(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 119 834 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**18.11.2009 Bulletin 2009/47**

(51) Int Cl.:
***E02F 3/36*** *(2006.01)*

(21) Application number: **09159504.1**

(22) Date of filing: **06.05.2009**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR**

(30) Priority: **15.05.2008 IT MO20080143**

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(54) **An attachment organ for coupling a tool to an operating arm with a safety block**

(57) An attachment organ (1) for coupling a tool (100) to an operating arm (110), comprising: a frame (9), which exhibits a first transversal seating (2) and a second transversal seating (3) which are respectively predisposed for housing a first attachment pin (101) and a second attachment pin (102) of the tool (100); a locking hook (4) which is mobile with respect to the frame (9) and means for moving (10) the locking hook (4), the locking hook (4) being predisposed for closing on the first seating (2), exerting via a contact surface (4a) of the hook (4) a blocking action on the first attachment pin (101) housed internally of the first seating (2) which maintains the second attachment pin (102) blocked against a bottom surface (3a) of the second seating (3) situated opposite to the contact surface (4a) of the locking hook (4). The organ further comprises a safety block (5) predisposed to prevent a disengagement of the second attachment pin (102) from the second seating (3) in a case in which the blocking action exerted by the blocking pin (4) ceases to be active. [**Fig. 2**]

Fig. 2

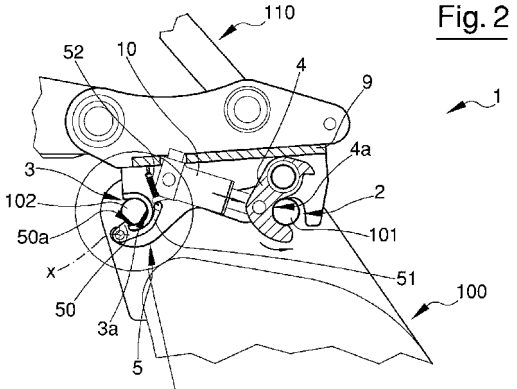
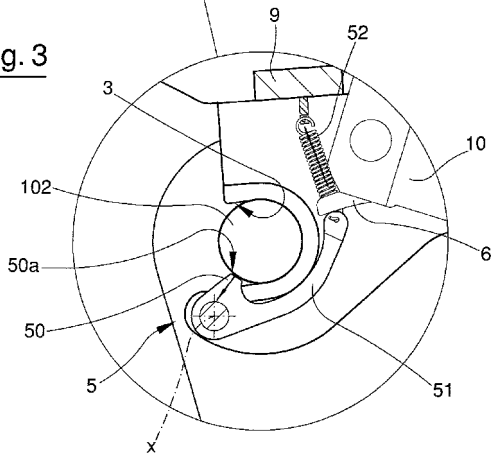



Fig. 3

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## Description

**[0001]** The invention relates to an attachment organ for coupling a tool to an operating arm.

**[0002]** Specifically, though not exclusively, organs of the above-mentioned type are usefully applied in the coupling of earth-moving tools, such as for example buckets, to articulated arms of work machines.

**[0003]** To enable a rapid and secure mounting of the tools to the articulated arms, the prior art provides attachment organs of various types.

**[0004]** In particular, they guarantee a satisfactory coupling, which can be performed especially rapidly, of rapid attachment organs of known type which exhibits two transversal seatings predisposed to receive two parallel attaching pins at the upper surface of the tool. The first of the pins is maintained in position by a hook activated by a special hydraulic or mechanical jack, which acts laterally on the pin, locking it internally of the respective seating. The action of the jack also enables the second pin to be maintained in the seating thereof; the laterally-exerted force performs traction on the associated tool, causing a pressing of the second pin against a bottom surface of the corresponding seating, which advantageously exhibits a substantially vertical portion.

**[0005]** The applicant has however noted that the above-described attachment organ, while offering undeniable advantages such as rapidity of attachment and versatility of use, might exhibit the risk of accidental unhooking of the tool in a case of a malfunctioning or breakage of the hooking system.

