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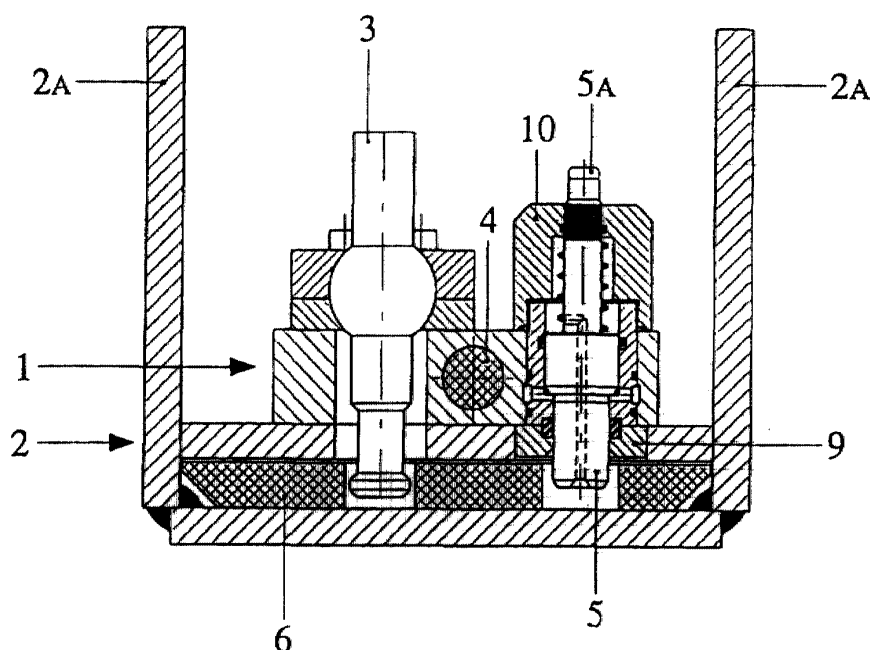
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(54) **Device for quick engagement and disengagement of the excavating tool in hydraulic excavators**

(57) The quick coupling device comprises a bolt element (6) acting as a locking element that is pushed constantly into the engaged condition by springs (7) and in the opposite direction by the temporary interventions of a hydraulic jack (4). The bolt element (6) is provided with two holes (6A,6B) adapted to receive, one the end

of an emergency lever (3) for emergency manual disengagement and the other one a safety pin (5) which is retained in the respective hole (6B) by the thrust of a spring. The safety pin (5) can be retracted both hydraulically and manually, at a protruding hook end (5A) thereof with which a lever (11) can be engaged when necessary.

Fig. 8



EP 1 138 833 A1

Description

[0001] Hydraulic excavators are machines equipped with a strong, articulated or telescopic arm which ends with a shovel or other excavating tool.

[0002] Depending on the orientation of the excavating tool, excavators are defined as face shovels or backhoes. In the first case, i.e., face shovels, the tool is directed outward and excavates by moving away from the machine; in the second case, i.e., backhoes, the tool

[0003] In both cases, the possibility to replace the excavating tool increases the versatility of these machines, since shovels for light materials and for dense materials, shovels for excavating ditches, special hydraulic hammers for breaking layers of rock and paving, clamshell or orange-peel buckets for excavating wells, extensions for lengthening the arm, magnets and buckets for handling metallic scrap, skeleton shovels for lifting stones and gravel, et cetera, are available.

[0004] For the very purpose of allowing interchangeability of the excavating tool, the arm of the excavator is equipped with an engagement or coupling device which can be operated manually in some cases and hydraulically in others and generally uses a bolt-like element which tends to protrude, by being pushed by appropriately provided springs, from the front opening of a box-like body shaped at the rear end so as to engage a pin of the excavating tool before the connection is completed by the insertion of said bolt element in an appropriately provided seat of said tool.

[0005] When the device for engaging the tool to the excavator is of the manually-operated type, the operator acts directly on said device in order to achieve, by means of a lever, the temporary retraction of the bolt element, which is pushed constantly in the opposite direction by its own springs. Clearly, such an intervention is necessary particularly for disengaging the tool from the arm of the excavator, since coupling is almost always obtained by snap action. However, in both cases the direct intervention of the operator is still necessary, since the safety retainer meant to prevent the accidental disengagement of the excavating tool is of the purely mechanical type and therefore requires manual actuation both for insertion after each engagement of the tool with the arm of the excavator and for extraction, which necessarily must precede the disengagement or uncoupling and removal of said tool from the excavator.

[0006] Apart from the effect of such manual interventions on the time required to engage and disengage the excavating tool, one must also consider that unfortunately nothing prevents the excavator from working even if the safety retainer for preventing accidental disengagement of the excavating tool has not been inserted.

[0007] Such a safety retainer, i.e., a retainer which is again of the mechanical type and is manually operated, is also present in excavators whose device for engaging

and disengaging the excavating tool is equipped with a jack connected to the hydraulic system of the excavator and controlled from the driver's seat whenever it is necessary to temporarily retract the bolt, which is constantly pushed in the opposite direction by its own springs.

[0008] Clearly, the advantage of such a device is relative, since the operator, despite being spared from having to perform the lever-like actuation of the bolt, is still forced to leave the driver's seat of the excavator to act manually on the safety device both after each engagement of the excavating tool and before each removal of said tool.

[0009] Actually, there are some versions in which not only the bolt but also the corresponding safety retainer is actuated hydraulically, but the operator cannot check the correct operation or failure of said retainer, and in case of problems or malfunctions affecting the hydraulic system of the excavator or just of the excavating tool, the impossibility to mechanically remove said tool prevents its transfer to another excavator in the first case and prevents simple replacement thereof with a similar tool in the second case.

[0010] In view of these limitations and drawbacks, the aim and objects of the present invention can be summarized as follows:

- to allow the operator to perform hydraulically all the operations for engaging and disengaging the excavating tool and, therefore, from the driver's seat of the excavator;
- to compensate for distraction or negligence of the operator by means of an automatic coupling and uncoupling of the safety retainer usable to prevent the accidental disengagement of the excavating tool;
- to allow in emergency conditions, or in case of problems or failures of the hydraulic system of the excavator or of the excavating tool alone, the manual actuation of the engagement device of said tool and of the corresponding safety retainer.

[0011] The solutions devised to achieve this aim and these objects are described hereinafter with the aid of eight drawings, which are given merely as a non-limitative example, since they are limited to a single preferred embodiment of the invention, and wherein:

Figure 1 is a perspective view of the device;
 Figures 2 and 3 are, respectively, a perspective view of the upper body and a perspective view of the lower body of the device prior to their assembly;
 Figures 4 and 5 are a front view and a longitudinal sectional view respectively, the latter taken along the plane X-X, of the entire device;
 Figures 6 and 7 are top views of the upper body and of the lower body of the device prior to their assembly;
 Figures 8 and 9 are cross-sectional views of the device, taken along the plane Y-Y thereof and referred

to Figures 5, 6 and 7, with the safety retainer inserted and, respectively, extracted;
 Figures 10, 12 and 14 are sequential views illustrating three steps of the engagement of the shovel with an excavator arm provided with the new device;
 Figures 11, 13 and 15 are detailed longitudinal sectional views of the device in the corresponding steps shown schematically by Figures 10, 12 and 14.

