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CA 2684656 C 2012/09/18

(11)(21) 2 684 656

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2008/04/23
(87) Date publication PCT/PCT Publication Date: 2008/10/30
(45) Date de délivrance/Issue Date: 2012/09/18
(85) Entrée phase nationale/National Entry: 2009/10/20
(86) N° demande PCT/PCT Application No.: EP 2008/003281
(87) N° publication PCT/PCT Publication No.: 2008/128773
(30) Priorité/Priority: 2007/04/24 (DE10 2007 019 310.8)

(51) Cl.Int./Int.Cl. *F41A 19/59* (2006.01),
F41A 17/06 (2006.01)

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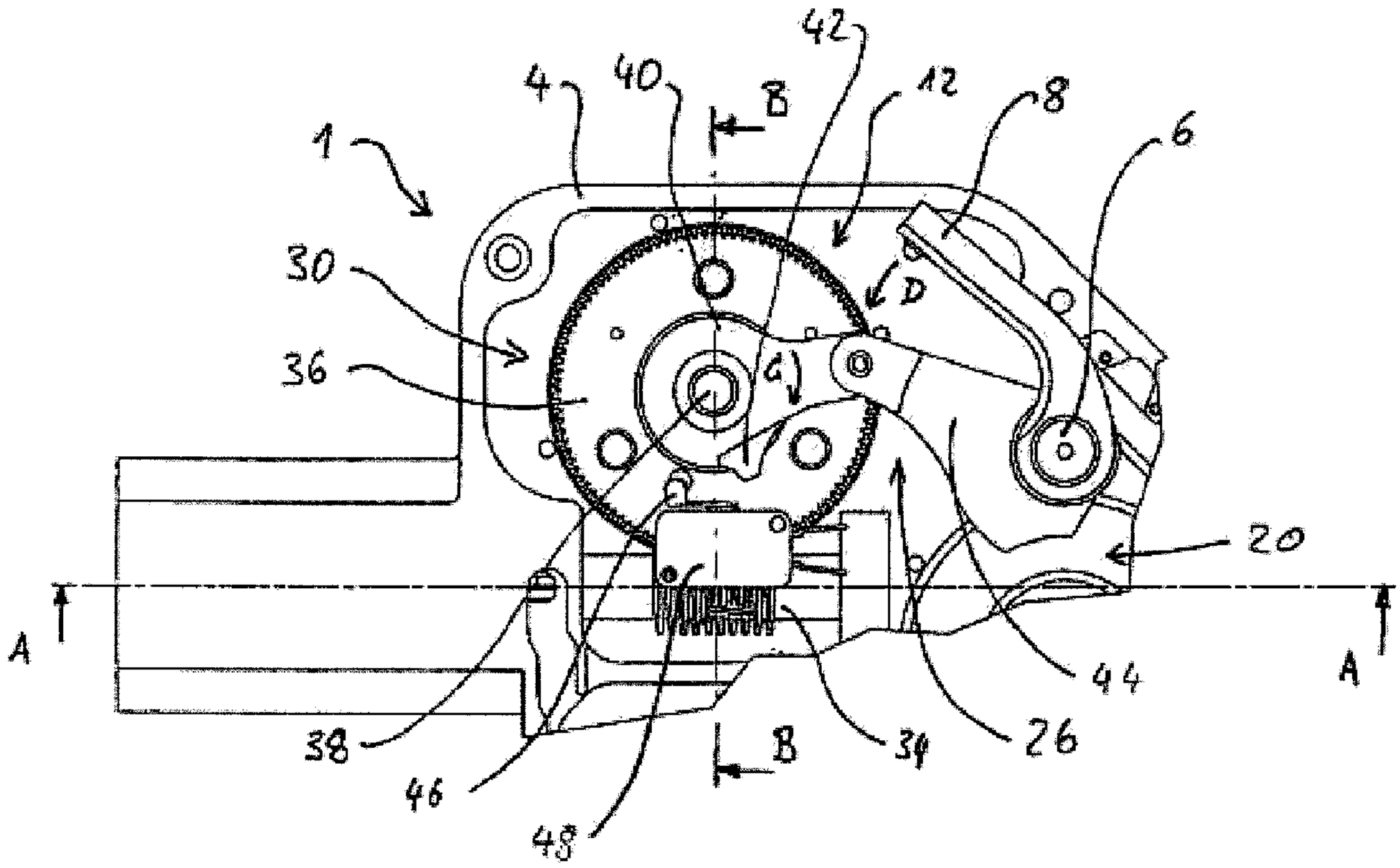
(54) Titre : DISPOSITIF DE REGLAGE
(54) Title: ACTUATING DEVICE



(57) Abrégé/Abstract:
The present invention relates to an actuating device (12, 20) for actuating a weapon, comprising a first actuating drive (30) acting in a working direction and configured to transfer an actuating element (8) from an idle position to a working position. The actuating drive (30) can be releasably coupled to the actuating element (8) by a switchable clutch (52). The invention also relates to a trigger device (1) or a weapon with a corresponding actuating device (12, 20).

ABSTRACT

The present invention relates to an actuating device (12, 20) for actuating a weapon, comprising a first actuating drive (30) acting in a working direction and configured to transfer an actuating element (8) from an idle position to a working position. The actuating drive (30) can be releasably coupled to the actuating element (8) by a switchable clutch (52). The invention also relates to a trigger device (1) or a weapon with a corresponding actuating device (12, 20).

WO 2008/128773 PCT/EP2008/003281

Actuating Device

The present invention relates to an actuating device comprising a first actuating drive acting in a working direction in order to transfer an actuating element from an idle position to a working position.

Actuating devices can be used with weapons for example to actuate the trigger of a weapon or a firing selection mechanism. Such actuating devices are for example necessary in order to be able to actuate via remote control firmly mounted weapons or weapons mounted on gun carriages (on a vehicle, an airplane, a ship, a building or in a gunner's cockpit) without immediate access to the weapon itself being necessary. The actuating device can for example be remotely controlled electrically, hydraulically, pneumatically or in some other suitable manner.

