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(54) **Punching machine with vibration-damping device**

(57) A punching machine comprising tool means arranged to punch workpieces and actuating means (1) arranged to actuate said tool means, said actuating

means (1) being operationally associated to said speed-adjusting means (11) arranged to adjust forward-travel speed of said tool means.

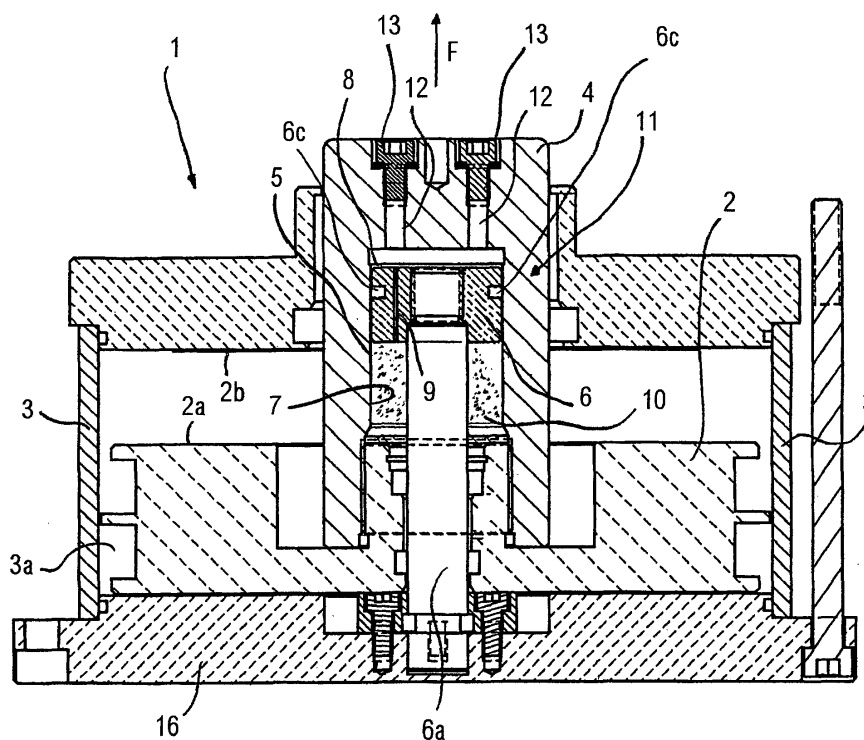


Fig. 4

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Description

[0001] The invention concerns a punching machine, namely a manually operated pneumatic punching machine that is provided with a vibration-damping device.

[0002] In order to make openings in metal elements such as circular holes, or slots, in the prior art, punching machines with punches make alternating straight cuts in a direction that is perpendicular to the surface in which the openings need to be made.

[0003] For the machining of light metal elements such as sections obtained, for example, from extruded aluminium, the prior art uses punching machines that are characterised therein that the tool is actuated by a dual-action actuator that is powered by a device that pressurises an operating fluid.

[0004] In particular, in the field of machining sections for fixtures and windows, the prior art uses punching machines that comprise a fixed base and a movable cross-piece fitted with many different tools designed to make openings of a wide variety of shapes that are arranged in different ways on the crosspiece in order to enable the machining of a vast range of types of workpiece by means of a single machine tool.

[0005] A first disadvantage of said prior-art punching machines is characterised therein that they enable only relatively imprecise machining to be achieved. This is mainly due to the fact that the operating fluid inside the pneumatic actuator is pressurised until said actuator is able to apply sufficient force to enable the tool to cut the sheet metal that constitutes the section. The cutting operation thus subjects the section to impulsive stress that may cause the section to shift slightly. This disadvantage is compounded by the fact that punching machines are not normally provided with devices for positioning and immobilising the sections to be machined, which sections are kept in the correct position manually during the machining phases.

[0006] A second disadvantage of prior-art punching machines is characterised therein that said impulsive stress may subject the workpieces to albeit slight deformation, which may nevertheless create products that are unsuitable for subsequent assembly.

[0007] A third disadvantage is characterised therein that the punching machines make a considerable amount of noise during the machining cycle, which noise levels may be near the maximum limits set by current legislation.

[0008] A fourth disadvantage is characterised therein that the parts that constitute the punching machine may be subjected to considerable wear due to their being frequently subjected to significant impulsive loads.

[0009] One aim of this invention is to obtain a punching machine of limited dimensions, the operation of which is simple and quiet.