[0012] With reference to the accompanying drawings, the device according to the invention, generally designated by the reference numeral 100, generally consists of two bodies: an upper body 1, at which the manual actuation lever 3, the hydraulic jack 2 and the pin 5 of the safety retainer are supported; and a lower body 2, on the two sides of which the perforated lugs 2A protrude parallel to each other for connection to the articulated arm 12 of the excavator and to the actuation jack of the shovel 13; the body 2 has substantially the shape of a flat box, open at the front and from which the bolt 6 which is slidably movable therein can protrude, said body being provided at the rear thereof with a recess 2B by means of which it straddles the retainer 13A of the excavating tool 13 for the mutual rotation of the two elements (as in Figures 7 and 8) until engagement is completed.

[0013] Said bolt 6, being pushed by a plurality of helical springs 7, constantly tends to protrude from the front side of the lower body 2 to the extent allowed by the wing 8 which is fixed on the bolt and by the opening 2C, which is provided in the upper part of the box in which said bolt slides, and determines the stroke of said bolt and allows said wing 8 to enter the cavity 1A of the upper body 1 where when necessary it can be pushed by the hydraulic jack 4 to retract in contrast with the springs 7.

[0014] The bolt 6 is also provided with circular holes 6A and 6B for accommodating, respectively, the manual actuation lever 3 and the pin 5 of the safety retainer, both of which are supported in the upper body 1 of the engagement device and reach said holes through the openings 2D and 2E provided in the upper wall of the box in which the bolt slides.

[0015] The opening 2D is elongated in the direction in which the bolt moves, as required by the variations in the inclination of the lever 3, stably engaged in the hole 6A of the bolt and pivoted for this purpose to the upper body 1 with a sort of ball-and-socket joint.

[0016] The opening 2E is instead circular in shape so as to accommodate the guiding bush 9 of the pin 5, which in turn engages the hole 6B of the bolt when such hole is concentric to the opening 2E (Figure 7), that is only when the bolt 6 has completed its engagement stroke.

[0017] As shown also by Figures 6, 8 and 9, the pin 5, acting as a safety retainer and therefore preventing the accidental disengagement of the shovel or of any other tool applied to the arm of the excavator, is in practice the piston of a sort of single-acting hydraulic jack

and is kept extended, i.e., so as to act as a retainer, by a return spring the thrust force of which is significantly lower than the force of the two or more springs 7 that tend to keep the bolt 6 closed or in any case protruding from the box-like body 2.

[0018] Accordingly, since said jack is connected to the hydraulic system so that the retraction of the piston or pin 5 occurs by means of the same oil causing the extension of the jack 4 and the retraction of the bolt, the required retraction of the pin 5 before the retraction of the bolt 6 being determined by the different thrust force of the springs that act on the two elements.

[0019] When the oil pressure ceases, said springs return the bolt to the protruding engagement position, and the return spring pushes the pin 5 to the position in which it locks said bolt by entering the hole 6B that arranges itself at the pin.

[0020] A possible variation for obtaining the same automatic sequence in the retraction of the pin-piston 5 and of the bolt 6 regardless of the thrust force of the respective springs consists in making the oil of the hydraulic system flow to the jack 4 of the bolt through a passage which is blocked by the pin-piston 5 until it is retracted completely by means of said oil.

[0021] As disclosed, the device according to the invention has been devised so that it can be actuated both hydraulically and manually. For manual intervention, it is possible to act on the lever 3 with an extension pipe, whereas as regards the safety retainer, at the top of the pin-piston 5 a hook 5A is provided where, when necessary, it is possible to engage a lever 11 by means of which said pin-piston can be easily lifted and also blocked in the retracted position for all the time required by the operator to manually retract the bolt 6.

[0022] As regards the pin-piston 5, it should be noted that the portion 5B thereof lying directly below the hook 5A and protruding with said hook from the bush 10 when the pin-piston is in the retracted position, is red in color, so that the operator can detect any anomaly even from a distance. In practice, if the red collar remains visible after the excavating tool has been engaged manually or hydraulically, this means that the engagement has not been performed correctly and/or in any case the safety retainer has not been inserted.

[0023] Finally, it should be added that the device according to the invention, without altering the general characteristics that have been illustrated and described, might be susceptible of modifications and variations which are in any case within the scope of the appended claims.

[0024] The disclosures in Italian Patent Application No. F02000A000006 from which this application claims priority are incorporated herein by reference.

[0025] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on

the scope of each element identified by way of example by such reference signs.

Claims

1. A device for quick engagement and disengagement of an excavating tool in hydraulic excavators, of the type to be applied to the arm (12) of the excavator in order to engage the excavating tool by way of a bolt-like element (6) which is pushed by adapted springs (7) accommodated in a same box-like body (2), said bolt element (6) being lockable in an engaged condition by interference with an element (5) that lies transversely to its motion direction, **characterized in that** said bolt element (6) and the corresponding locking element (5) are provided so as to be actuatable in sequence hydraulically and/or mechanically in emergency cases, so as to prevent any failure or anomaly in the hydraulic system of the excavator alone, or of the excavating tool alone, hinder separation thereof and therefore immediate use of the still efficient part.
2. The device according to claim 1, **characterized in that** the bolt element (6), in particular the element that is pushed constantly into the engaged condition by said appropriately provided springs (7) and in the opposite direction by temporary interventions of a jack (4) connected to the hydraulic system of the excavator, is provided with two holes (6A, 6B) or other engagement elements so as to receive in one of them the end of the lever (3) for emergency manual disengagement and in the other one the safety pin (5) which, retained thereat by the thrust of a spring, can be retracted both hydraulically and manually, since it also protrudes outside the device.
3. The device according to the preceding claims, **characterized in that** the safety pin (5), constituting the locking element adapted to prevent accidental disengagement of the excavating tool or of any other implement engaged by the device on the excavator arm (12), is the piston of a single-acting hydraulic jack elastically biased so as to protrude in a safety condition by a spring the thrust force whereof is significantly lower than the thrust force of the set of springs (7) that keep the bolt element (6) engaged, said hydraulic jack being connected to the hydraulic system so that the retraction of the safety pin-piston (5) occurs due to the hydraulic pressure causing the elongation of the actuation jack (4) of the bolt element (6), the different thrust force between said springs (7) and the spring of the safety pin (5) forcing the safety pin-piston (5) to retract before the bolt element (6).