**[0006]** In a case of cessation of the thrust exerted by the hooking system, due to the operator's having incompetently performed his task, or possibly due to a fault in the hooking system itself, both the pins of the tool would no longer be constrained internally of the respective seatings; both the direct blocking caused by the hooking on the first pivot, and the indirect hooking due to the traction transmitted to the second pin, might be absent.

**[0007]** The main aim of the present invention is to provide an attachment organ of the described type which does not exhibit the above-described risk of unhooking.

**[0008]** An advantage of the attachment organ of the present invention derives from the high degree of flexibility of use and the rapidity of the hooking of the tool on the operating arm.

**[0009]** A further advantage of the attachment organ of the invention relates to the possibility of unhooking both the tool pins from the blocking mechanism by means of a single action of the hooking system.

**[0010]** A further advantage of the attachment organ of the invention is to simplify the mounting of a tool on the device.

**[0011]** Further characteristics and advantages of the invention will better emerge from the detailed description that follows, of a preferred embodiment thereof, described with reference to the accompanying figures of the drawings, which are provided by way of non-limiting example and in which:

figure 1 is a perspective view of the attachment organ of the present invention;

figure 2 is a view in section, with respect to the median plane, of the attachment organ of figure 1, associated to an operating arm and to a tool in an operating configuration;

figure 3 is a detailed view of the safety block illustrated in figure 2;

figure 4 is a median section of the attachment organ of figure 1 in a non-operating configuration of release of the tool.

**[0012]** With reference to the figures of the drawings, 1 denotes in its entirety an attachment organ for coupling a tool 100 to an operating arm 110, in particular for fixing a tool (for example a bucket) to an earth-moving machine of known type.

**[0013]** In the following description, the attachment organ 1 of the invention is described with reference to an ideal operating configuration thereof, shown in figure 2. This configuration is shown here instead of other possible views only for reasons of clarity of explanation; obviously the device can, according to the morphological characteristics of the elements to which it associated and the working displacements thereof, take on even radically different orientations to the one described and illustrated. Positional relations between elements identified in terms of relative height, for example by the use of words such as lower and upper, are however to be interpreted at all times with reference to the ideal configuration defined above.

**[0014]** The attachment organ 1 of the invention is thus superiorly associable to an end of an operating arm 110 and inferiorly associable to a tool 100 to be coupled to the arm 110.

**[0015]** The organ comprises a frame 9, which exhibits a first seating 2 and a second seating 3 which are transversal and predisposed respectively to house a first attachment pin 101 and a second attachment pin 102 of the tool 100 in an attached operating configuration, a locking hook 4 which is mobile with respect to the frame 9 and means for moving 10 the hook 4. As in the above-described prior art devices, the locking hook 4 is predisposed to close on the first seating 2, in the operating configuration of the attachment organ 1, exerting, through a contact surface 4a of the hook 4 a blocking action on the first attachment organ 101 housed internally of the first seating 2. The blocking action is further predisposed to maintain the second attachment pin 102 blocked against a bottom surface 3a of the second seating 3; the bottom surface 3a is opposite, at least in the attachment configuration, to the contact surface 4a of the locking hook 4.

**[0016]** In particular, the means for moving 10 the locking hook 4 comprise a hydraulic jack as in the prior art as previously described.

**[0017]** With respect to known devices, the attachment organ 1 of the present invention is **characterised in that** it comprises a safety block 5 predisposed to prevent, in the attached configuration of the organ 1, a disengagement of the second attachment pin 102 from the second seating 3 in case of cessation of the blocking action exerted by the locking hook 4.

