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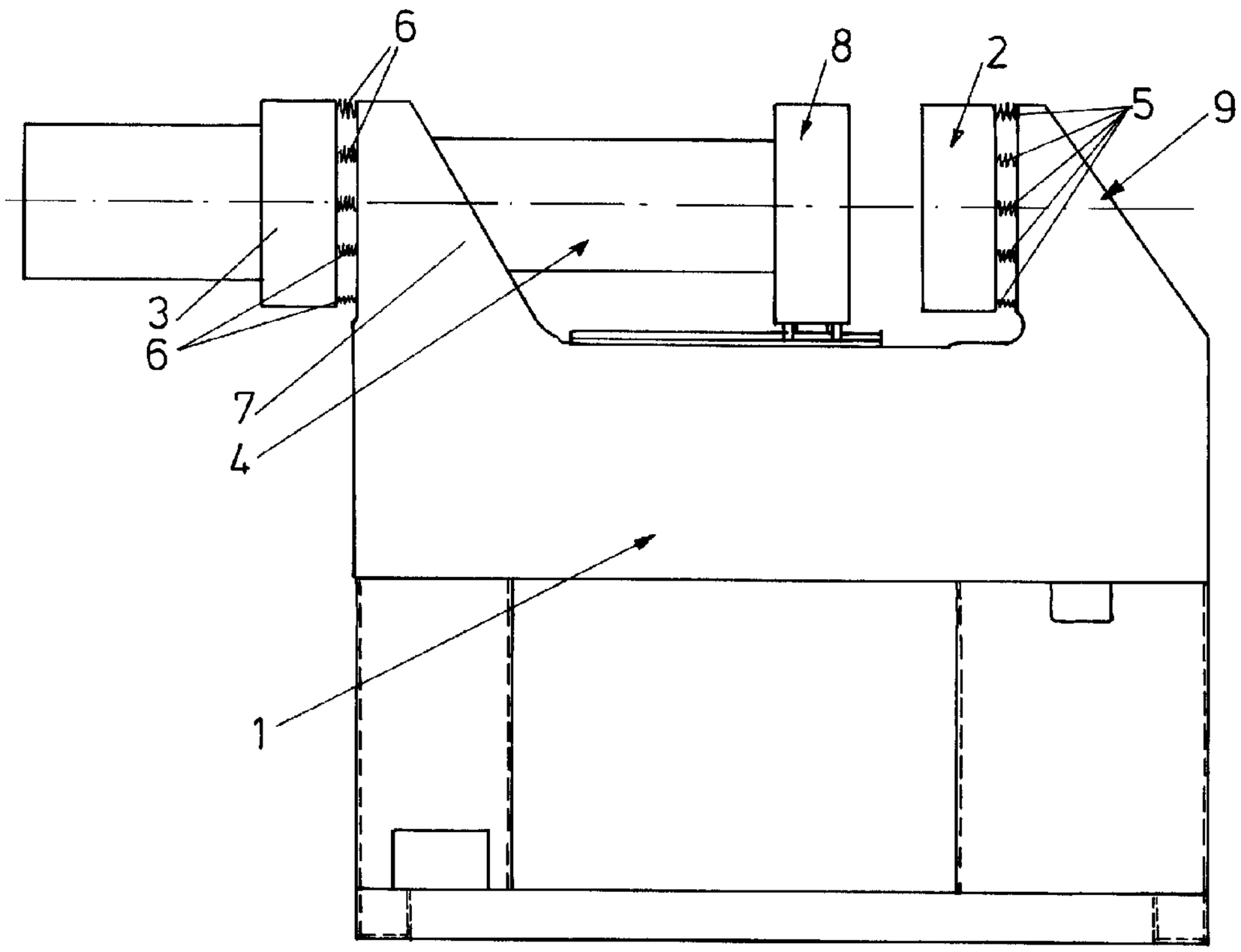


(57) Abrégé/Abstract:
The invention concerns an injection-moulding machine comprising a substantially C-shaped machine frame (1) on whose one leg (9) a stationary die platen (2) is mounted and on whose other leg (7) a closure mechanism (4) is mounted for driving a movable die platen (8). The free ends of the machine frame legs, which ends are not connected by spars, deform under the influence of the closure force occurring during the closure process. Disposed between the stationary die platen (2) and/or the closure mechanism (4), on the one hand, and the machine frame (1), on the other, is at least one retaining part (5, 6) which deforms when the closure force is applied, whereby the stationary die platen (2) or the closure mechanism (4) is tilted relative to the machine frame (1).