[0010] Another aim of this invention is to obtain a punching machine wherein the speed of the punch stroke can be controlled so as to limit machining errors

and deformation of the workpieces.

[0011] Another aim of this invention is to obtain a punching machine that is subjected to limited mechanical stress, which as a result will have a longer working life.

[0012] In a first aspect of the invention a punching machine is provided comprising tool means arranged to punch workpieces and actuator means arranged to actuate said tool means, characterised in that said actuator means are operationally associated to speed-adjusting means arranged to adjust the forward-travel speed of said tool means.

[0013] In one advantageous version, the actuator means can consist of pneumatic actuating means.

[0014] In a preferred version, said speed-adjusting means comprise fluid-damping means.

[0015] This invention thus makes it possible to obtain a punching machine characterised therein that delivery of an operating fluid to inside the actuator means is matched by the flow of a fluid inside said speed-adjusting means, whereby the desired damping of vibrations is achieved.

[0016] Another advantage of this invention is characterised therein that a punching machine can be obtained that is characterised therein that the stress to which the workpieces and the machine tool are subjected is drastically reduced as compared to prior-art punches. Moreover, achieving greater control of the parameters that adjust the tool stroke enables deformation of the machined workpiece to be minimised or totally eliminated.

[0017] In another preferred version, the fluid damping means comprise first chamber means and second chamber means between which said fluid can be transferred, and vice versa, the first chamber means and the second chamber means are identified by further piston means arranged inside the cavity means and connected to one another by conduit means that are created in the further piston means. The conduit means are also provided with choking means arranged to impede movement of said fluid. In this way the fluid, for example, a sheet of viscous fluid such as oil, is forcibly drawn from the first chamber means to the second chamber means and vice versa, thereby enabling said speed-adjusting means to act as vibration dampers and stabilisers of the speed of forward travel of the tool means.

[0018] In another preferred version, said speed-adjusting means are positioned inside the actuator means so that they are built into them. In particular, the actuator means comprise cylinder means that are linked to piston means connected to stem means within which said speed-adjusting means are located.

[0019] As a result of this particular arrangement, the mobile fluid inside said speed-adjusting means is efficiently cooled, because it is touched by the masses of operating fluid that at each cycle of the actuator means are inserted into the cylinder means and are then expelled from said cylinder means.

[0020] In another preferred version, said speed-ad-

justing means are positioned upstream or downstream of the actuator means and are aligned on the actuator means in order to obtain a serial connection.

[0021] In another preferred version, said speed-adjusting means are positioned alongside the actuator means whereby a longitudinal axis of said speed-adjusting means is placed parallel to the longitudinal axis of the actuator means.

[0022] In a second embodiment of this invention, a punching machine comprising support means on which the workpieces are placed and mobile crosspieces to bring up to and take away from said support means, said crosspiece means being linked to tool means arranged to punch said workpieces, characterised therein that between said support means and said crosspiece means said speed-adjusting means are positioned that adjust the forward travel speed of said tool means.

[0023] In a preferred version, said speed-adjusting means comprise fluid damping means.

[0024] This embodiment of the invention enables existing punching machines to be modified by applying to the latter commercially available speed-adjusting means, whereby the punching machines are less subject to stress and instances of damage to the workpieces during machining are limited.

[0025] Said solution is albeit economically less advantageous than the previously described solution and is characterised therein that said speed-adjusting means are linked to the actuating means arranged to actuate the tool means, nevertheless, it enables good results to be achieved without punching machines' having to be replaced that the operator already possesses.

[0026] In order that the invention may be clearly and completely disclosed, by way of examples that do not limit the scope of the invention, reference will now be made to the accompanying drawings, wherein:

Figure 1 is a section diagram of a vertical plane of the actuating means of a punching machine, according to the invention, showing a version that is characterised therein that said speed-adjusting means are inserted inside the actuating means;

Figure 2 is a section, like that of Figure 1, showing another version of the punching machine, according to the invention, that is characterised therein that the actuating means and said speed-adjusting means are serially arranged;

Figure 3 is a section like those shown in Figures 1 and 2 that shows a further version of the punching machine, according to the invention, characterised therein that said speed-adjusting means have a parallel arrangement;

Figure 4 is a section like that of Figure 1 that has been enlarged and drawn in greater detail.