**[0018]** The safety block 5 enables the aim of the present invention, as specified herein above, to be achieved, i.e. to prevent the accidental unhooking of the tool 100 coupled to the operating arm 110. Even in a case where there is a fault, due for example to loss of hydraulic power, or a mechanical seizure of the jack of the means for movement 10, the tool 100, though the first pin 101 will free itself, remains constrained to the frame 109 by its second pin 102. The emergency delineated above naturally precludes the operability of the joint formed by the attachment organ 1, but annuls the risks of the tool 100 falling with an evident improvement of the functioning safety of the machine.

**[0019]** In particular, the safety block 5 comprises, in the preferred embodiment of the invention: a retractable tooth 50, mobile between a projecting position and a retracted position, and means for maintaining the retractable tooth 50 in the projecting position at least in the attached configuration as defined herein above. In the projecting position thereof the retractable tooth 50 at least partially occludes the second seating 3, preventing disengagement of the second attachment pin 102 with respect thereto; in the retracted position thereof, on the other hand, it does not prevent disengagement of the second attachment pin 102 from the second seating 3.

**[0020]** The safety block 5 further comprises an activating arm 51, solidly constrained to the retractable tooth 50. The two elements are rotatably associated, according to a hinge axis x, to the frame 9.

**[0021]** The means for maintaining the retractable tooth 50 in the projecting position comprise elastic means 52 arranged between a free end of the activating arm 51 and the frame 9. The elastic means 52, preferably constituted by at least a helical extension spring the ends of which are respectively constrained to the non-hinged end of the activating arm 51 and the frame 9, have a passive role, i.e. independent of the functional state of the hydraulic jack which, in the illustrated embodiment, represents the means for movement 10, in which passive role they maintain the retractable tooth 50 in the projecting position.

**[0022]** In particular, in the illustrated embodiment the conformation of the retractable tooth 50 and the position of the hinge axis x are particularly advantageous. Apart from facilitating the insertion of the second attachment pin 102 in the seating during mounting, they are such that any pressure of the second pin 102 blocked in the second seating 3 against the retractable tooth 50 generates a torque on the rotatable elements of the safety block 5 (i.e. the block made up of the retractable tooth 50 and the activating arm 51) which tends to maintain the retractable tooth 50 in the projecting position.

**[0023]** In the example, as is visible in the figures of the drawings, the retractable tooth 50 exhibits a stop surface 50a which precludes, in the projecting position of the tooth, the disengaging of the second attachment position of the tooth, the disengaging of the second attachment pin 102 from the second seating 3, i.e. the attachment pin 102 abuts on the stop surface 50a in a case in which it is solicited to exit the seating. In this situation, leaving aside the friction forces, the contact between the cylindrical surface of the pin 102 and the flat stop surface 50a generates, on the retracting tooth 50, a force which is perpendicular the stop surface 50a and applied in the tangential point between the two surfaces. This force, illustrated in figure 3, is contained in a plane which passes close to the hinge axis x; the torque it generates with respect to the axis x tends to keep the retractable tooth 50 in the projecting position. With reference to the cited figure 3, the force passes above the hinge axis x and the torque exerted is anticlockwise.

**[0024]** The form of both the second seating 3 and the above-defined rotatable elements of the safety block 5 merit special attention. The second seating 3 is U-shaped and faces on a vertical surface of the frame 9; the rotatable elements of the safety block 5 are hinged below the second seating 3 and in proximity of the mouth thereof. Thanks to this arrangement of the functional elements, the stop surface 50a directly opposes the gravitational action acting on the tool 100 in a case in which the block exerted by the locking hook 4 fails.

**[0025]** The development directions of the retractable tooth 50 and the activating arm 51 in proximity of the hinge axis x define between them an acute angle. In this way, the activating arm 51 performs the excursion thereof immediately below the second seating 3. The activating arm 51 further exhibits a slightly arched development such as to follow the concave progression of the seating 3; the helix spring hinges to the end of the arm in proximity of the bottom surface of the second seating 3a. The other end of the spring is preferably hinged to an upper horizontal surface of the frame 9.