In the case of actuating devices which act on the trigger, which thus directly serve the purpose of firing the weapon, the problem exists that relatively long travel distances – for example pulling through completely around a trigger – have to be bridged in order to achieve the desired actuating action. In the case of the actuation of the trigger it is also important that said actuation can be stopped very rapidly and immediately in order to rapidly cease fire. In particular in the case of weapons with high cadences (machine guns, aircraft cannons, grenade launchers) one important problem to be solved lies in being able to emit short bursts of fire in controlled manner.

Simultaneously the energy requirements of such actuating devices should be as low as possible in order to spare limited energy resources.

For example, if one uses a solenoid drive, in which case the trigger travel is to be bridged by means of an electromagnetically actuated actuating element, either a relatively long travel with the correspondingly high losses of current associated with it must be realized or a transmission gearing is necessary, which then requires higher actuating forces and with it higher active voltages. A geared down drive acts under circumstances only with reduced speed of action on the actuating element. A lowered speed of action or actuating speed is in particular detrimental in the case of an interruption of the firing operation.

From US 2,576,953 and US 2,457,827 and actuating device is known in which case the trigger actuation takes place via a continuously rotating drive device which by means of a clutch/interrupter mechanism for a 360° is coupled with a swivel lever drive, which in turn causes a connecting rod mechanism acting on the trigger mechanism to execute a single back and forth movement cycle. An interruption of the one initiated movement cycle is not possible.

Proceeding from here the object of the present inventions consists in providing an improved actuating device in which case the above named disadvantages are at leas partially eliminated.

Such an actuating device is provided by the present invention, which in a broad aspect provides an actuating device for actuating a trigger/selection or safety device of a weapon comprising a first actuating drive acting in a working direction and configured to transfer an actuating element from an idle position to a working position, in which it actuates a

trigger of a weapon or a safety lever/selector lever, wherein the first actuating drive can be releasably coupled to the actuating element by a swithchable clutch, can be releasably coupled with the actuating element, is constructed as a swivel drive and acts on the actuating element constructed as a swivel lever, characterized in that a second actuating drive is provided which acts in opposition to the working direction in order to move the actuating element from the working position to an idle position when the clutch is released. In the process the first actuating drive can be releasably coupled by a switchable clutch with the actuating element constructed as a swivel lever – which for example acts on a trigger lever or on a safety lever/selector lever. The invention makes it possible with this to optimally adapt the actuating drive to its task. The first actuatinig drive in the process acts e.g. only for the discharge of the shot, i.e. for movement of the trigger to its working position. Through the releasable coupling of the first actuating drive with the actuating element via a switchable clutch the first actuating drive does not need to be moved back to its initial or idle position itself for interruption of the shot. It is only uncoupled from the actuating element, which then under direct action of the rest mechanism of the trigger is moved back to its idle position. Thus the fastest possible interruption of fire can be realized.

A reverse acting second actuating drive is provided, which for example provides accelerated support for the reset mechanism of the trigger.

If the actuating device is used for example for the actuating of a safety or firing selection mechanism, the first actuating drive can for example move a selector lever upon activation to the safety off position, while the resetting of the selector lever in the safety on position likewise takes place rapidly and immediately without resetting of the first actuating drive during the action of the second actuating drive.

In the process the first actuating drive (or the second actuating drive) is constructed as a swivel drive. This has several advantages: swivel drives act normally along the sector of a circle and thus can be realized with simple and cost-effectively realizable swivel bearing arrangements. Linear drives on the other hand can usually only realized with greater expenditure. In the case of the connection of a swivel drive with a clutch the actuating drive only needs to work in one direction, i.e. the actuating drive can, proceeding from its last stopping point adjust a corresponding actuating element in the same direction (the actuating element can for this purpose be uncoupled from the actuating drive and relative to said actuating drive e.g. can be adjusted/reset by the second actuating drive). With this the actuating drive can always be driven in one direction.

In one embodiment of the actuating device of the present invention, the first motor driven actuating drive, can be constructed as a worm gear transmission unit with an electric motor and in which case the second actuating drive is constructed as a tensile drive unit. Motor driven actuating drives are available in particular as swivel drives in great number and variety. Worm gear transmission units with an electric motor are in addition as a rule self-locking and can energy-efficiently apply high actuating forces via swivel or travel distances as long as one wants with sufficiently great actuating speed. No energy supply is necessary to hold a specified position. Tensile drive units have the advantage that they do not require any additional energy source but rather store the required actuating energy as strain energy (similar to a mechanical clockwork). In the case of corresponding preload they can also execute several actuating operations.

In accordance with a further improvement this principle is further refined: namely here the first actuating drive is used in order

to tension the second actuating drive, while the first actuating drive moves the actuating element into the working position. With this the second actuating drive can reset the actuating element into its idle position over and over again without an additional supply of energy or a special re-stressing being necessary.

The clutch may be constructed as a spring-loaded electromagnetically acting clutch which only occupies its clutch position in the case of electrical excitation, i.e. in the case of the loss of the power supply the clutch is released (vented) and the actuating device moves the actuating element back to its idle position immediately. Thus in the case of the use of the actuating device to discharge a trigger in the case of an interruption of the power supply no shots will be fired or the firing of rounds is immediately stopped.

The improvement in accordance with a further embodiment in which the first actuating drive and the actuating element are arranged on parallel swivel axes expands the design options and permits for example particularly flat arrangements with short swivel shafts in spatially restricted settings. In the process then in accordance with another embodiment a coupling gear can be provided between the actuating element and the first actuating drive, said actuating drive for example being constructed as a slider crank.

The travel distance of the first actuating drive may be set via a contact piece which acts on a switch acting as an interrupter. This travel distance can for example be adapted via a swiveling control cam. Thus the actuating device can be adapted to the features of different weapons components. The arrangement of the second actuating drive coaxially to the swivel axis of the actuating element in accordance with a particularly compact construction, the second actuating drive may be arranged coaxially to the swivel axis of the actuating element.