[0027] Figures 1 and 4 show pneumatic actuating means that are arranged to actuate the tool of a punching machine and comprise piston means 2 that move

inside the cylinder means 3. The pneumatic actuating means 1 are double-action and have first intake means 16a for the entry of the air, which means are created in the bottom wall 16 of the cylinder means 3 and second intake means 17a for the movement of the air, which means are created in the wall 17 of the cylinder means 3.

[0028] The pneumatic actuating means 1 are provided with adjusting means 11 that control the forward travel speed of said tool and comprise further piston means 6 that slide along the relative chamber means 5. The further piston means 6 divide the chamber means 5 into first chamber means 7 and second chamber means 8 that are connected by conduit means 9 of unvarying dimensions that are created in the further piston means 6.

[0029] One version that is not illustrated is characterised therein that the dimensions of the conduit means can be adjusted to enable the flow of oil to be adjusted that flows through them.

[0030] The interior of the first chamber means 7 contains a viscous fluid 10, such as oil.

[0031] The further piston means 6 comprise shank means 6a that are fixed to the bottom wall 16, whereby the further piston means remain in place during operation of the actuating means 1.

[0032] The chamber means 5 are housed inside the stem means 4, which are connected to the piston means 2 to guide its stroke inside the cylinder means 3. The control means 11 are thus contained inside the actuating means 1, and in particular inside the stem means 4, thereby enabling a particularly compact punching machine of limited dimensions to be achieved. A seal 6b positioned in a seat 6c created in the further piston means 6 ensures the hydraulic seal between the further piston means 6 and the relative chamber means 5.

[0033] When pressurised air is inserted, via the first intake means 16a, into the region 3a of the cylinder means 3, the piston means move in the direction indicated by arrow F. The subsequent sideways movement of the stem means 4 ensures that the viscous fluid 10 is progressively transferred by the first chamber means 7 to the second chamber means 8 through the conduit means 9. The narrow diameter of the conduit means 9 makes it act as choking means on the viscous fluid 10, which thus tends to flow at greatly reduced speed, thereby enabling the adjusting means 11 to act as vibration dampers.

[0034] The adjusting means 11 are assembled by placing the piston means 2 in the top end-of-stroke position, namely by making their surface 2a make contact with the wall 2b of the piston means 3, thereby delivering the viscous fluid 10 through feed pipes 12 and then closing the feed pipes 12 by means of the screws 13.

[0035] Figure 2 shows pneumatic actuating means 1 arranged to actuate the tool of a punching machine to which adjusting means 11 are linked that are basically constructed as per Figures 1 and 4.

[0036] As Figure 2 shows, the shank means 6a are fixed by a threaded means 18 to the piston means 2 and

consequently the further piston means 6 are aligned on the piston means 2 and move with them. The chamber means 5 are arranged inside the casing means 14 that are located outside the cylinder means 3 on the bottom wall 16.

[0037] Figure 3 shows the pneumatic actuating means 1 arranged to actuate the tool of a punching machine, to which means the adjusting means 11 are linked in parallel, which adjusting means 11 are basically constructed as per Figures 1, 2 and 4.

[0038] The shanks means 6a are joined to the stem means 4 by a bar 18, whereby axis A of the pneumatic actuating means 1 and axis B of the further piston means are parallel and arranged in a vertical direction.

[0039] The further piston means 6 are actuated to run inside further casing means 15 that are joined to the top wall 17, which casing means are arranged outside cylinder means 3 and to the side of the cylinder means 3.

Claims

1. Punching machine, comprising tool means arranged to punch workpieces and actuating means (1) arranged to actuate said tool means, **characterised in that** said actuating means (1) are operationally associated to speed-adjusting means (11) arranged to adjust the forward-travel speed of said tool means.
2. Punching machine according to claim 1, wherein said speed-adjusting means (11) comprise fluid means (10).
3. Punching machine according to claim 1, or 2, wherein said speed-adjusting means (11) comprise cavity means (5) within which sliding piston means (6) are fitted.
4. Punching machine according to claims 2 and 3, wherein said piston means (6) identify said cavity means (5) first chamber means (7) and second chamber means (8) designed to receive said fluid means (10).
5. Punching machine according to claim 4, wherein said further piston means comprise conduit means (9) arranged to permit the transfer of said fluid means (10) from said first chamber means (7) to said second chamber means (8), and vice versa.
6. Punching machine according to one of the previous claims, wherein said actuating means (1) comprise piston means (2) moving inside cylinder means (3).
7. Punching machine according to claim 6, wherein said actuating means (11) in addition comprise stem means (4) arranged to guide the stroke of said pis-

ton means (2) inside said cylinder means (3).

