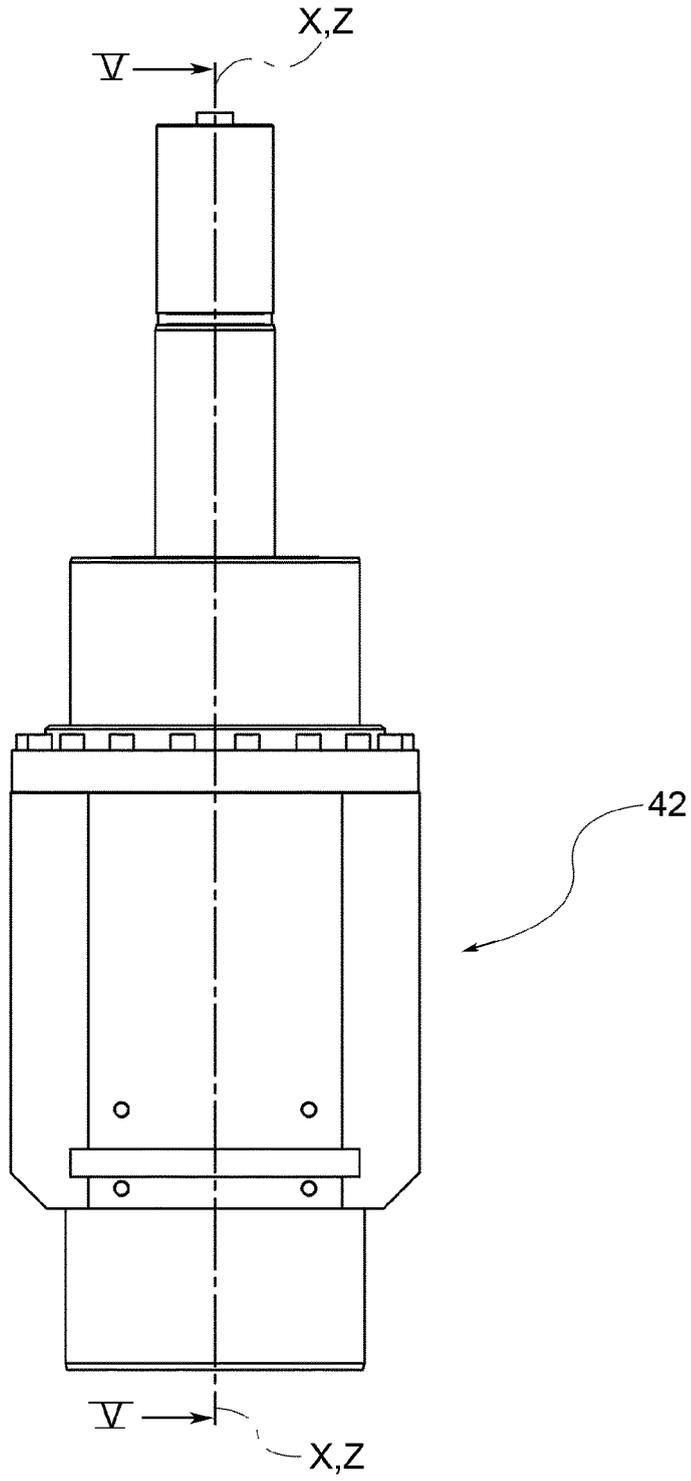


Fig. 4

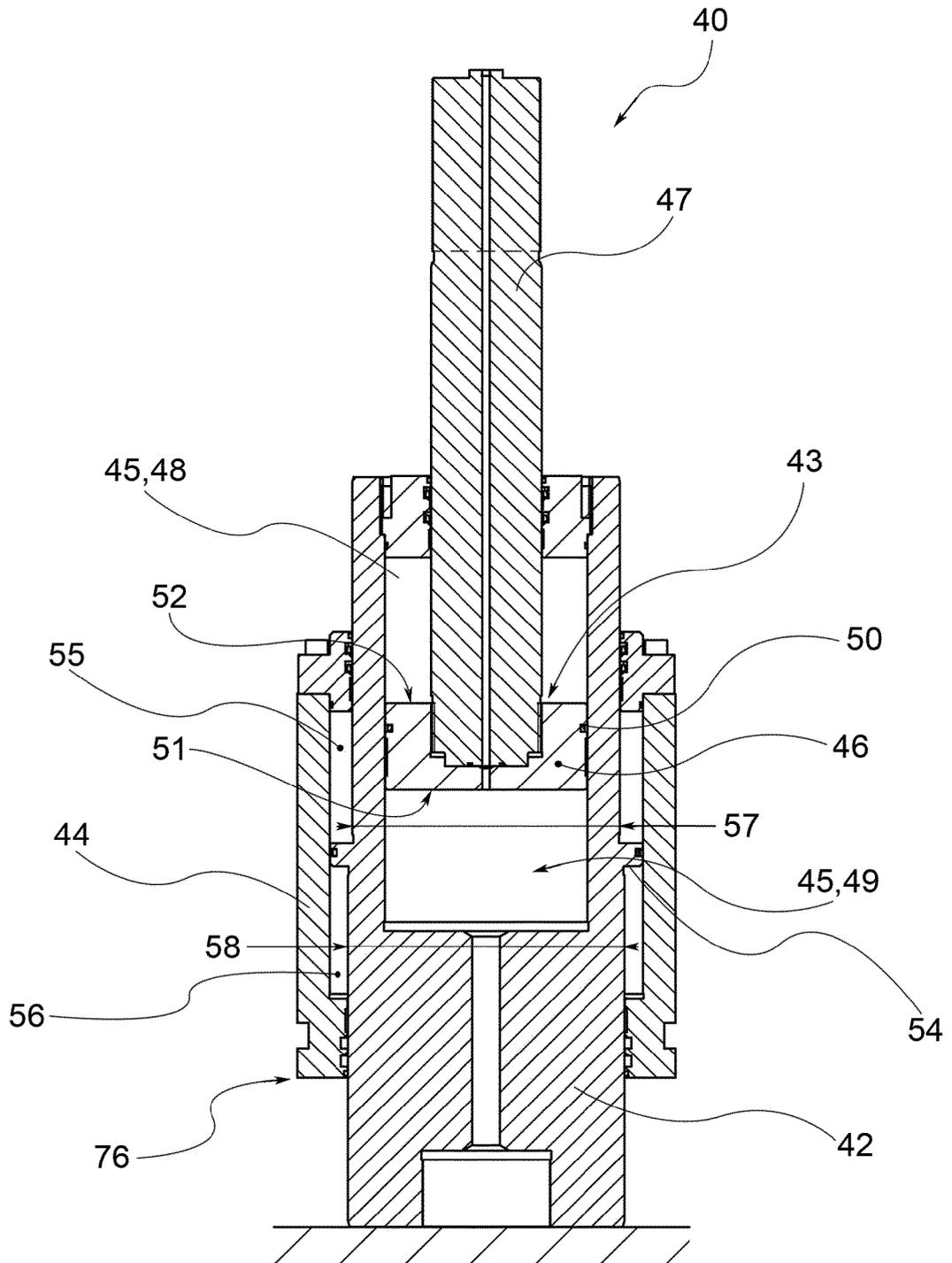


Fig. 5

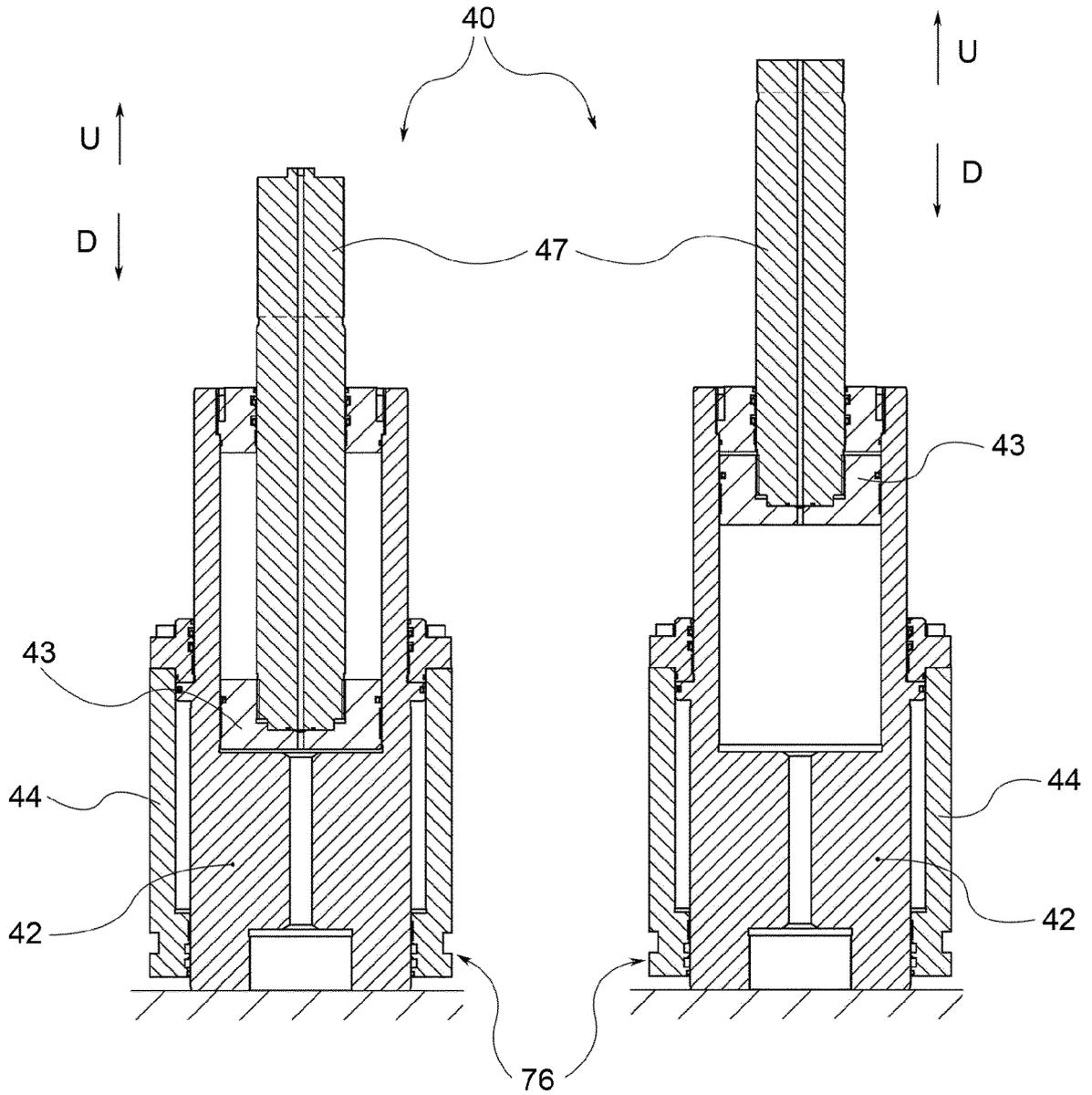


Fig. 6

Fig. 7

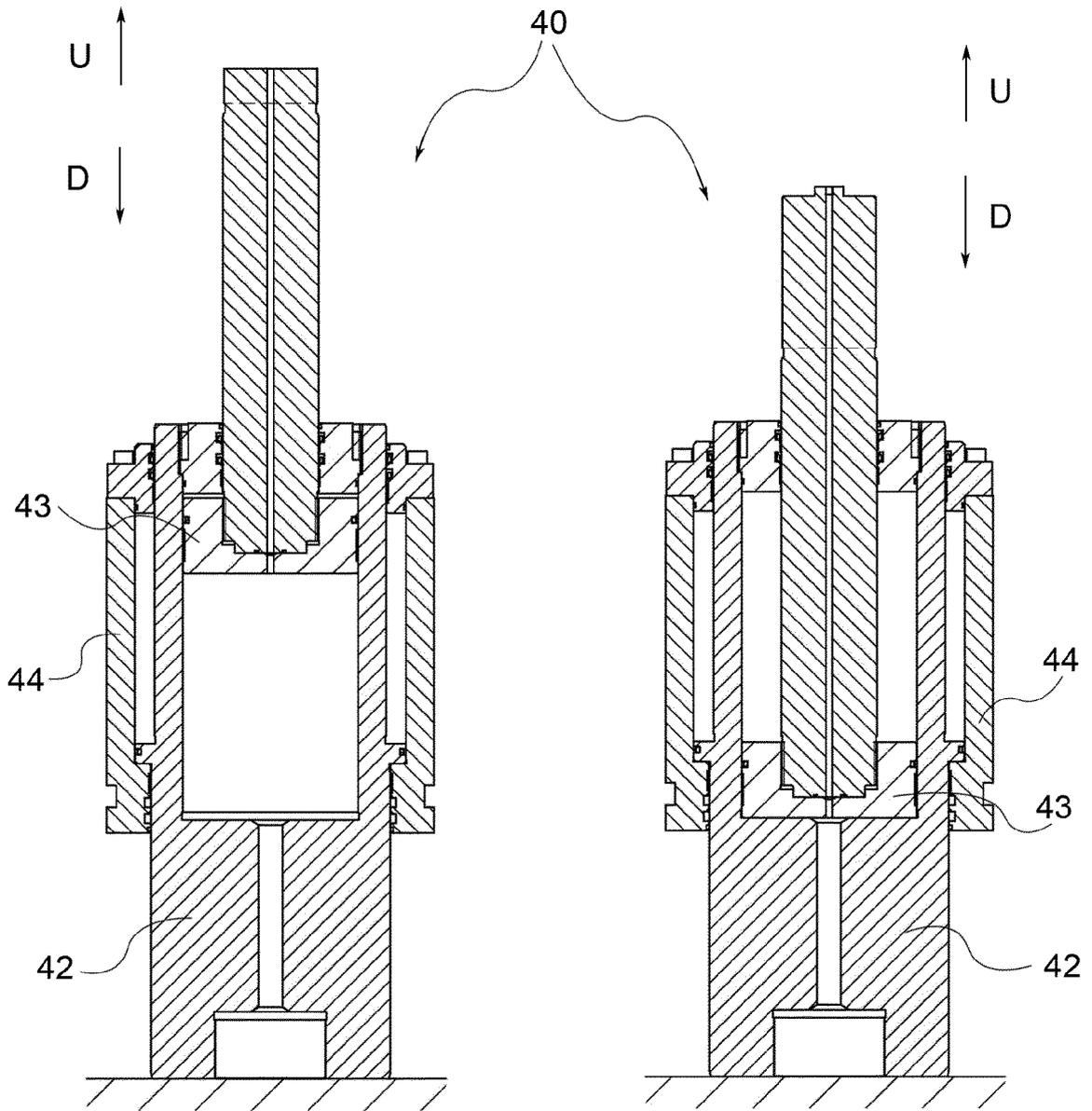


Fig. 8

Fig. 9



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Application Number
EP 11 18 6186

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Place of search		Date of completion of the search	Examiner
Munich		3 February 2012	Cano Palmero, A
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons	
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