The present invention also relates to a trigger device in which case the actuating element in its working position actuates a weapons trigger for discharge of a shot. In the process the first actuating drive of the actuating device may be actuated by remote control via a switch. In accordance with a further aspect of the present invention a second actuating device is provided which additionally acts on a safety mechanism of the weapon, to be precise in such a way that the safety mechanism is in safety off position in working position of the second actuating device. Here too the principle of maximum security is realized: In the case of a power interruption the first actuating device acting on the trigger cannot be actuated and simultaneously the second actuating device immediately moves the safety mechanism of the weapon to its safety on position. In the case of a breakdown the weapon itself is always in the state of maximum security.

Activation can be realized via a single switch which actuates both the first and second actuating devices or via separate switches: one for safety off/safety on and one for the firing of rounds/interruption of the firing of rounds. The switches themselves can in the process be adapted to the normal actuating of a weapon. For example the switch for activation of the safety mechanism can be constructed as a latch switch, while the switch for the activation of the trigger device can be constructed as a pushbutton switch.

The present invention also relates finally to a weapon with an actuating device or a corresponding trigger device as described herein.

An exemplary embodiment of the present invention will be described in the following with the help of the drawings. The figures show the following:

Figure 1 shows a perspective partial view of an inventive trigger device which is mounted on a weapon,

Figure 2 shows a partial view of the opened trigger device from Figure 1,

Figure 3 shows a longitudinal section (Section A-A from Figure 2) of the trigger device shown in Figures 1 and 2,

Figure 4 shows a cross-section (Section B-B from Figure 2) of the inventive trigger device and

Figure 5 shows a schematic circuit diagram of an inventive actuating device.

The exemplary embodiment represented in Figure 1 shows a trigger device 1 which is arranged on the operating region 2 of a weapon not further represented. A drive shaft 6 protrudes from the housing 4 of the trigger device 1, upon said drive shaft a swivel lever 8 serving as an actuating element being fixed. The end of the swivel lever 8 radially distant from the shaft lies close on the trigger lever 10 of the weapon in order to be able to actuate said trigger lever. The drive shaft 6 and swivel lever 8 are part of a first actuating device 12 arranged predominantly in the interior of the trigger device 1 (Figures 2-4).

An additional drive shaft 14 protrudes from the housing 4 of the trigger device 1, upon said drive shaft likewise a swivel lever 16 being fixed and being arranged in the region of a safety rocker switch 18, via which the weapon can be unlocked or locked. There are also weapons in which case such a safety rocker switch 18 or a safety lever serves as a selector lever, on which the weapon is not only locked, but rather also on which a firing mode can be set (semi-automatic fire, burst of fire, continuous fire). The drive shaft 14 and swivel lever 16 for actuating the safety rocker switch 18 are assigned to a second actuating device 20, which is likewise accommodated extensively in the housing 4 of the trigger device 1. The actuating devices 12, 20 of the trigger device 1 are actuated by schematically represented switches 22, 24, which likewise, via a control system not displayed control the actuating devices 12 and 20. In the process the switch 22 for the actuation of the of the first actuating device 12 acting on the trigger lever 10 can be constructed as a pushbutton, the switch 24 for actuating the second actuating device 20 acting on the safety rocker switch 18 can be constructed as a selector switch.

In another embodiment both the first as well as the second actuating devices 12 and 20 are actuated by a single switch, which then in the case of the actuation of the switch causes the weapon to be unlocked by the second actuating device 20 and then fires the weapon via the first control device 12.

The function and structure of the first actuating device 12 will now be described on the basis of Figures 2 through 5.

In Figure 2 the first actuating device 12 is shown in the opened housing 4 of the trigger device 1. The drive

shaft 6, which bears the swivel lever 8 and is pivoted in the housing 4, is coupled via the slider crank 26 with the first actuating drive 30, said actuating drive being constructed as a motor driven worm gear transmission unit. In the process an electric motor 32 is provided, which drives the worm 34, which in turn drives the worm gear 36, which is pivoted on the shaft 38 (see Figure 4). On the shaft 38 the crank and rocker mechanism 40 sits fixed, said crank and rocker mechanism being provided with a control cam 42. The crank and rocker mechanism 40, together with the crank and rocker mechanism 44 fixed on the drive shaft 6 forms the slider crank 26.

The control cam 42, depending on the rotating position of the crank and rocker mechanism 40, acts on a contact element 46 of a limit switch 48. In the case of corresponding rotating position of the crank and rocker mechanism 40 the control cam 42 then disconnects the electric motor 32 via the limit switch 48. Through the self-locking of the worm gear transmission unit with this also the swivel lever 8 is held in its working position, in which it actuates the trigger lever 10.

Figure 4 shows the coupling of the worm gear 36 with the crank and rocker mechanism 40 via the shaft 38. The worm gear 36 is pivoted on the shaft 38 by a bearing arrangement 50. For fixed coupling a switchable clutch 52 is provided, which is constructed as an electromagnetic clutch. It exhibits a coil former 54 which sits fixed in the housing 4, and a drive hub 56, which is arranged fixed on the shaft 38 (but rotatable to the coil former 54) via a feather key connection. On the worm gear 36 an armature disk 62 is rotationally fixed via a spring washer spring disk 64 via an adapter ring 60. The adapter ring 60, armature disk 62 and

the spring washer 64 are rotationally coupled with the worm gear 36 via fastening screws 66.

The spring washer 64 holds the armature disk 62 with its front surface in axial direction of the shaft 38 at a distance from the opposing front surface of the drive hub 56, so that between both surfaces a so-called air gap 68 exists (this position is represented in Figure 4).

In the case of electrical excitation of the coil (not shown) in the coil former 54 the armature disk 62 is pulled under elastic deformation of the spring washer 64 in axial direction with its front surface against the front surface of the drive hub 56. The frictional engagement thus formed between the armature disk 62 and the drive hub 56 couples the shaft 38 with the worm gear 36. If the worm gear 36 is driven in this position, it twists the crank and rocker mechanism 40 correspondingly via the shaft 38.

In uncoupled position the crank and rocker mechanism 40 together with the shaft 38 is freely rotatable relative to the worm gear 36 and the housing 4. The worm gear 36 in the process is held in its rotating position by the stationary worm 34. In the case of a driven worm 34 the worm gear 36 rotates on the shaft 38.