## (57) Abstract

The invention concerns an injection-moulding machine comprising a substantially C-shaped machine frame (1) on whose one leg (9) a stationary die platen (2) is mounted and on whose other leg (7) a closure mechanism (4) is mounted for driving a movable die platen (8). The free ends of the machine frame legs, which ends are not connected by spars, deform under the influence of the closure force occurring during the closure process. Disposed between the stationary die platen (2) and/or the closure mechanism (4), on the one hand, and the machine frame (1), on the other, is at least one retaining part (5, 6) which deforms when the closure force is applied, whereby the stationary die platen (2) or the closure mechanism (4) is tilted relative to the machine frame (1).

The invention relates to an injection molding machine. An injection molding machine known, for example, from DE-U1-92 12 480 comprises a substantially C-shaped machine frame, on one limb of which is mounted a stationary mold mounting plate and on the other limb of which is mounted a closing mechanism for driving a movable mold mounting plate, wherein the free ends of the limbs of the machine frame, which are not connected by beam members, deform under the influence of the closing force which occurs during the closing operation.

The object of the invention is to simplify the construction and nonetheless to provide for good guidance of the mold mounting plates and absolute parallelism of the two mold halves, even when very high mold driving forces are involved.

The invention provides an injection molding machine comprising a substantially C-shaped machine frame, on one limb of which is mounted a stationary mold mounting plate and on the other limb of which is mounted a closing mechanism for driving a movable mold mounting plate, wherein the free ends of the limbs of the machine frame, which are not connected by beam members, deform under the influence of the closing force which occurs during the closing operation, characterised in that arranged between the stationary mold mounting plate and the machine frame, or between the closing mechanism and the machine frame, or between the stationary mold mounting plate and the closing mechanism on the one hand and the machine

frame on the other hand, is at least one holding portion which is deformed when the closing force is applied whereby the stationary mold mounting plate or the closing mechanism is tilted relative to the machine frame.

Such a design configuration makes it possible to avoid the pivot trunnions which were used hitherto in relation to injection molding machines without connecting beam members. If, in an injection molding machine according to the invention, the two limbs of the machine frame pivot outwardly about notional lower axes of rotation under the influence of the closing force, the stationary mold mounting plate and/or the closing mechanism mutually pivot about notional upper pivot axes.

The invention can be embodied by means of different structures. In that respect the only essential consideration is that the deformation of the connecting region of the stationary mold mounting

plate or closing mechanism on the one hand and the machine frame on the other hand, as is produced by the closing force, at least approximately compensates for expansion of the machine frame which is open at the top.

Preferably the holding portions as well as the machine frame comprise steel. The holding portions however do not have to be in one piece with the machine frame but can be in the form of separate components. That affords the possibility of making holding portions and machine frame from different material and in particular making the elasticity of the holding portions greater than that of the machine frame.

Various embodiments of the invention are described in detail hereinafter with reference to the Figures of the accompanying drawings.

Figure 1 is a diagrammatic side view of an injection molding machine according to the invention and Figures 2 and 3 each diagrammatically show side views of the stationary mold mounting plate and the associated part of the machine frame.

The essential part of the injection molding machine is the machine frame 1 which carries the stationary mold mounting plate 2 by way of a frame limb 9 and a flange 3 of the closing mechanism 4 by way of a frame limb 7.

In the illustrated embodiment the closing mechanism is a hydraulic piston-cylinder unit. It would however also be possible to provide an electromechanical closing mechanism, for example also a bell crank mechanism. The movable mold mounting plate 8 is displaced by way of the closing mechanism 4.

In the embodiment shown in Figure 1 both the stationary mold mounting plate 2 and also the closing mechanism 4 are mounted on the machine frame 1 by means of a plurality of separate holding portions 5, 6. In the illustrated embodiment the holding portions 5 between the stationary mold mounting plate 2 and the machine frame are loaded in

compression and the holding portions 6 between the drive plate 3 and the machine frame 1 are loaded in tension. It would however also be possible for the flange 3 of the closing mechanism 4 to be mounted at the inside of the frame limb 7, that is to say at the side towards the mold mounting plates 2, 8 so that the holding portions 6 would also be loaded in compression. The holding portions 5, 6 which are distributed over the height of the mold mounting plate 2 and the flange 3 respectively are of different strengths (higher elasticity), the lower holding portions 5, 6 being of lower strength than the upper holding portions 5, 6.