8. Punching machine according to claim 7, when dependent on claim 3, wherein said cavity means (5) are cut inside said stem means (4).
9. Punching machine according to one of the claims from 6 to 8, when dependent on claim 3, wherein said piston means (6) are fixed to said cylinder means (3).
10. Punching machine according to claim 7, when dependent on claim 3, wherein said piston means are fixed to said stem means (4) and aligned on them.
11. Punching machine according to claim 10, wherein said chamber means (5) are arranged inside casing means (14) located outside said cylinder means (3) and fixed to them.
12. Punching machine according to claim 7, when dependent on claim 3, wherein said piston means (6) are fixed to said stem means (4) in such a way that the respective axes (A, B) are parallel to one another.
13. Punching machine according to claim 12, wherein said chamber means (5) are arranged inside further casing means (15) located to the side of said cylinder means (3) and fixed to them.
14. Punching machine, comprising support means designed to support the workpieces and mobile crosspiece means that are brought up to and removed from said support means, said crosspiece means being linked to tools means arranged to punch said workpieces, **characterised** therein that between said support means and said crosspiece means said speed-adjusting means (11) are placed that are designed to adjust the speed of forward travel of said tool means.
15. Punching machine according to claim 14, wherein said speed-adjusting means (11) comprise fluid means (10).
16. Punching machine according to claim 14, or 15, wherein said speed-adjusting means (11) comprise cavity means (5) in which sliding piston means (6) are fitted.
17. Punching machine according to claims 15 e 16, wherein said piston means (6) identify in said cavity means (5) first chamber means (7) and second chamber means (8) designed to receive said fluid means (10).
18. Punching machine according to claim 17, wherein

said piston means comprise conduit means (9) arranged to enable said fluid means (10) to transfer from said first chamber means (7) to said second chamber means (8), and vice versa.

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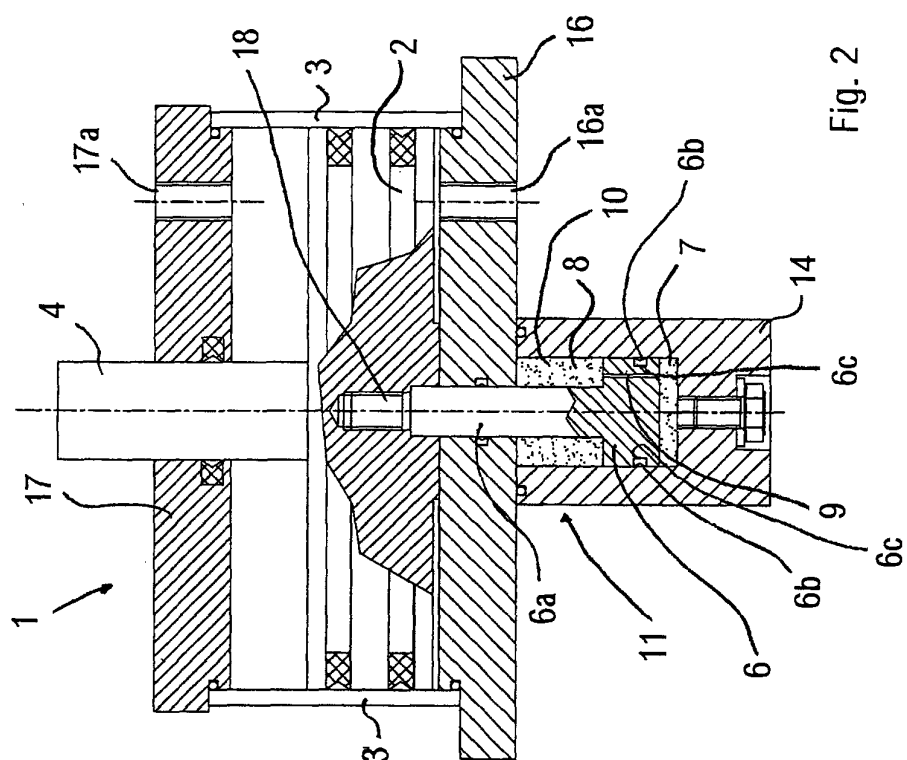