4. The device according to the preceding claims, **char-**

acterized in that it is generally constituted by two bodies:

- an upper body (1), in which the manual actuation lever (3), the hydraulic jack (4) and the pin (5) of the safety retainer are supported;
- a lower body (2), on the sides of which the perforated lugs (2A) protrude parallel to each other for connection to the articulated arm (12) of the excavator and to the jack actuating the shovel (13), said body (2) consisting of a sort of flat box open at the front and from which the bolt (6) sliding therein can protrude, said body being provided, at the rear thereof, with a recess (2B) by means of which it can straddle the retainer (13A) of the excavating tool (13) for the mutual rotation of the two elements until engagement is completed.

5. The device according to the preceding claims, **characterized in that** the bolt (6), pushed by a plurality of helical springs (7), constantly tends to protrude from the front side of the lower body (2) to the extent allowed by the wing (8) fixed on the bolt and by the opening (2C) provided in the upper wall of the box in which the bolt slides and determines the stroke of said bolt and allows said wing (8) to enter the cavity (1A) of the upper body (1), where, when necessary, it can be pushed to retract by the hydraulic jack (4) in contrast with the springs (7).
6. The device according to the preceding claims, **characterized in that** the bolt (6) is also provided with the circular holes (6A, 6B) for respectively accommodating the manual actuation lever (3) and the pin (5) of the safety retainer, both the lever (3) and the pin (5) being supported in the upper body (1) of the engagement device reach said holes through the openings (2D, 2E) provided in the upper wall of the box in which the bolt slides.
7. The device according to claim 6, **characterized in that** the opening (2D) is elongated in the direction in which the bolt moves as required by the variations in the inclination of the lever (3) stably engaged in the hole (6A) of the bolt and pivoted for this purpose to the upper body (1), with a sort of ball-and-socket joint.
8. The device according to claim 6, **characterized in that** the opening (2E) is instead circular in shape so as to accommodate the guiding bush (9) of the pin (5), which in turn engages the hole (6B) of the bolt when said hole is concentric with the opening (2E) (Figure 7), that is only when the bolt (6) has completed its engagement stroke.
9. The device according to the preceding claims, **char-**

acterized in that in order to allow the manual removal of the safety retainer according to claim 3, a hook (5A) is provided at the top of the pin-piston (5), which can engage, when necessary, a lever (11) by means of which said pin-piston can be easily lifted and also blocked in the retracted position for as long as required by the operator to retract the bolt (6) manually.

10. The device according to the preceding claims, **characterized in that** the upper portion (5B) of the pin-piston (5), that is the portion lying directly under the hook (5A) and protruding with it from the bush (10) when the pin-piston is in the retracted position, is red in color, so as to allow the operator to visually detect any anomaly even from a distance; if the red collar is still visible after the hydraulic or manual engagement of the excavating tool, this means that the engagement has not been performed correctly and/or in any case the safety retainer has not been inserted.

11. The device according to claim 3, **characterized in that** in order to achieve hydraulically the automatic retraction of the pin-piston (5) before the retraction of the bolt (6), the oil flow to the jack (4) acting on said bolt might be controlled by flow through a passage which is blocked by the pin-piston (5) until fully retracted by said oil.