**[0026]** The retractable tooth 50 exhibits, in opposition to the stop surface 50a, an entry surface which connects the stop surface to a base of the tooth, i.e. the portion of tooth hinged to the hinge axis x.

**[0027]** The entry surface enables insertion of the second attachment pin 102 of the tool 100 in the second seating 3, in a first stage of mounting the tool 100 to the attachment organ 1. During this stage the second attachment pin 102 is inserted up to blocking it in position internally of the seating therefor; the pressure of the pin 102 against the entry surface overcomes the closing torque exerted on the rotatable elements of the safety block 5 by the elastic means 52.

**[0028]** The following stage of mounting the tool 100 to the attachment organ 1 is done after insertion of the pivot 102 into the second seating 3 with the locking hook 4 in the retracted position, and includes the insertion of the

first attachment pin 101 in the first seating 2 and thus the closing thereon of the locking hook 4. Note that the presence of the safety block 5 considerably facilitates this stage of mounting, given that it maintains the second pin 102 in position during the course of the operation; during the mounting of the devices of the prior art, the positioning has to be guaranteed by other means.

**[0029]** The attachment organ 1 of the invention can comprise, in a non-exclusive embodiment thereof, means for moving the retractable tooth 50 from the projecting position to the retracted position during an opening movement of the locking hook 4. The means enable the disengagement of the tool operating only on the means for moving 10 the locking hook 4.

**[0030]** In effect, the locking hook 4 is rotatably mobile between a closed position on the first seating 2 and an open position. The above-mentioned means for moving 10 the retractable tooth 50, illustrated in figure 4, comprise a rocker 6 the opposite ends of which are constrained restingly to the locking hook 4 and to the non-hinged end of the activating arm 51, such as to realise a kinematic coupling between the two rotatable elements upon a rotation of the second element towards the open position.

**[0031]** Constructionally, all the functional elements of the attachment organs 1 are closed between two lateral longitudinal plates of the frame 9; superiorly the two plates are constrained to a horizontal plate of the frame 9. The first and the second seatings 2, 3 are afforded on the lateral plates; consequently, the transversal attachment pins of the tool 100 are constrained to the attachment organ 1 at the opposite ends thereof. The locking hook 4 and the retractable tooth 50, on the contrary, are rotatably arranged along the median axis of the device; they thus come into contact with a central portion of the attachment pins of the tool 100.

## Claims

1. An attachment organ (1) for coupling a tool (100) to an operating arm (110), which organ (1) is superiorly associable to an end of an operating arm (110) and inferiorly associable to a tool (100) to be coupled to the operating arm (110), comprising: a frame (9), which exhibits a first transversal seating (2) and a second transversal seating (3) which are respectively predisposed for housing a first attachment pin (101) and a second attachment pin (102) of the tool (100) in an operating attachment configuration; a locking hook (4) which is mobile with respect to the frame (9) and means for moving (10) the locking hook (4), the locking hook (4) being predisposed for closing on the first seating (2) in the operating configuration of the attachment organ (1), exerting via a contact surface (4a) of the hook (4) a blocking action on the first attachment pin (101) housed internally of the first seating (2); the blocking action being further predisposed to maintain the second attachment pin (102) blocked against a bottom surface (3a) of the second seating (3) situated opposite, at least in the attachment configuration, to the contact surface (4a) of the locking hook (4); **characterised in that** it further comprises a safety block (5) predisposed to prevent, in the attached configuration of the attachment organ (1), a disengagement of the second attachment pin (102) from the second seating (3) in a case in which the blocking action exerted by the blocking pin (4) ceases to be active.

2. The attachment organ (1) of claim 1, **characterised in that** the safety block (5) comprises: a retractable tooth (50), mobile between a projecting position in which it at least partially occludes the second seating (3), preventing disengagement of the second attachment pin (102) therefrom, and a retracted position, at which it does not hamper disengagement of the second attachment pin (2) from the second seating (3); and means for maintaining the retractable tooth (50) in the projecting position at least in the attachment configuration of the attachment organ (1).