If the limbs 7, 9 of the machine frame 1 are urged away from each other at the top the stationary mold mounting plate 2 and/or the closing mechanism 4 can perform a tilting movement relative to the machine frame 1 whereby plate parallelism of the mold mounting plates 2, 8 is maintained.

The differing strength or elasticity of the holding portions 5, 6 can be achieved by virtue of different configurations. Thus the holding portions 5, 6 may be of different dimensions or they may be provided with material weakenings, for example slots.

The differing elasticity and strength can likewise be achieved by the use of different materials. The holding portions are advantageously made from steel, in particular spring steel.

The embodiment shown in Figure 3 has only one holding portion 5 which carries the stationary mold mounting plate 2. That holding portion 5 is provided at the bottom side with relatively deep slots 10 and at the top side with slots 11 of lesser depth. The slots 10, 11 overlap so that the holding portion 5 is compressible in a harmonica-like manner. In that way the holding portion 5 is compressed to a greater degree at the bottom side than at the top side and, if the machine frame 1 is deformed under the application of the closing force and the frame limb 9 tilts outwardly, the stationary mold mounting

plate 2 can perform a tilting movement relative to the frame limb 9 or relative to the machine frame 1.

The holding portion 5 could also be of a concertina-like configuration.

In the embodiment shown in Figure 2 the stationary mold mounting plate 2 is mounted on the machine frame 1 by means of two holding portions 5, wherein both holding portions 5 are provided with slots 10, 11 but the lower holding portion 5 has more slots 10, 11 or deeper slots 10, 11 than the upper holding portion 5 and is therefore of lower strength.

The slots 10, 11 in the holding portions 5, 6 advantageously extend at a right angle to the longitudinal axis of the machine.

The holding arrangement shown in the embodiment of Figure 2 for the stationary mold mounting plate 2 could also be used as a holding arrangement for the closing mechanism 4.

The separate holding portions 5, 6 between the machine frame 1 and the stationary mold mounting plate 2 or the closing mechanism 4 respectively form an axis-less hinge or pivot which besides the rotary movement also permits a translatory movement.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An injection molding machine comprising a substantially C-shaped machine frame, on one limb of which is mounted a stationary mold mounting plate and on the other limb of which is mounted a closing mechanism for driving a movable mold mounting plate, wherein the free ends of the limbs of the machine frame, which are not connected by beam members, deform under the influence of the closing force which occurs during the closing operation, characterised in that arranged between the stationary mold mounting plate and the machine frame is at least one holding portion which is deformed when the closing force is applied whereby the stationary mold mounting plate is tilted relative to the machine frame.

2. An injection molding machine comprising a substantially C-shaped machine frame, on one limb of which is mounted a stationary mold mounting plate and on the other limb of which is mounted a closing mechanism for driving a movable mold mounting plate, wherein the free ends of the limbs of the machine frame, which are not connected by beam members, deform under the influence of the closing force which occurs during the closing operation, characterised in that arranged between the closing mechanism and the machine frame is at least one holding portion which is deformed when the closing force is

applied whereby the closing mechanism is tilted relative to the machine frame.

3. An injection molding machine comprising a substantially C-shaped machine frame, on one limb of which is mounted a stationary mold mounting plate and on the other limb of which is mounted a closing mechanism for driving a movable mold mounting plate, wherein the free ends of the limbs of the machine frame, which are not connected by beam members, deform under the influence of the closing force which occurs during the closing operation, characterised in that arranged between the stationary mold mounting plate and the closing mechanism on the one hand and the machine frame on the other hand is at least one holding portion which is deformed when the closing force is applied whereby the stationary mold mounting plate or the closing mechanism is tilted relative to the machine frame.

4. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that the holding portion or the holding portions is or are made of steel.

5. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that at least one holding portion is in the form of a component which is separate from the machine frame.

6. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that the holding portions and the machine frame are made from different material.

7. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that the elasticity of the holding portions is greater than that of the machine frame.

8. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that there are provided two or more holding portions of different strengths, which are distributed over the height of the stationary mold mounting plate and/or a flange of the closing mechanism, and by means of which the stationary mold mounting plate or the closing mechanism is mounted to the machine frame.

9. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that the holding portion or portions is or are made of spring steel.

10. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that the holding portions are of different dimensions.

11. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that the holding portions are provided with different material weakenings, for example slots.

12. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that the holding portion is formed by a cylinder or block which is provided at the underside with slots.

13. The injection molding machine as set forth in claim 12 characterised in that the holding portion is also provided with slots at the top slide, wherein the depth of said slots is less than the depth of the slots at the underside.

14. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that the holding portions are made from different material.

15. The injection molding machine as set forth in claim 1, claim 2 or claim 3 characterised in that the holding portions are made from steel of different elasticity.

16. An injection molding machine comprising a substantially C-shaped machine frame, on one limb of which is mounted a stationary mold mounting plate and on the other limb of which is mounted a closing mechanism for driving a movable

mold mounting plate, wherein the free ends of the limbs of the machine frame, which are not connected by beam members, deform under the influence of the closing force which occurs during the closing operation, characterised in that arranged between the stationary mold mounting plate and the machine frame is a flectional joint which is deformed when the closing force is applied whereby the stationary mold mounting plate is tilted relative to the machine frame.

17. An injection molding machine comprising a substantially C-shaped machine frame, on one limb of which is mounted a stationary mold mounting plate and on the other limb of which is mounted a closing mechanism for driving a movable mold mounting plate, wherein the free ends of the limbs of the machine frame, which are not connected by beam members, deform under the influence of the closing force which occurs during the closing operation, characterised in that arranged between the closing mechanism and the machine frame is a flectional joint which is deformed when the closing force is applied whereby the closing mechanism is tilted relative to the machine frame.

18. An injection molding machine comprising a substantially C-shaped machine frame, on one limb of which is mounted a stationary mold mounting plate and on the other limb of which is mounted a closing mechanism for driving a movable mold mounting plate, wherein the free ends of the limbs of the

machine frame, which are not connected by beam members, deform under the influence of the closing force which occurs during the closing operation, characterised in that arranged between the stationary mold mounting plate and the closing mechanism on the one hand and the machine frame on the other hand is a flectional joint which is deformed when the closing force is applied whereby the stationary mold mounting plate or the closing mechanism is tilted relative to the machine frame.

19. The injection molding machine as set forth in claim 16, claim 17 or claim 18 characterised in that the flectional joint is free of any pivot shaft.

20. An open frame injection molding machine comprising:

a frame that supports a stationary mold mounting surface, a movable mold mounting surface that is essentially parallel to the stationary mold mounting surface, and a clamp mechanism, characterised in that at least a portion of the frame is geometrically configured to maintain a relatively constant moment of inertia relative to a line of force applied by the clamp mechanism during a molding cycle, so that the two mold mounting surfaces remain essentially parallel throughout the molding cycle.

21. An open frame injection molding machine comprising:

a frame having a mold support end and a clamp end,

a stationary platen structurally integrated with the frame at the mold support end,

an intermediate support member structurally integrated with the frame between the clamp end and the stationary platen, such that clamping forces generated during a molding cycle are transmitted through the stationary platen and intermediate support member to the frame,

a first set of rails attached to the frame and generally extending from the stationary platen to the intermediate support member,

a second set of rails attached to the frame and generally extending from the intermediate support member to the clamp end of the frame,

a movable platen located between the intermediate support member and stationary platen, the movable platen resting on and guided by the first set of rails,

a die height platen resting on the second set of rails, such that the die height platen is positioned between the intermediate support member and the clamp end of the frame,

die height adjustment means for connecting the die height platen to the intermediate support member and for altering the relative distance between the die height platen and the stationary platen, and

a clamp mechanism including a toggle linkage connecting the die height platen and the movable platen, the

clamp mechanism configured to provide reciprocating motion to the movable platen.

22. The injection molding machine according to claim 21 characterised in that the stationary platen and mold support end of the frame are geometrically configured to maintain a relatively constant moment of inertia relative to a line of force applied during the molding cycle.

23. The injection molding machine according to claim 21 or 22 characterised in that the die height adjustment means includes a plurality of threaded rods connecting the die height platen and intermediate support member.