Fig. 1

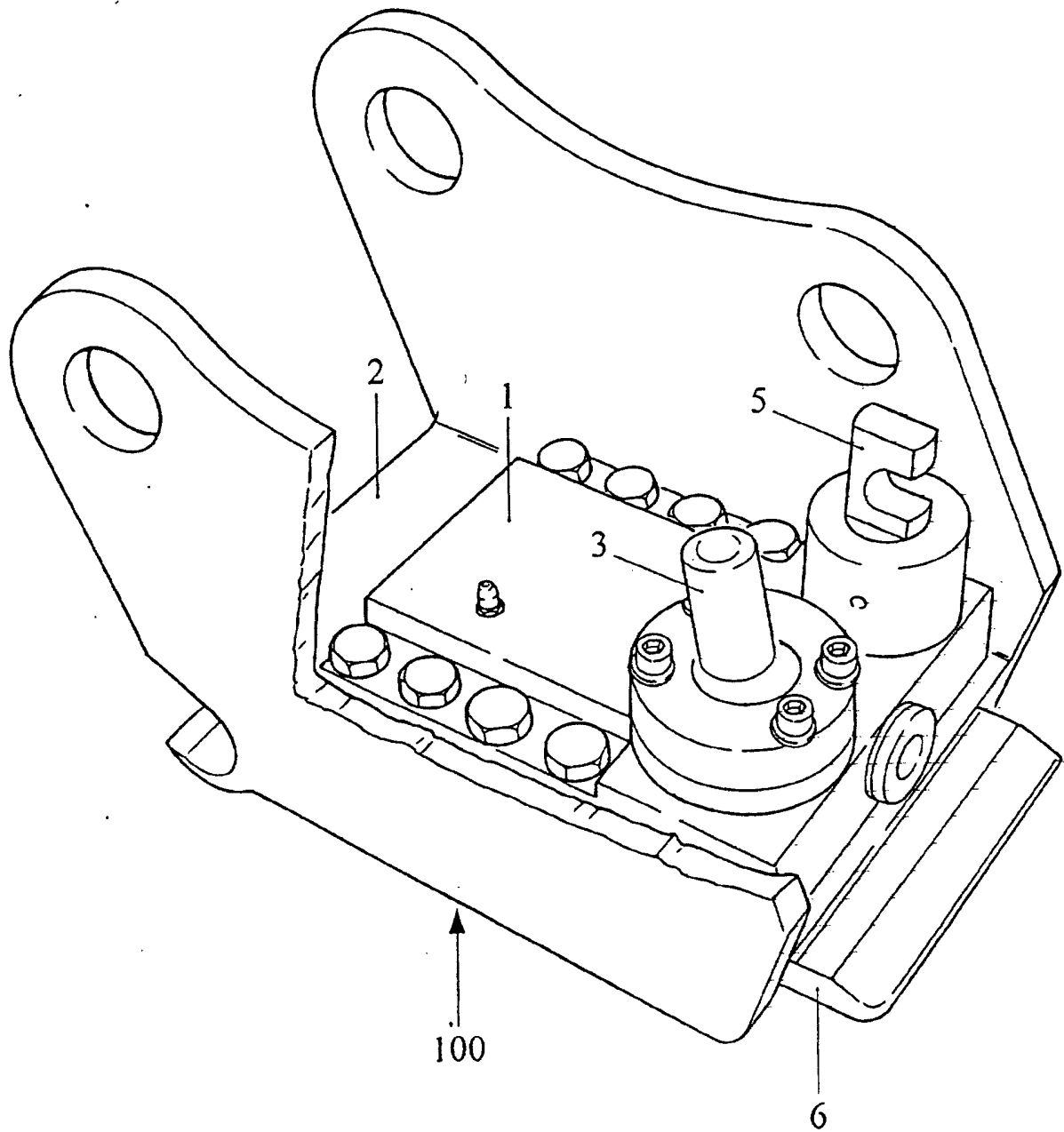


Fig. 2

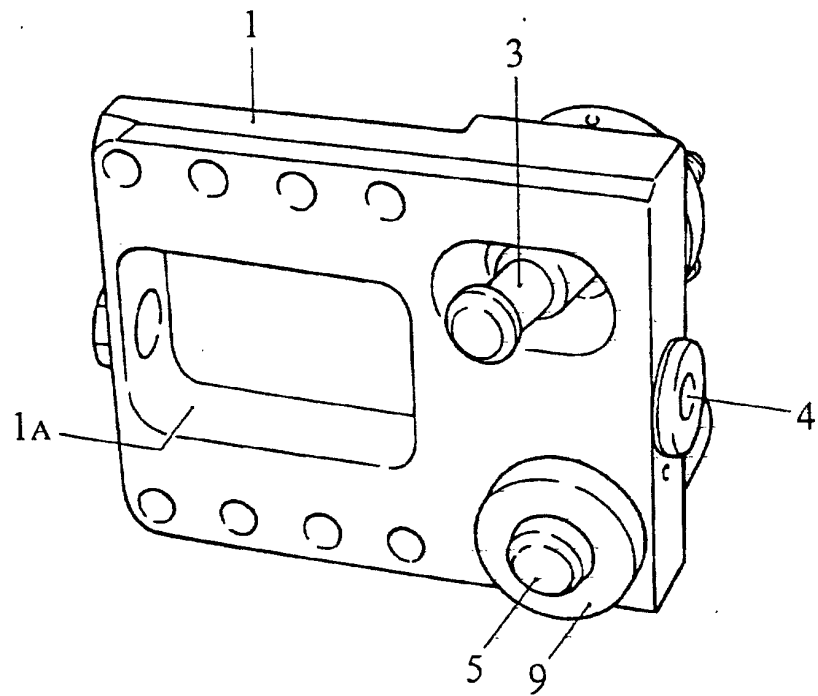


Fig. 3

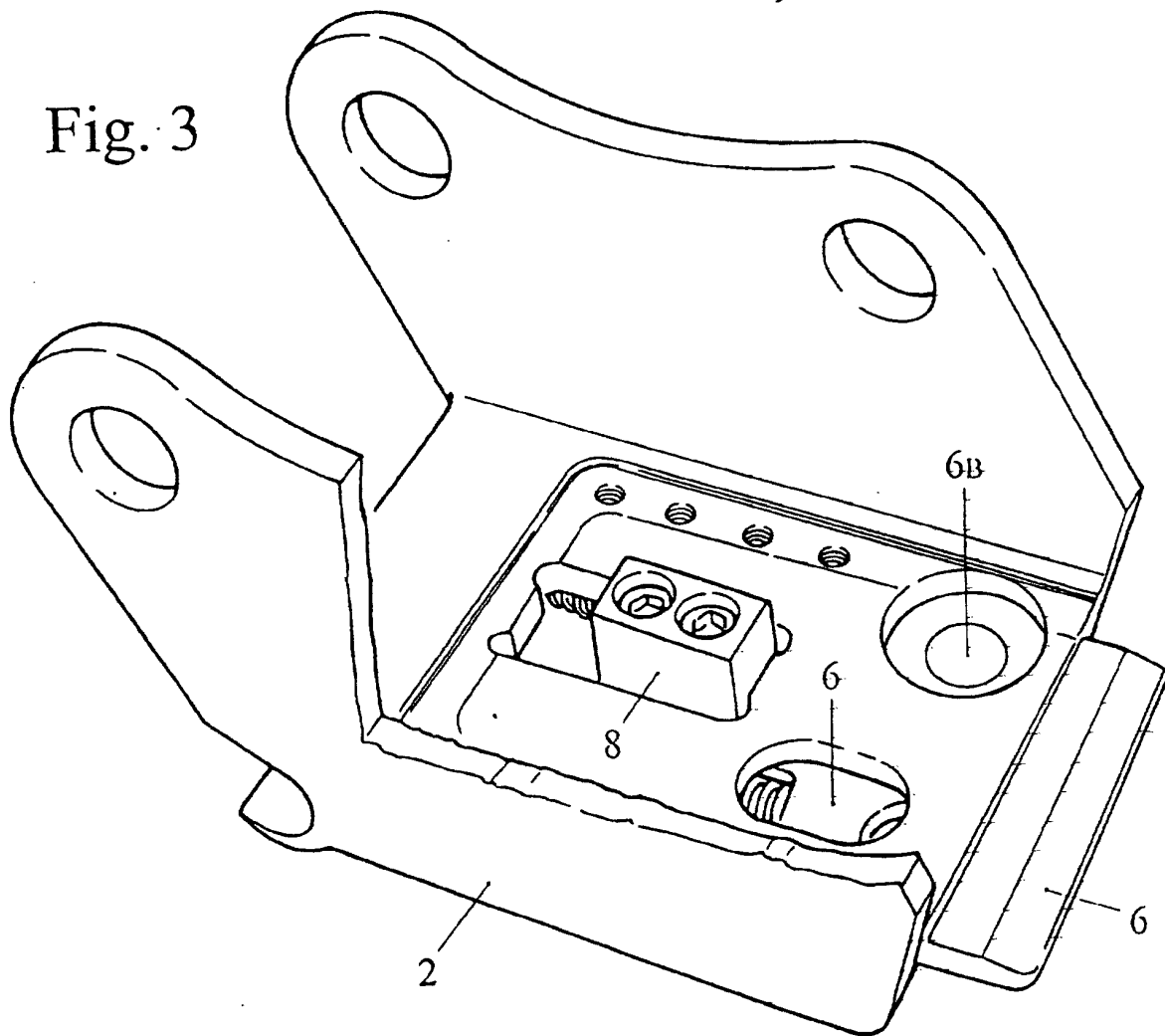


Fig. 4

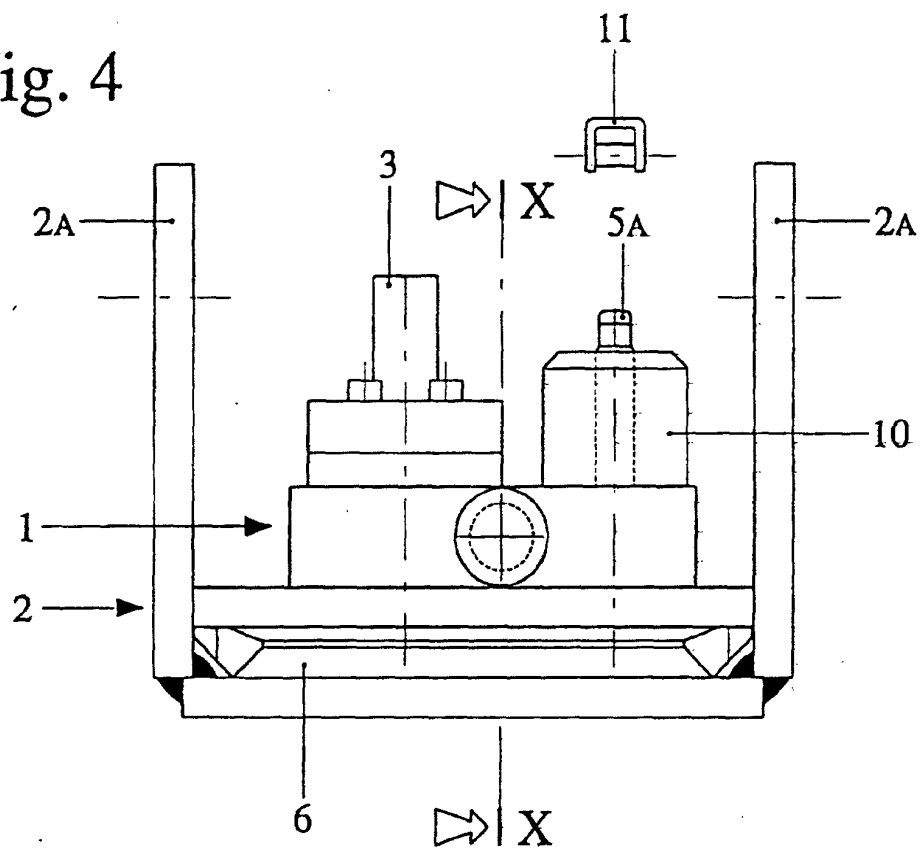