3. The attachment organ (1) of claim 2, **characterised in that** the safety block (5) further comprises an activating arm (51) which is solidly constrained to the retractable tooth (50), the two elements being rotatably associated, at a hinge axis (x) to the frame (9); the means for maintaining the retractable tooth (50) in the projecting position comprising elastic means (52) arranged between a non-hinged end of the activating arm (51) and the frame (9).

4. The attachment organ (1) of claim 3, **characterised in that** the conformation of the retractable tooth (50) and the position of the hinge axis (x) are such that a pressure of the second attachment pin (102) blocked in the second seating (3) against the retractable tooth (50) generates a torque on the rotatable elements of the safety block (5) which torque tends to keep the retractable tooth (50) in the projecting position.

5. The attachment organ (1) of one of claims 3 or 4, **characterised in that** the retractable tooth (50) exhibits a stop surface (50a) which prevents, at the projecting position of the tooth (50), a freeing of the second attachment pin (102) from the second seating (3), and also exhibits an entry surface opposite the stop surface (50a) which enables inserting (3) of the second attachment pin (102) of the tool (100) in the second seating, the pressure of the second pin (102) against the entry surface opposing a closing torque exerted on the rotatable elements of the safety block (5) by the elastic means (52).

6. The attachment organ (1) of one of claims from 3 to 5, **characterised in that** in proximity of the hinge

axis (x) the development directions of the retractable tooth (50) and the activating arm (51) define an acute angle with respect to one another.

**7.** The attachment organ (1) of one of claims from 3 to 6, **characterised in that** the second seating (3) is U-shaped and faces onto a vertical surface of the frame (9), the rotatable elements of the safety block (5) being hinged below the second seating (3) and in proximity of a mouth thereof.

**8.** The attachment organ (1) of one of claims from 3 to 7, **characterised in that** the elastic means (52) are constituted by at least an extending helical spring, ends of which are constrained respectively to the free end of the activating arm (51) and to the frame (9).

**9.** The attachment organ (1) of one of claims from 3 to 8, **characterised in that** it comprises means for moving the retractable tooth (50) from the projecting position to the retracted position in an opening movement of the locking hook (4).

**10.** The attachment organ (1) of claim 9, **characterised in that** the locking hook (4) is rotatably mobile between a closed position on the first seating (2) and an open position, the means for moving the retractable tooth (50) comprising a rocker (6), opposite ends of which are restingly constrained to the locking hook (4) and to the activating arm (51) such as to realise a kinematic coupling between the two rotatable elements on rotation of the second thereof towards the open position.