Fig. 2

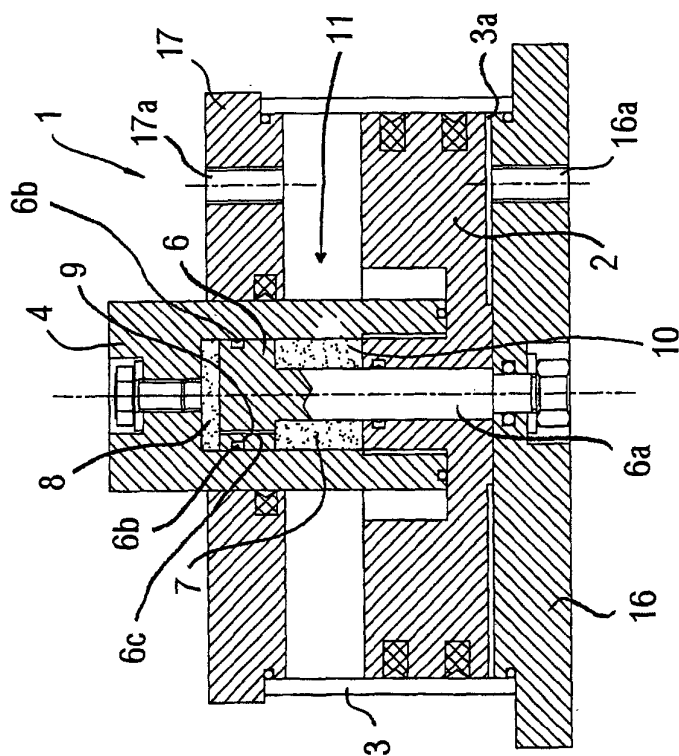


Fig. 1

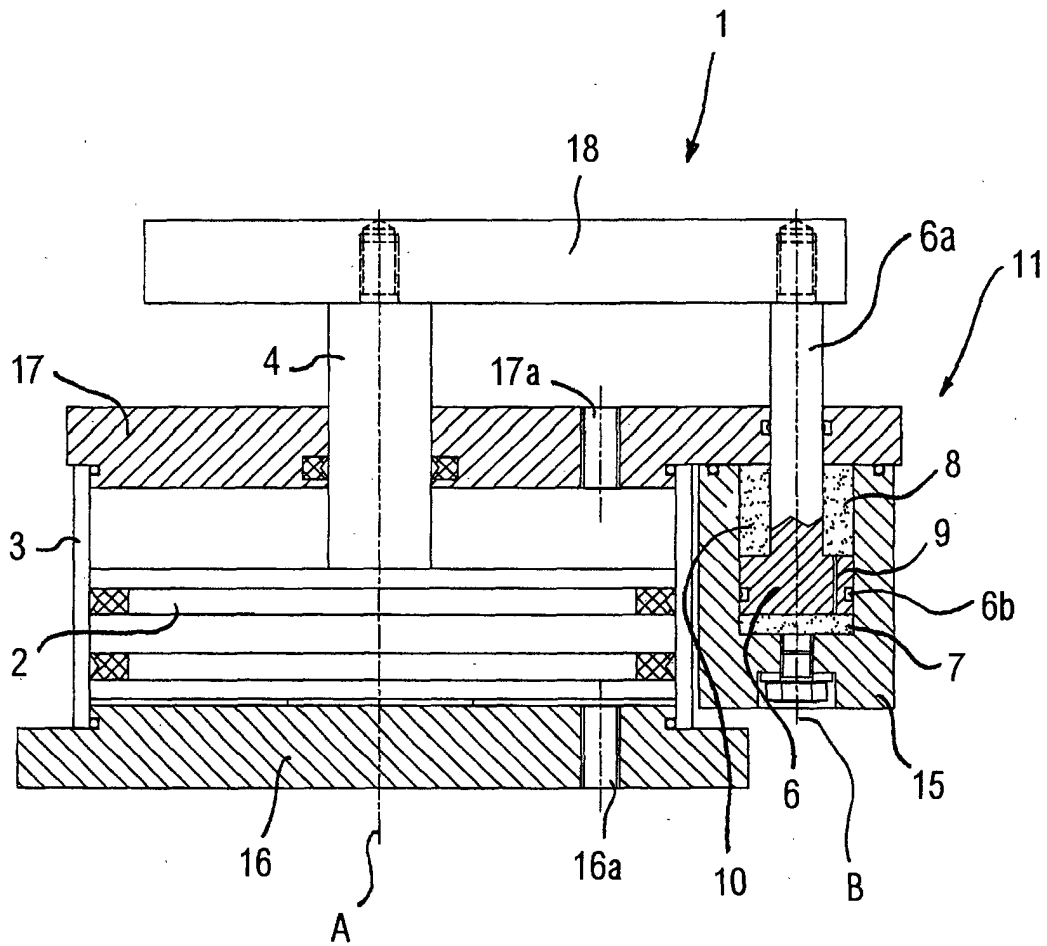