Fig. 5

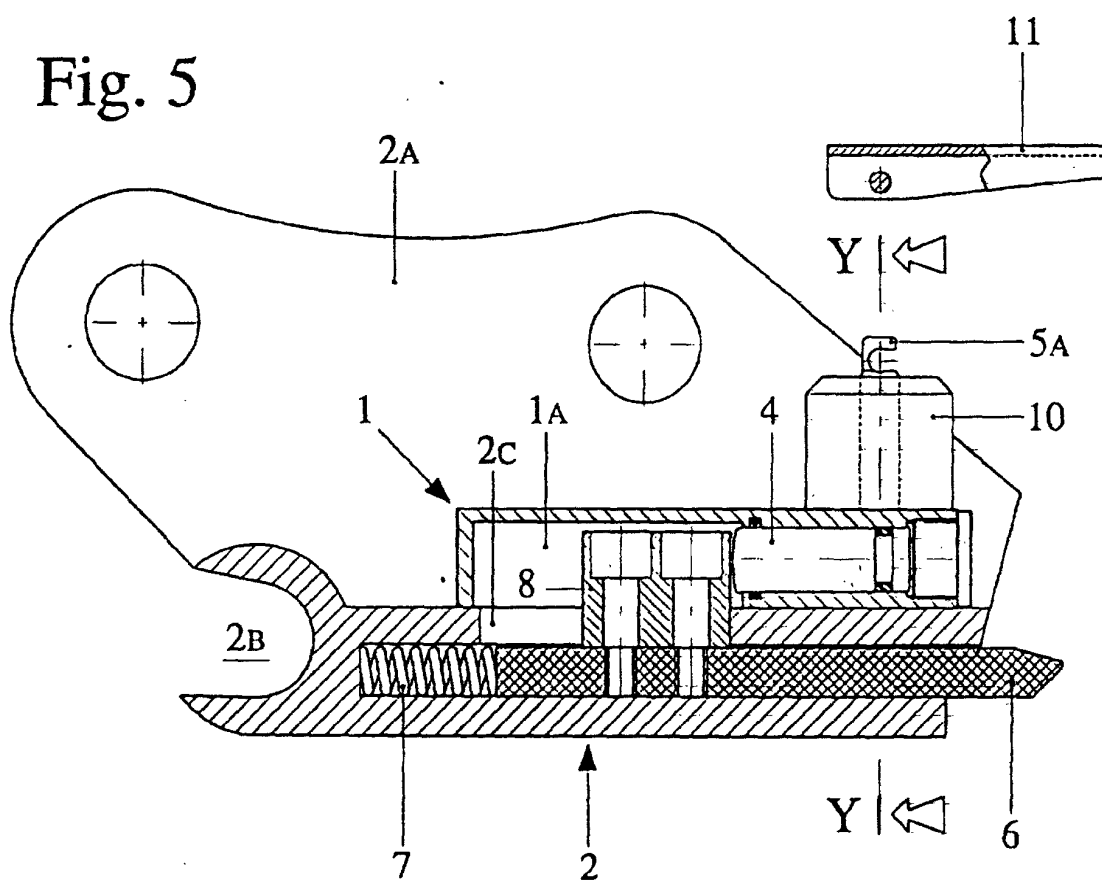


Fig. 6

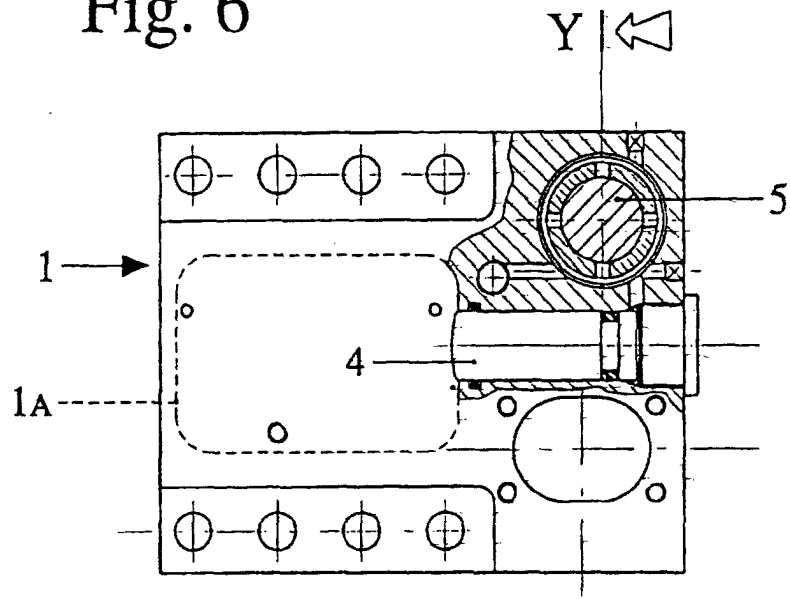


Fig. 7

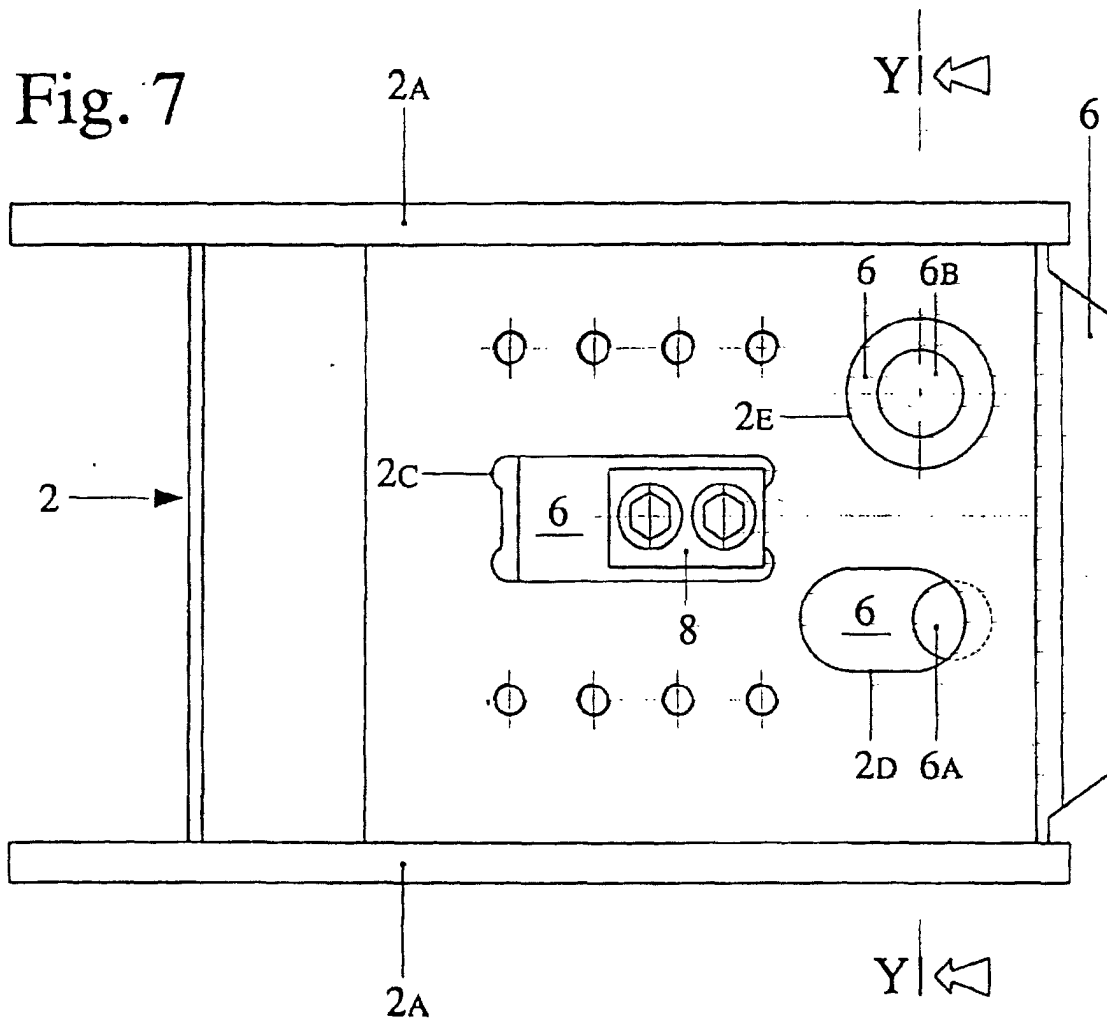


Fig. 8

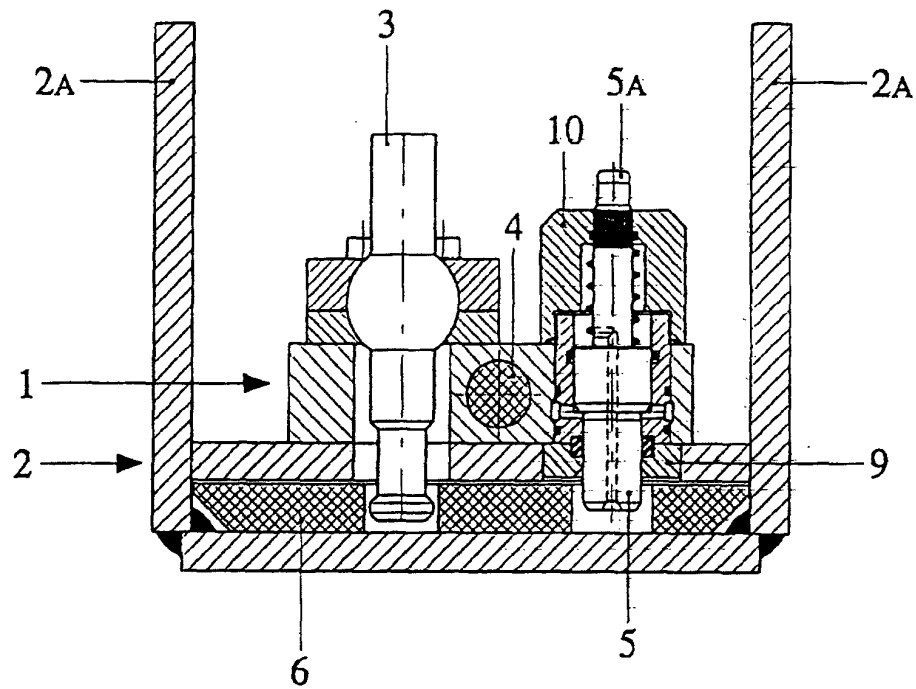


Fig. 9