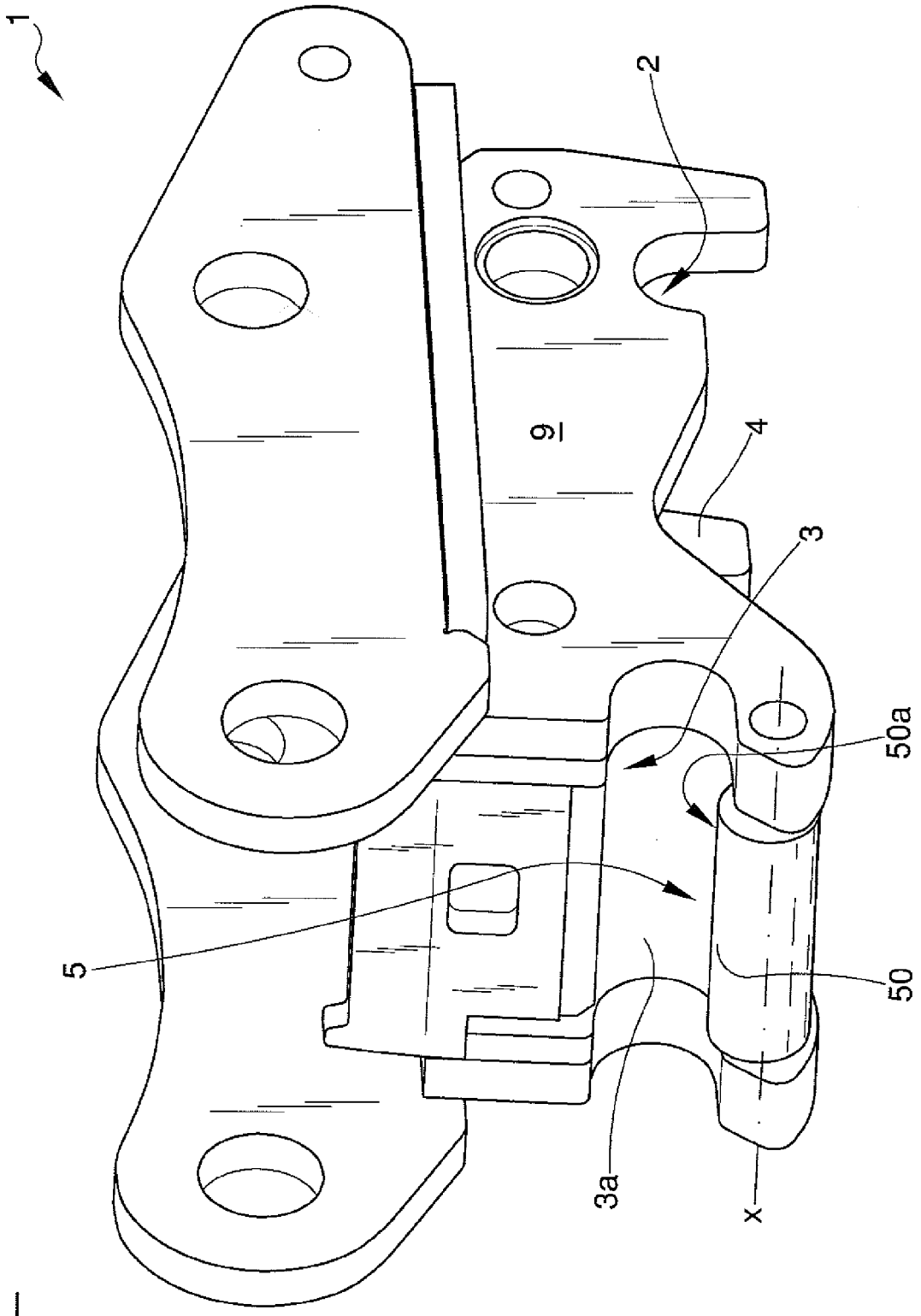



Fig. 1

Fig. 2

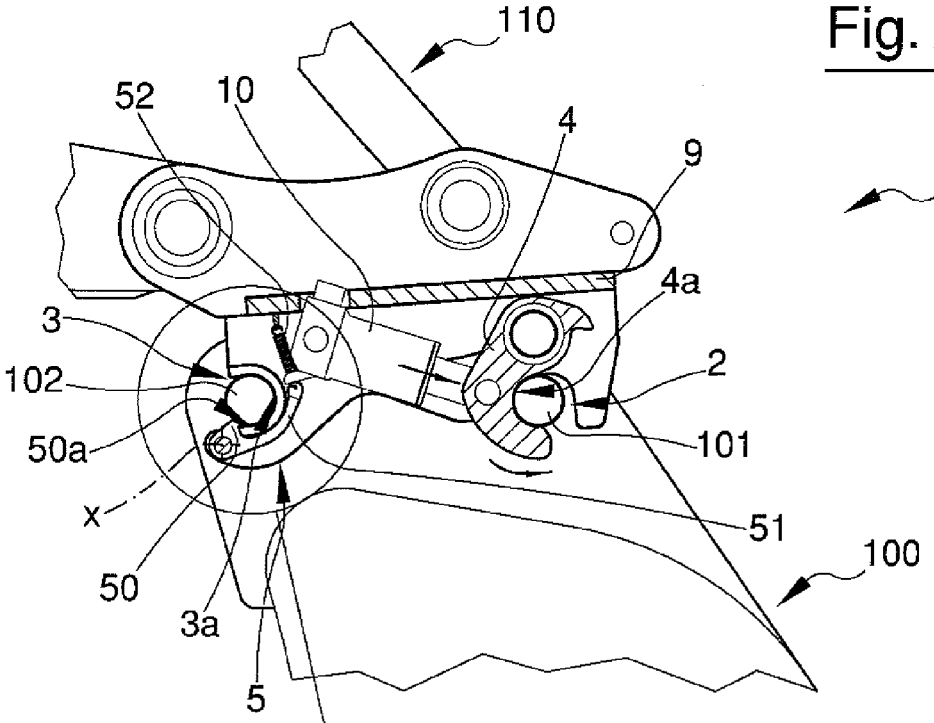
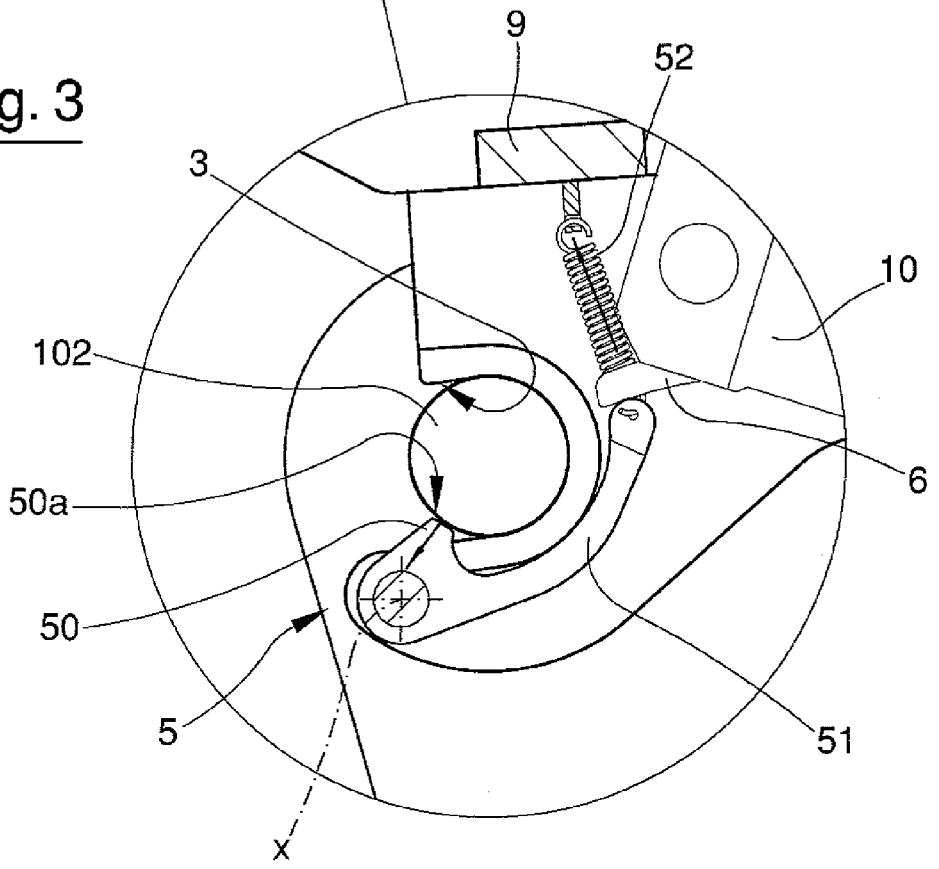

110
52
10
4
9
1
4a
3
2
102
101
50a
x
51
100
50
3a
5

Fig. 3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10
102
6
50a
50
5
51
x