24. An open frame injection molding machine comprising:

a frame having a mold support end and a clamp end,

a stationary platen structurally integrated with the frame at the mold support end and

an intermediate support member,

characterised in that the mold support end of the frame has a configuration that maintains a relatively constant moment of inertia relative to a line of force applied during a molding cycle, and the intermediate support member is structurally integrated with the frame between the stationary platen and the clamp end, such that forces generated during the molding cycle are transmitted through the stationary platen and intermediate support member to the frame.

25. The injecting molding machine according to claim 24 further comprising:

a movable platen located between the intermediate support member and stationary platen,

a die height platen located between the intermediate support member and the clamp end of the frame,

die height adjustment means for connecting the die height platen to the intermediate support member and for altering the relative distance between the die height platen and the stationary platen, and

a clamp mechanism including a toggle linkage connecting the die height platen and the movable platen, the clamp mechanism configured to provide reciprocating motion to the movable platen.

26. A tiebar-less injection molding machine with a machine frame, a stationary mold mounting plate and a movable mold mounting plate driven by a closing mechanism, specific regions of said machine frame being bent outwardly due to the closing force during the step of closing the mold, said mold mounting plates being articulated so that they remain parallel with respect to one another despite the fact that said machine frame regions are bent outwardly, wherein between at least one of said mold mounting plates and said outwardly bent region of the machine frame there is arranged a flexible region acting as a flectional joint, which is bent when the closing force is applied, so that said at least one mold mounting plate is tilted with respect to said outwardly bent region of the machine frame without the use of pivot pins.

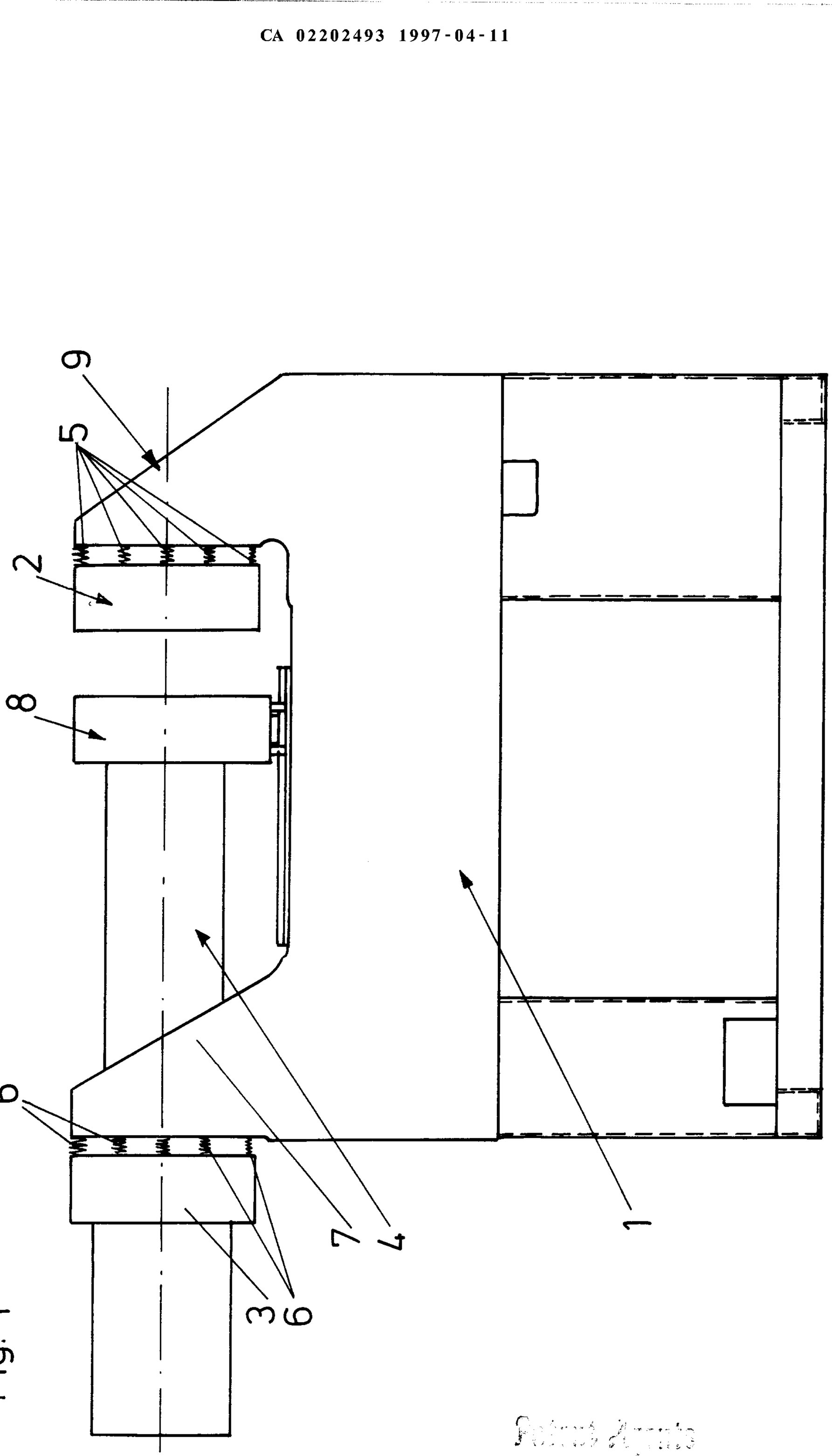
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Fig. 1