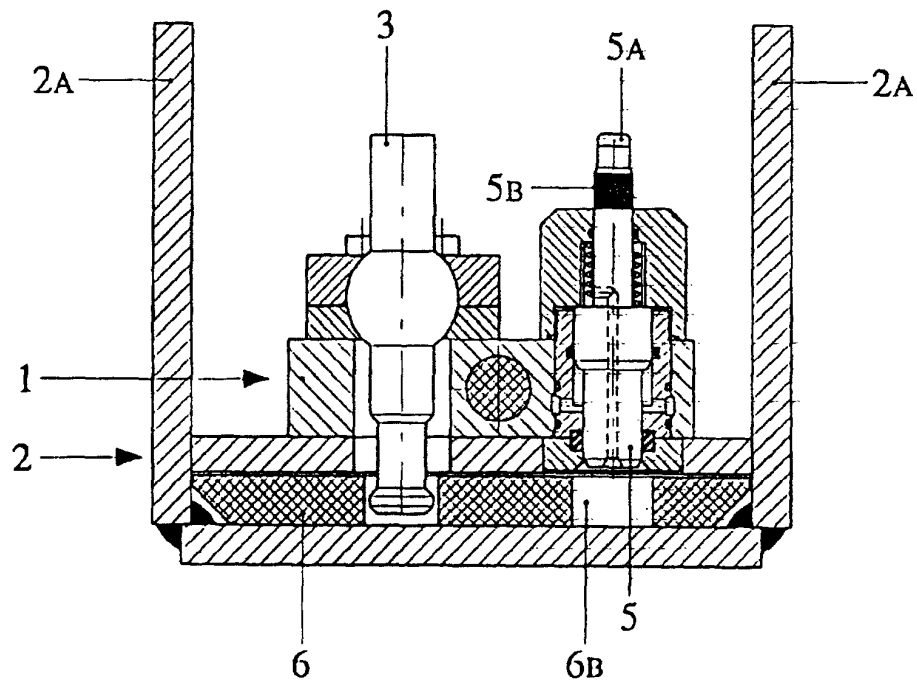


Fig. 10

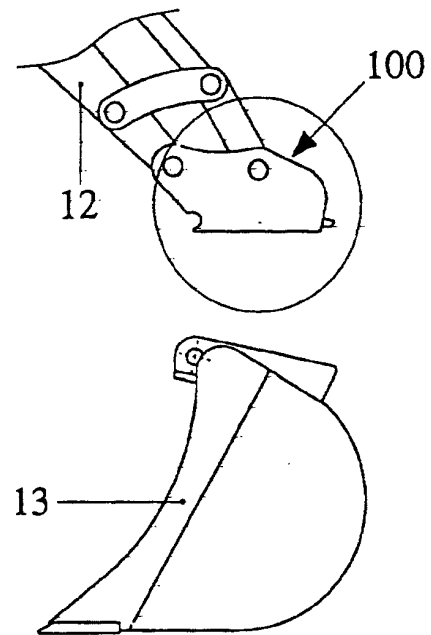


Fig. 11

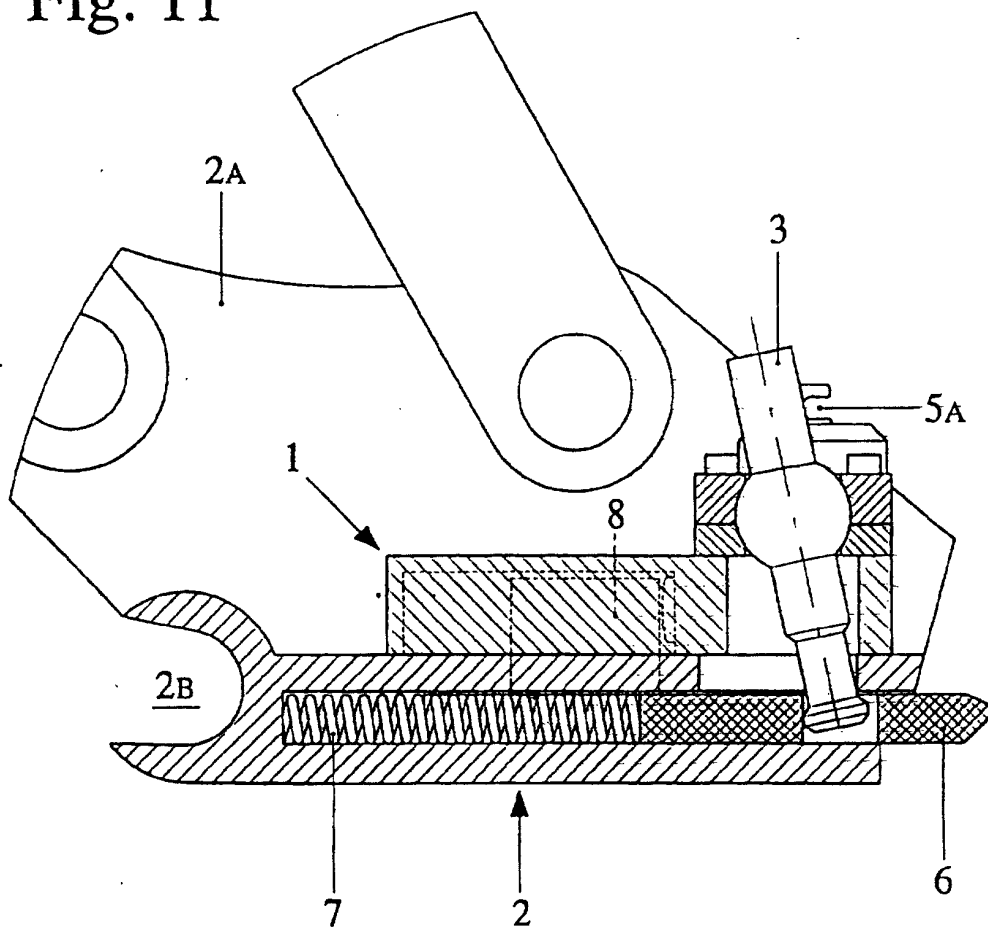


Fig. 12

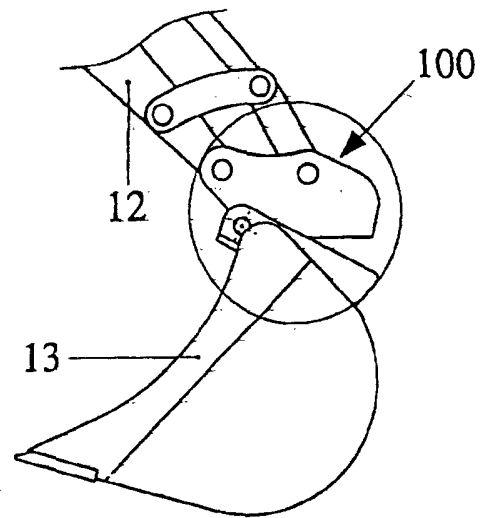


Fig. 13