In the case of the actuation of the first actuating drive 30 in its idle position (see Figure 2) the following takes place: Via the corresponding switch 22 the switchable clutch 52 is closed and the electric motor 32 is switched on. The worm 34 moves the worm gear 36 together with the crank and rocker mechanism 40 coupled via the shaft 38 in the direction of the arrow C (Figure 2). In the process the swivel lever 8 coupled

via the slider crank 26 in direction D is moved into its working position, in which it discharges the weapon via the trigger lever 10. In this position the control cam 42 hits the contact element 46 of the limit switch 48, which then stops the electric motor 32. The excitation of the electromagnetic clutch 52 is however maintained; said clutch remains closed and the lever 8 remains in engagement with the trigger lever 10. Not until the actuation of the switch 22 is interrupted is also the power supply to the electromagnetic clutch 52 interrupted and with this the shaft 38 and crank and rocker mechanism 40 released. The reset mechanism of the trigger lever 10 moves the swivel lever 8 back to its idle position.

Figure 5 shows a schematic circuit diagram via which the above described function can be realized. In the process the electromagnetic clutch 52 and the electric motor 32 are connected in parallel. If the swivel lever 8 is in its idle position, the switch 48 is in the represented position and upon actuation of the switch 22 closes the circuit to the drive motor 32. If the control cam 42 (see Figure 2) reaches the contact element 46 the switch 48 is toggled, the power supply to the motor is interrupted and the motor is short-circuited via the resistor 72 and as a result immediately stopped. The power supply of the electromagnetic clutch 52 remains unaffected by this and the clutch remains closed. Not until the supply of power – as already described above – is completely switched off or also interrupted, is the effect of the electromagnetic clutch 52 canceled and the swivel lever 8 is uncoupled and can be reset.

The above specified reset operation is supported in the represented exemplary embodiment by a second actuating drive, which is constructed as a torsion spring 70 between the housing 4 and the drive shaft 6 (see Figure 3). The torsion spring 70 is tensioned in its working position in the case of the shifting of the swivel lever 8 and presses it back to its idle position as soon as the worm gear 36 and shaft 38 and with it the first actuating device 12 and swivel lever 8 are uncoupled. In the case of the resetting of the swivel lever 8 the crank and rocker mechanism 40 together with the control cam 42 are also reset via the slider crank 26. This embodiment disengages the resetting mechanism of the trigger lever 10 and is in particular also suitable for actively toggling corresponding adjusting levers on a weapon between different positions. The second actuating device 20 works according to the same principle.

In another embodiment the swivel lever 8 can also be fixed directly on the shaft 38. The same applies for the second actuating drive (the torsion spring 70), which then acts directly between the housing 4 and the shaft 38.

Along with the embodiment with a control cam 42 and a switch 48 several swivel positions of the crank and rocker mechanism 40 can be detected via several control cams 42 and if necessary several switches 48. This is for example helpful if more than two switch positions are provided for the swivel lever 8 or a corresponding actuating element. For example, such an actuating device can be used for the actuation of a selector lever which can occupy more than two different positions. There are also embodiments in which case in place of a mechanical

switching for example electronic or electro-optical position detectors are provided in order to detect one or more switching positions and appropriately take said switching positions into consideration via a control system.

Further embodiments and variants of the present invention arise for the person skilled in the art within the scope of the appended claims.

Claims

1. An actuating device (12, 20) for actuating a trigger/selection or safety device of a weapon comprising a first actuating drive (30) acting in a working direction and configured to transfer an actuating element (8) from an idle position to a working position, in which it actuates a trigger of a weapon (10) or a safety lever/selector lever (18),
wherein the first actuating drive (30) can be releasably coupled to the actuating element (8) by a swithchable clutch (52), can be releasably coupled with the actuating element (8), is constructed as a swivel drive and acts on the actuating element (8) constructed as a swivel lever,
characterized in that
a second actuating drive (70) is provided which acts in opposition to the working direction in order to move the actuating element (8) from the working position to an idle position when the clutch (52) is released.

2. The actuating device (12, 20) according to Claim 1, in which the first (30), or second actuating drives (70) or both actuating drives (30, 70) are constructed as swivel drives.

3. The actuating device (12, 20) according to Claim 1 or 2, in which the first actuating drive (30) is motor driven, in particular constructed as a worm gear transmission unit (34, 36) with an electric motor (32), and the second actuating drive (70) is constructed as a tensile drive unit, in particular as a spring drive unit.

4. The actuating device (12, 20) according to Claim 3, in which the first actuating drive (30), the second actuating drive (70) and the clutch (52) are constructed and arranged in such a way that the actuating drive (30) in operation and in the case of an acting clutch (52) moves the actuating element (8) into the working position and in the process tensions the second actuating drive (70).

5. The actuating device (12, 20) according to any one of Claims 1 to 4, in which the clutch (52) is constructed as a spring-loaded, electromagnetically acting clutch and is arranged in such a way that it occupies its clutch position in the case of electrical excitation.

6. The actuating device (12, 20) according to any one of Claims 2 to 5, in which the first actuating drive (30) and the actuating element (8) are arranged on two parallel swivel axes.

7. The actuating device (12, 20) according to Claim 6, in which the first actuating drive (30) and the actuating element (8) are coupled via a coupled gear (26), in particular a slider crank.

8. The actuating device (12, 20) according to any one of Claims 2 to 7, in which the travel distance of the first actuating drive (30) via a contact piece (42) acting on a switch (48), in particular constructed as a swiveling control cam, can be correspondingly set to the desired travel distance of the actuating element (8).

9. The actuating device (12, 20) according to any one of Claims 1 to 8, in which the second actuating drive (70) is arranged coaxially to the swivel axis of the actuating element (8).

10. A trigger device (1) for a weapon with a first actuating device (12) according to any one of Claims 1 to 9, wherein the actuating element (8) in its working position actuates a weapons trigger (10) for the discharge of a round.