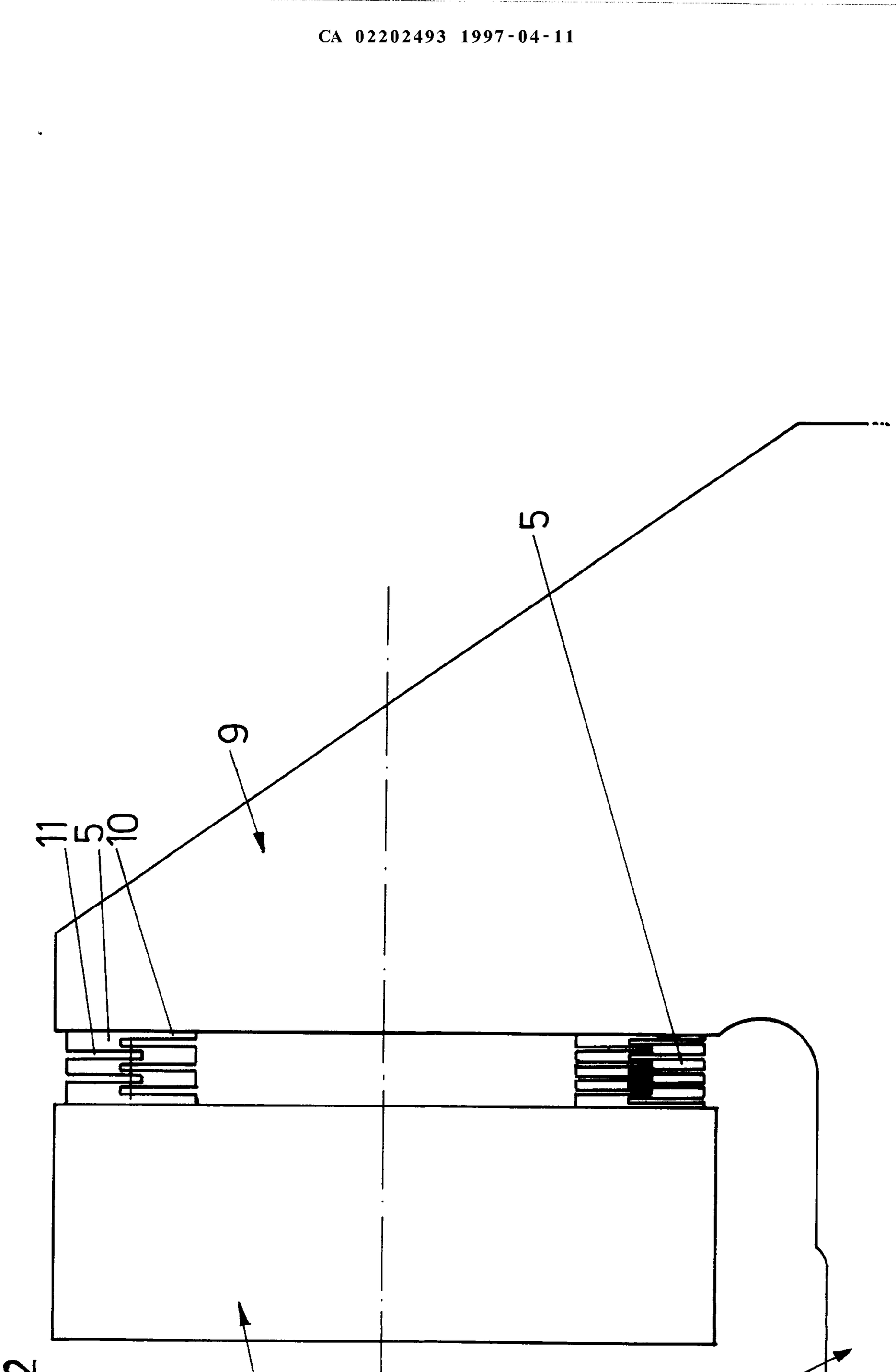



Fig. 2