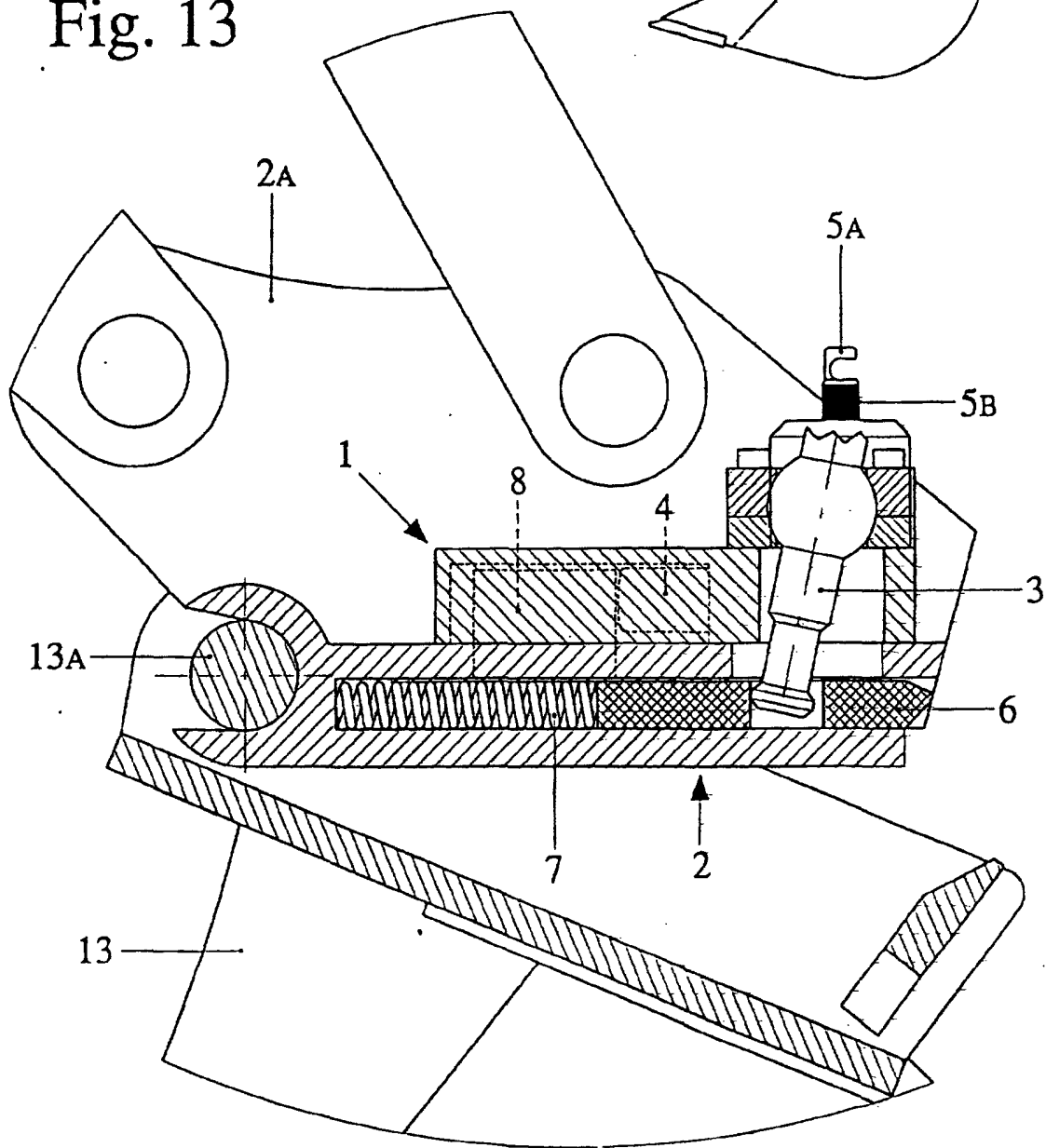


Fig. 14

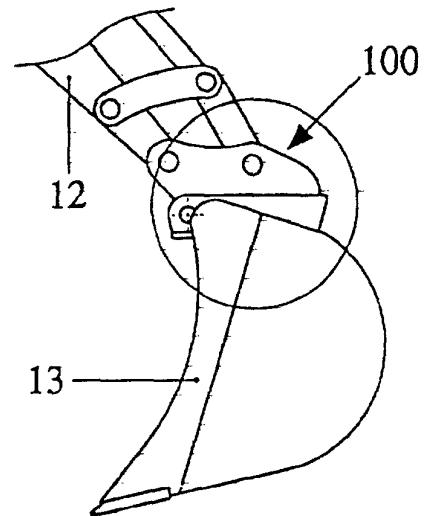
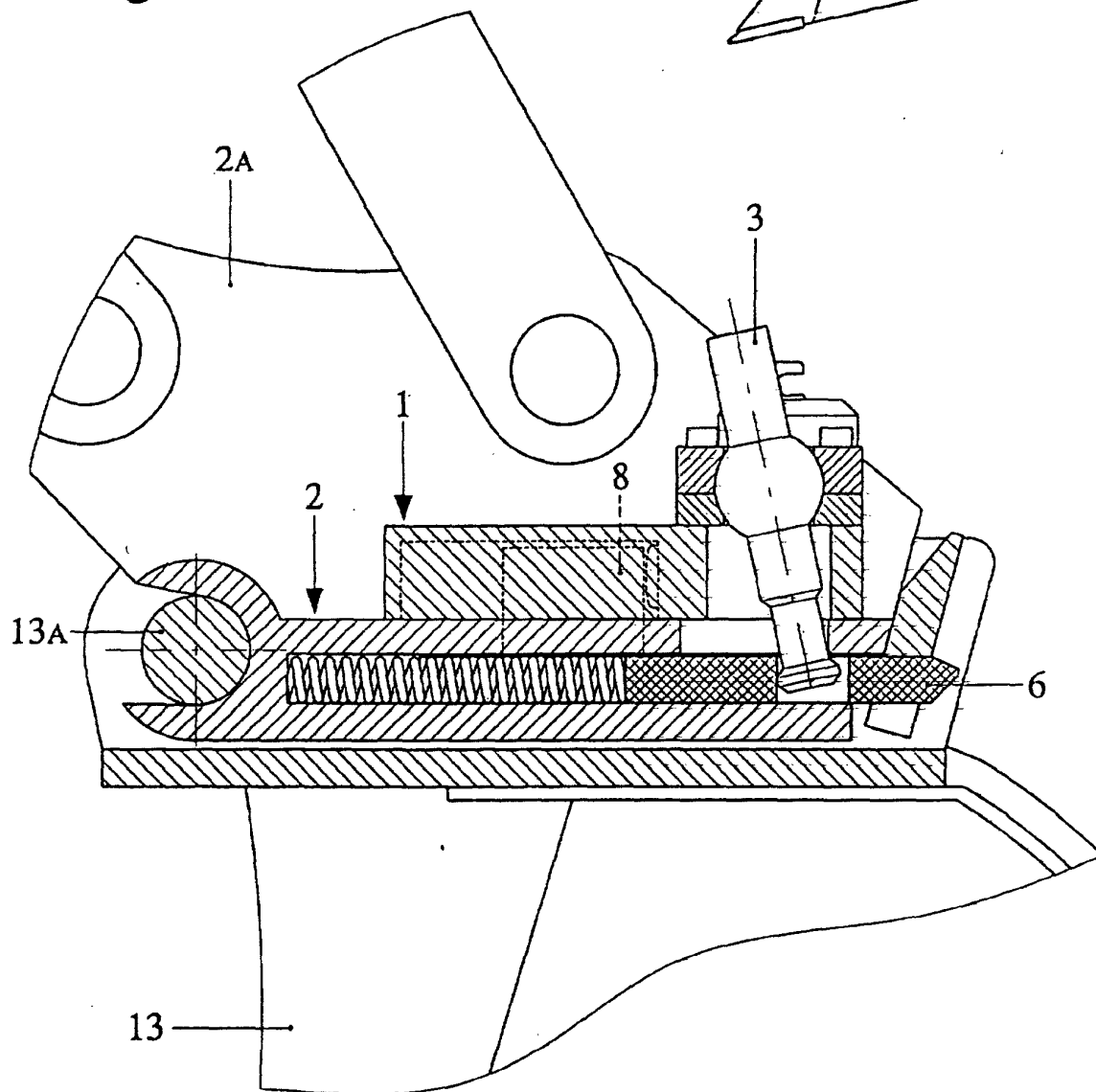


Fig. 15





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EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 June 2001	Examiner Guthmuller, J
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EP 01 10 6465

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