11. The trigger device (1) according to Claim 10, in which the first actuating drive (30) of the actuating device (12, 20) can be actuated by remote control via a switch (22, 24).

12. The trigger device (1) according to Claim 10 or 11, in which a second actuating device (20) according to any one of Claims 1 through 10 is provided, which acts on a safety mechanism (18) of the weapon, wherein the actuating element (16) of the second actuating device (20) in its working position moves the safety mechanism into an unlocked position.

13. The trigger device (1) according to Claim 12, with a switch which activates both the first (12) and the second actuating device (20).

14. The trigger device (1) according to Claim 12, in which for the first actuating device (12) and the second actuating device (20) separated switches (22, 24) are provided for their activation.

15. A weapon with an actuation device (12, 20) according to any one of Claims 1 through 9 or a trigger device (91) according to any one of Claims 10 through 14.

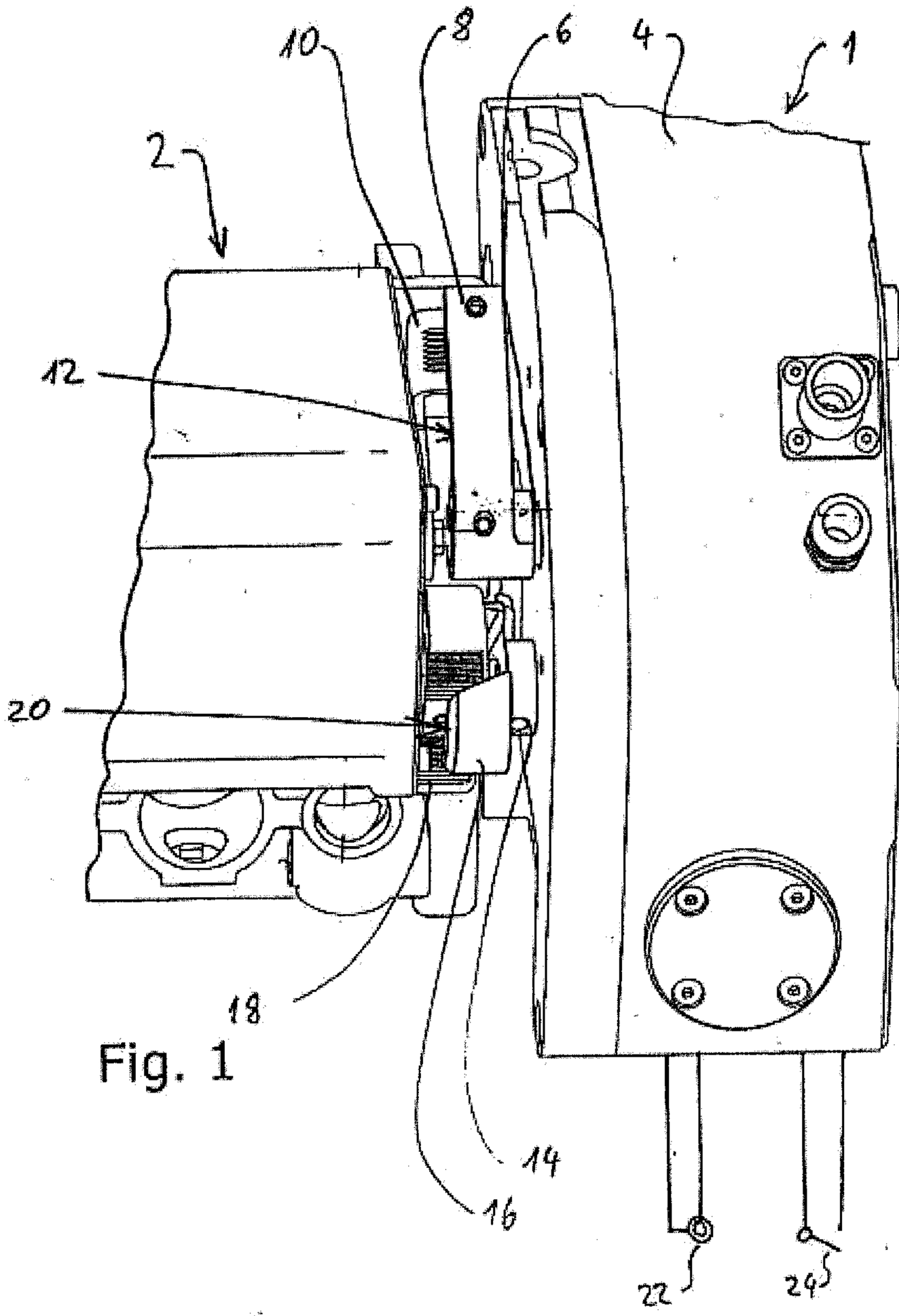


Fig. 1

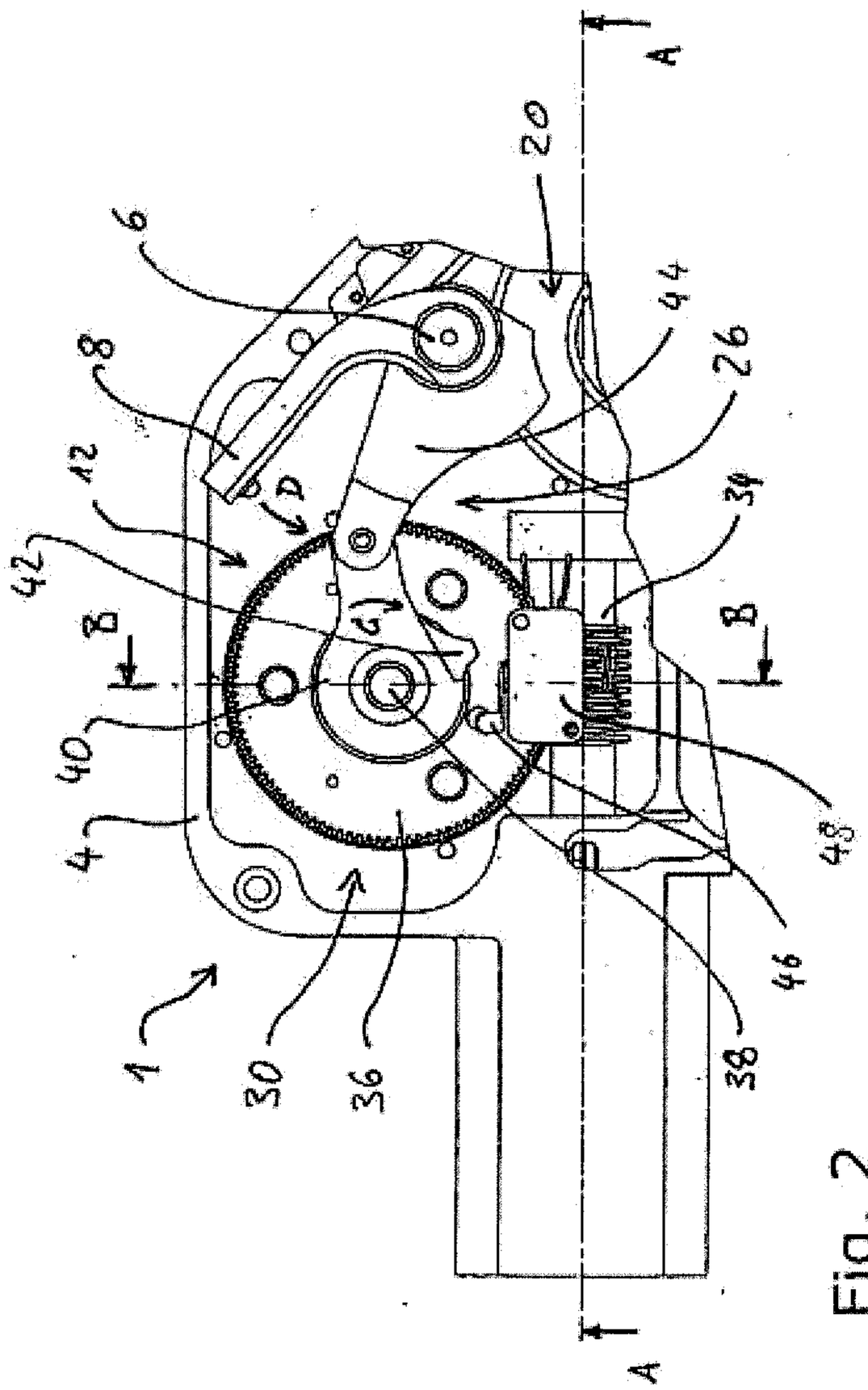
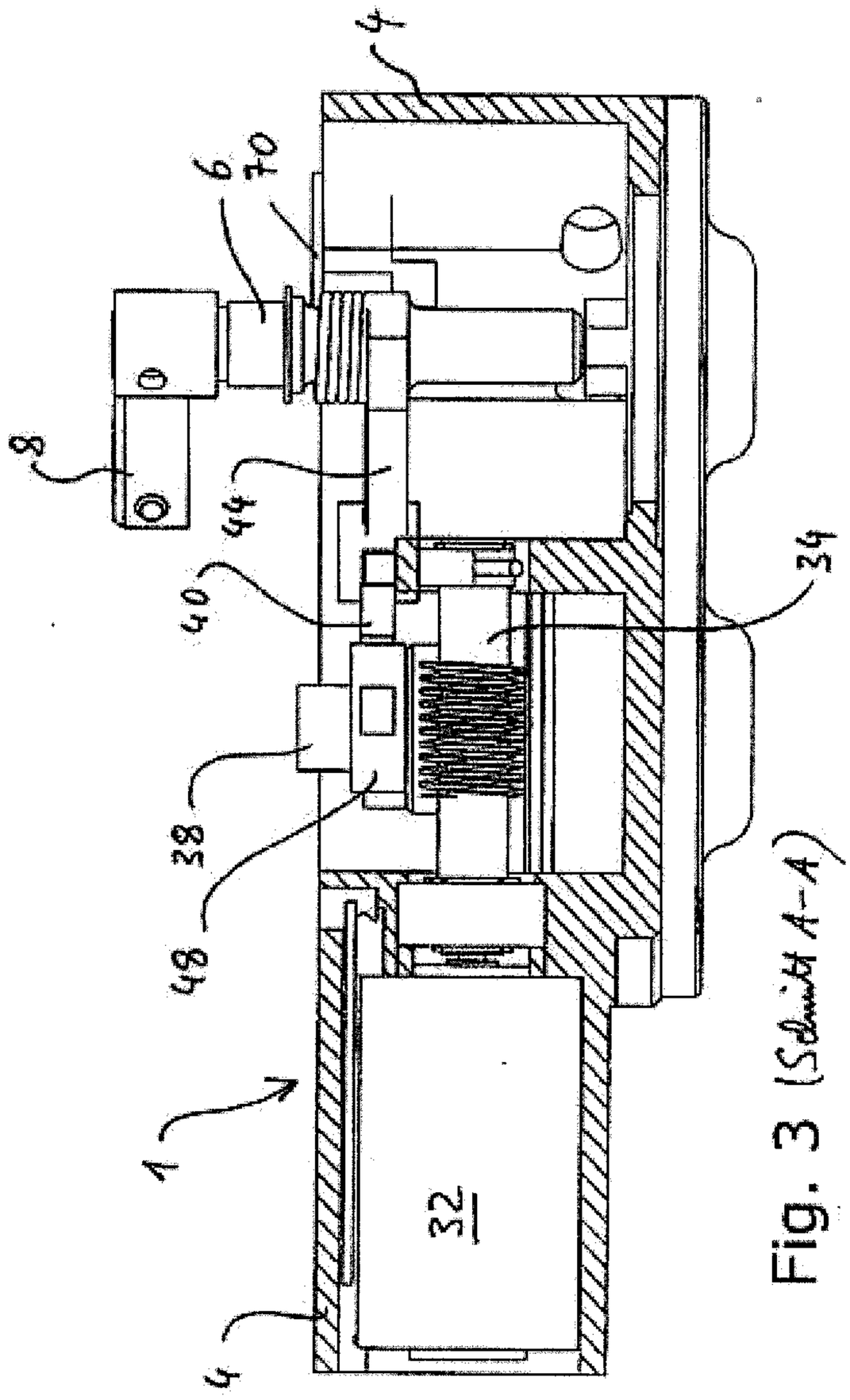