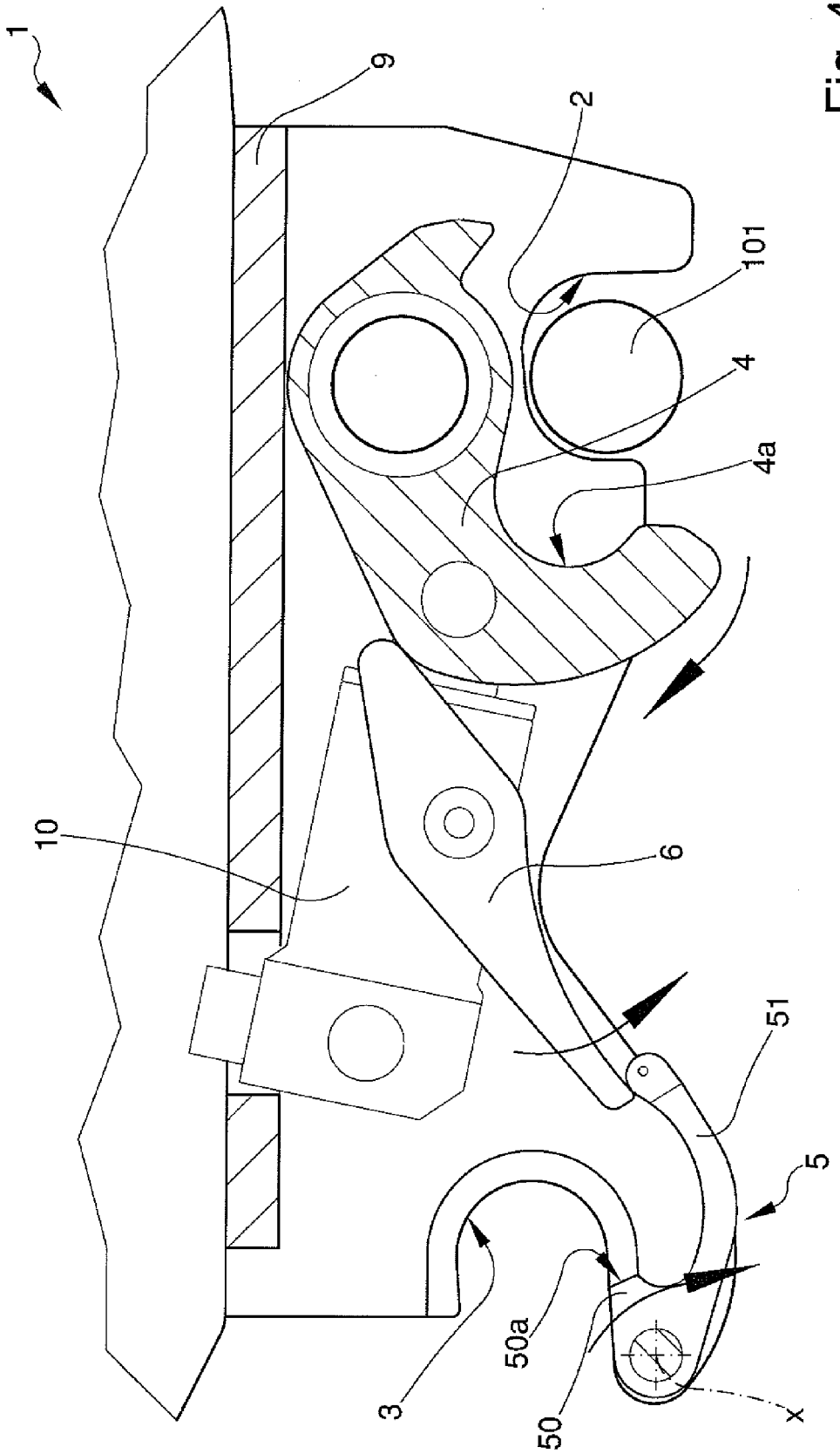


Fig. 4