Fig. 3

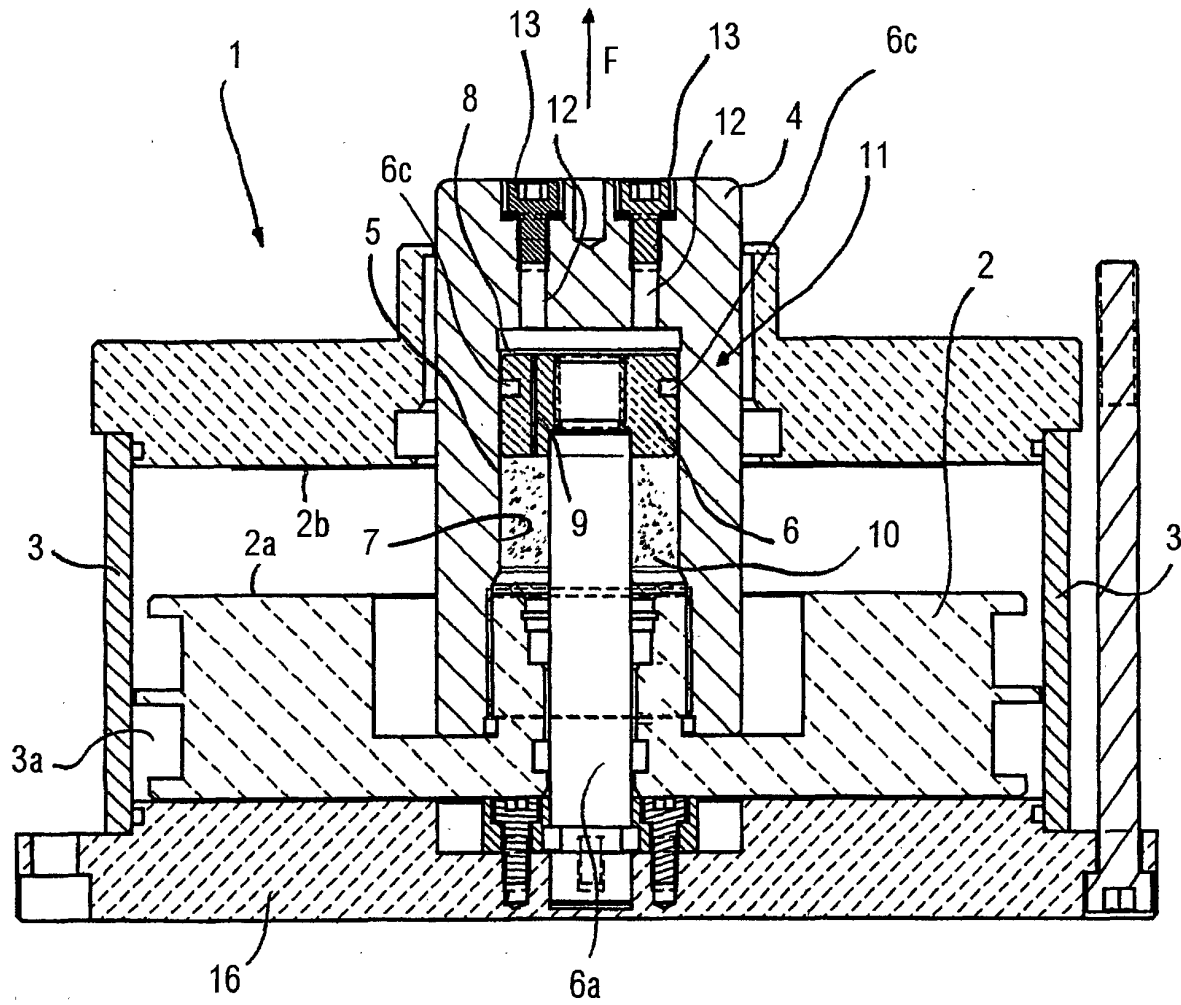


Fig. 4