Fig. 2



3 (Schnitt A-A)

Fig. 3

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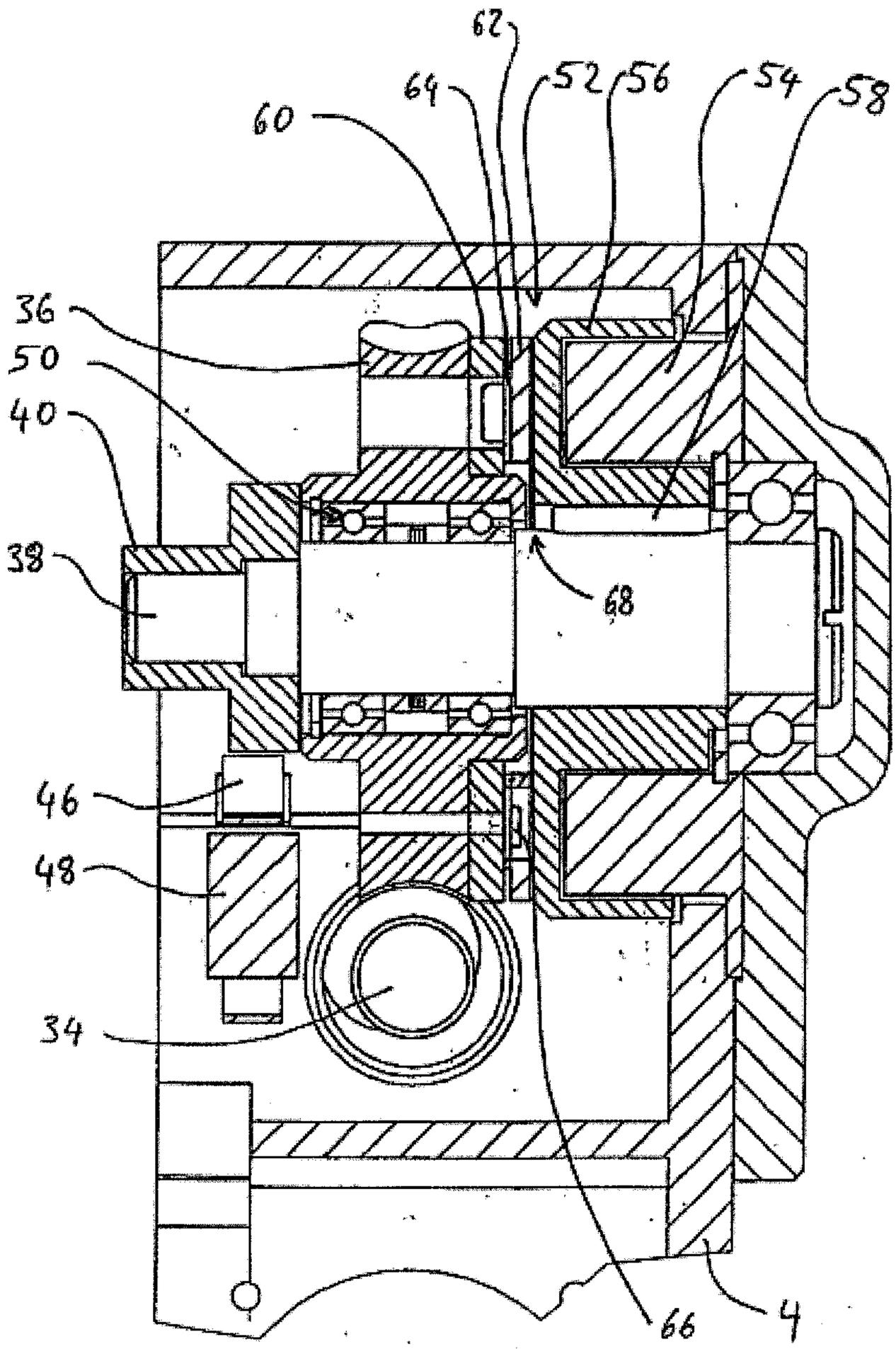


Fig. 4 (Schnitt B-B)

(Schnitt B-B) = (Section B-B)