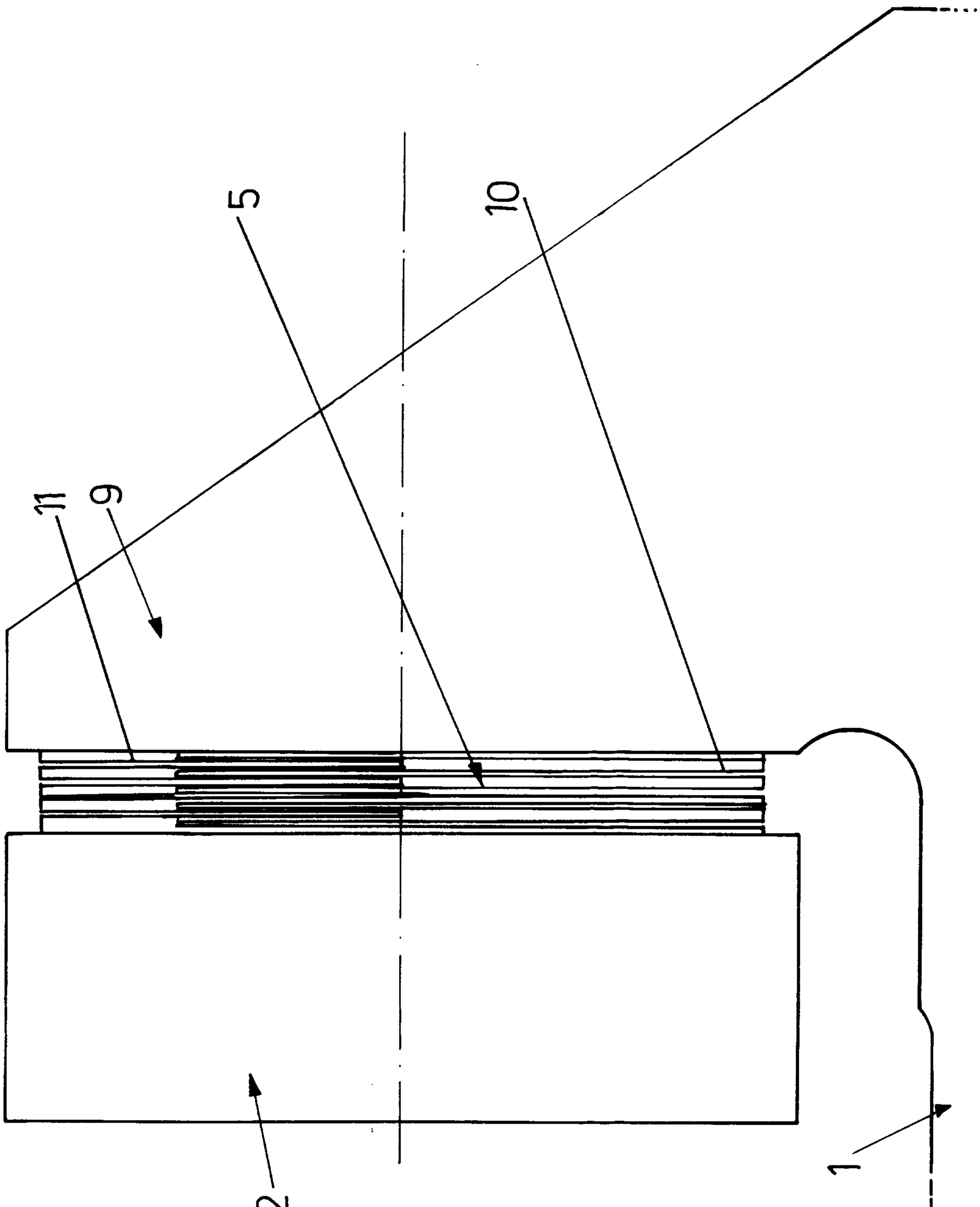
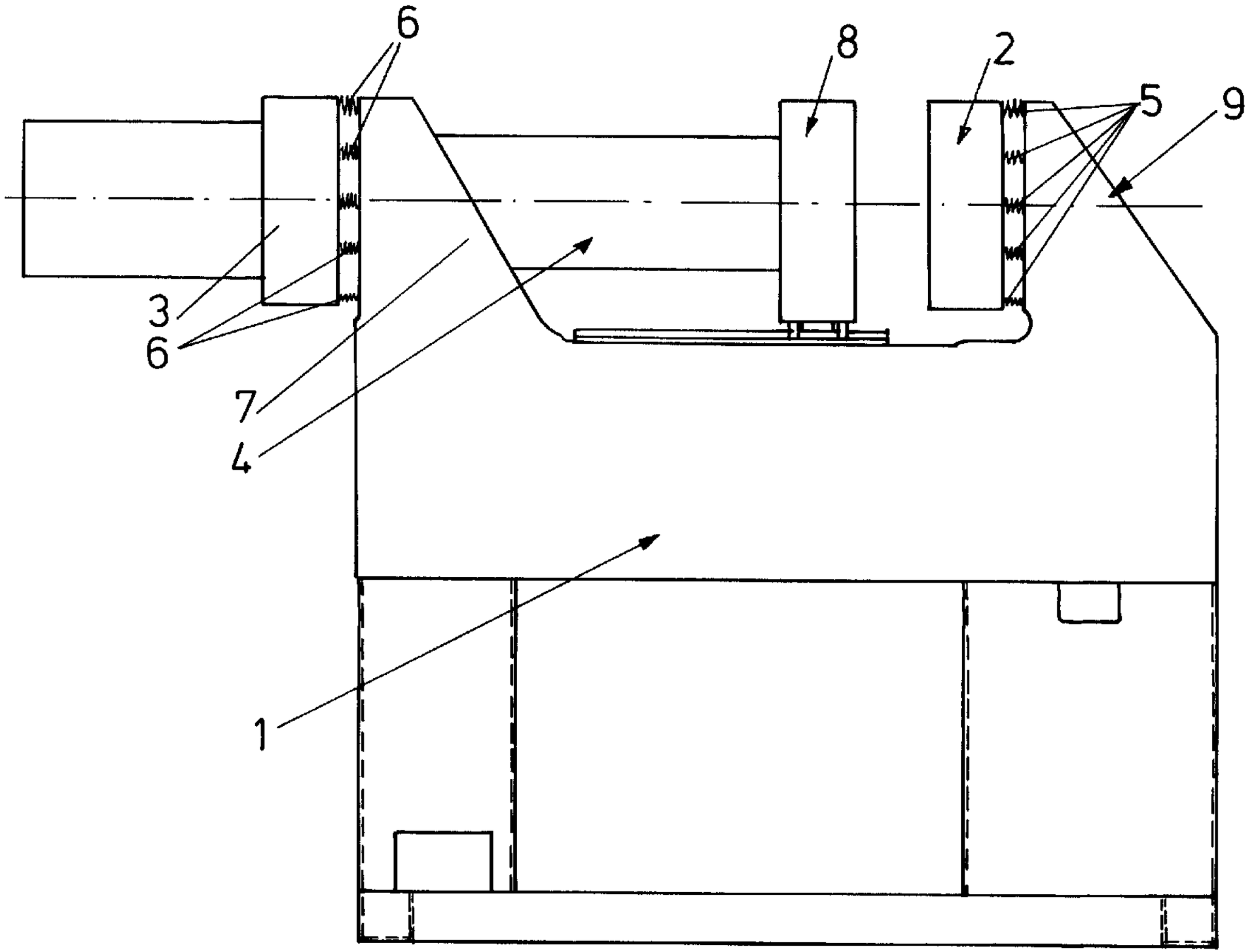



Fig. 3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