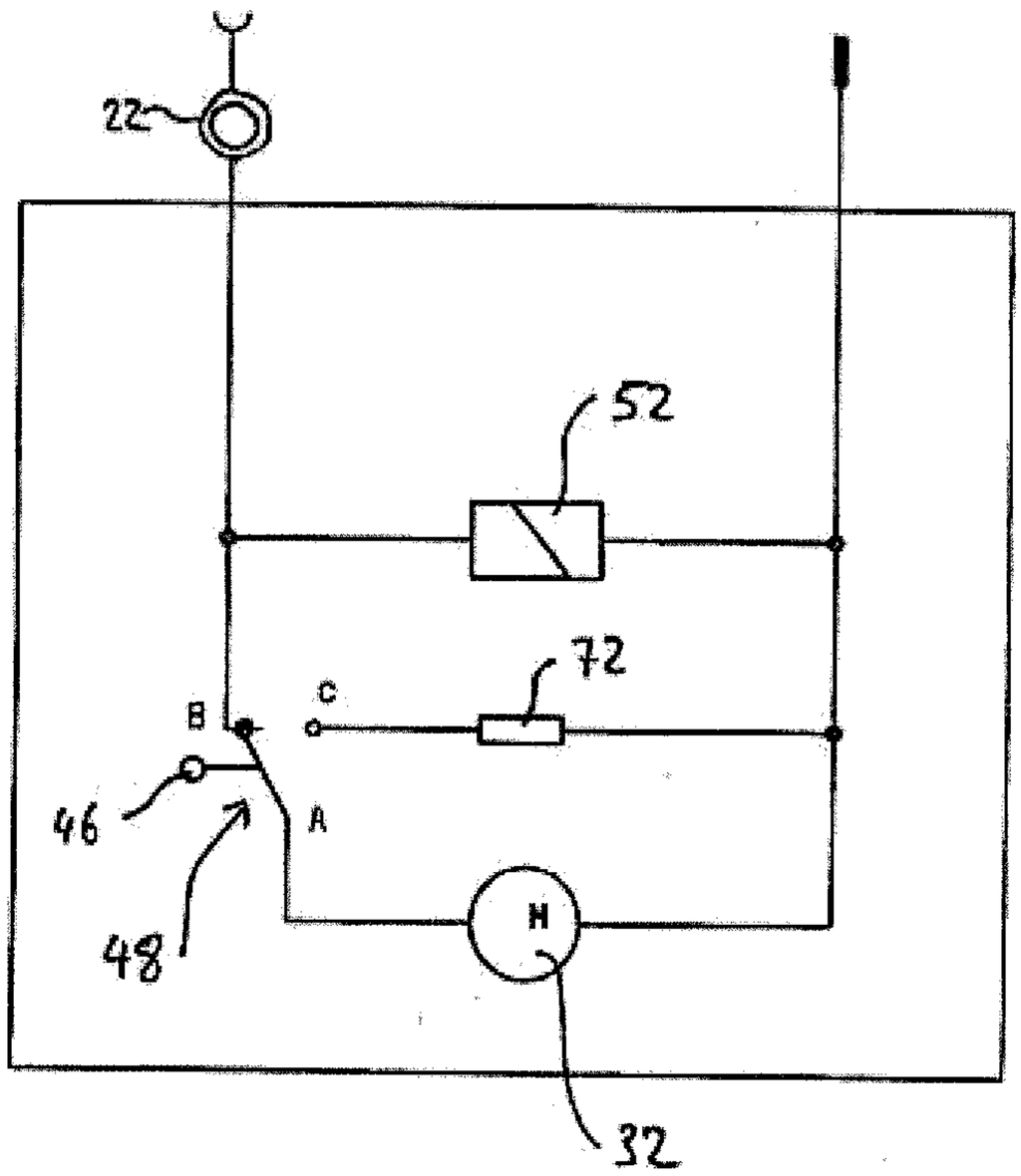
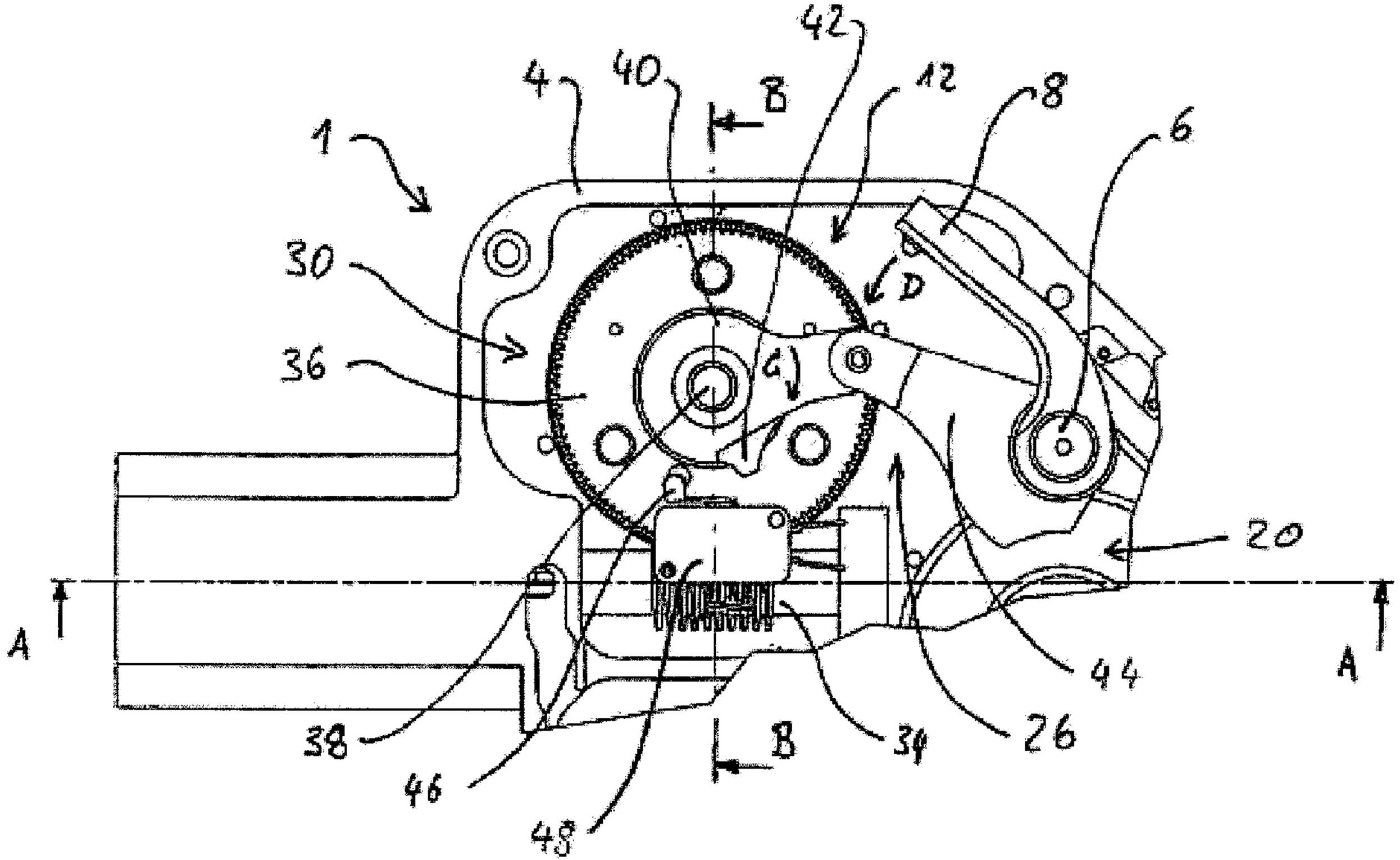


Fig. 5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