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(54) **A MECHANICAL WINCH WITH A MECHANICAL SWITCH FOR TERMINATING WINDING OF A ROPE ON THE WINCH DRUM**

(57) The invention relates to a mechanical winch with a mechanical switch for terminating winding of a rope on the winch drum. An orifice (1) of a guide for the rope is provided with a spring-supported pushing element (11). Upon contact of an end part of the rope with the pushing element (11), a wire rope guided in a Bowden (B) is arranged to translate this movement to a switching plate (2), which is a part of a switching mechanism that comprises:

- a base plate (3) with two legs (31,32) directed in opposite directions, wherein the upper leg (31) is connected to the green rope for activation of pulling,
 - a switching plate (2), to which a wire rope (Z) is attached,
 - a housing (4) provided with a bore (42) for connection with a coupling of the drum drive and an ear for mounting a spring (43),
 - two springs (43,34) for return movement of the base plate (3) and the housing (4) from their end position to their initial (null) position,
- wherein between the base plate (3) and the housing (4) at least one restraining element (5) is provided in suitable grooves or holes (3a, 4a), and wherein the switching plate (2) is provided with grooves or holes (2a) for receiving said restraining element (5) and is arranged to rotate upon movement of the wire rope (Z), thus causing the grooves (2a) to cover with holes on the base plate (3), which leads to movement of the restraining element (5), and to disengagement of the connection between the base plate (3) and the housing (4), which terminates pulling.

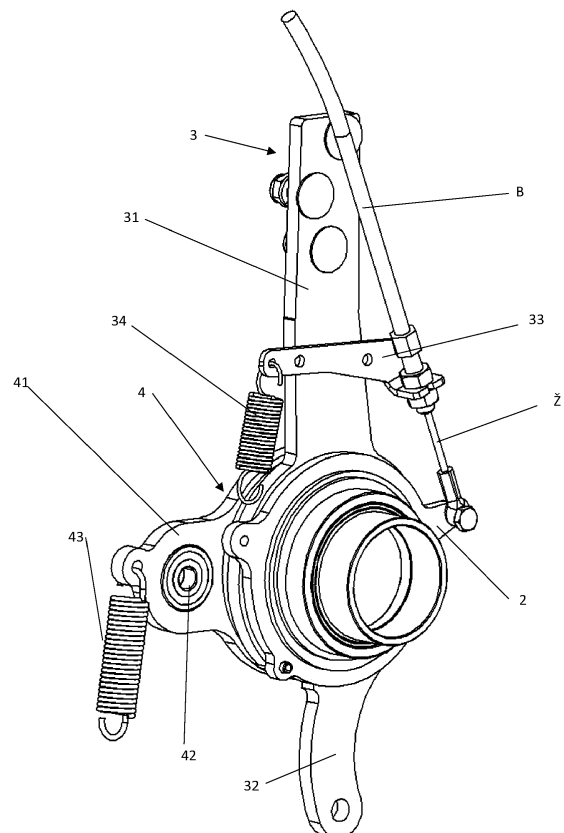


Figure 4

Description

Field of the invention

[0001] The present invention belongs to the field of mechanical engineering, more precisely to the field of forestry winches and safety devices for forestry winches. The invention relates to a mechanical winch with a mechanical switch for terminating winding of a rope on a drum of the winch.

Background of the invention and the technical problem

[0002] During rope winding, it is common that the user does not terminate winding timely, resulting in the rope being trapped in-between rope layers on the drum or the end part of the rope is damaged. Consequently, work must be suspended, as the damaged rope and/or any other element has to be replaced due to severe lasting deformation. Often the rope is permanently damaged, particularly if it is pulled into the layers of the rope on the drum, which squeezes the rope and leads to permanent deformation. Such permanent deformation during unwinding of the rope may be solved with a large pulling force, otherwise the rope cannot be unwound from the drum. In case the rope of the drum is not timely stopped, other constructional elements of the winch may be damaged, most commonly the rope guide on the sheave.

[0003] Mechanical winches are demanding due to their construction, as control of the winch is done via a mechanism comprising a first rope (usually green) for activation of pulling and a second rope (usually red) for releasing (deactivation) a brake (i.e., brake for proportional release).

[0004] When the first, green rope is pulled for activation of winding, the brake is automatically activated, which ensures that the brake belt slides along the winch drum, but it does not brake, because the drum is rotating in the direction of winding. Consequently, the drum is rotated, rope is wound onto it and the load is pulled towards the winch. When the first rope for activation of winding is released with the load attached, the drum would rotate in the direction of unwinding of the rope, which is automatically prevented by the activated brake. This is enabled by an eccentric connected to the brake belt. Thus, the drum does not rotate and the rope is not winding anymore, which consequently holds the load steady.

[0005] In case the wire rope has to be pulled out, the second, red rope for deactivation of the brake has to be pulled, which via a special lever system releases the brake belt, thus allowing rotation of the drum, wherein the said lever system is connected to the brake belt so that the latter can be partly released using a handle. By pulling the second rope the brake can be released in two manners, i.e., proportionally with slight pulling so that the load is released in a step-wise manner, or completely with full movement to the position in which the brake is completely deactivated, thus locking the lever system

and allowing the rope to freely unwind. The latter is used for example when pulling of the rope is needed during fixing of the load. During operation of the brake for proportional release the cardan shaft or the sprocket with the chain for transferring torque from the drive onto the drum still rotates (idle state). In case the first rope for activation of pulling is pulled, the brake is re-activated and the above-described process is repeated.

[0006] The technical problem, which is solved by the present invention, is a constructional design of a mechanism, which will reliably terminate the pulling function in a mechanical winch, wherein the mechanism has to enable easier return into the initial position, in which unwinding of the rope and consequent load pulling is enabled.

Prior art

[0007] According to EP3095748 a winch with a safety mechanism for switching off winding of a rope is known, wherein an end switch for switching off rope winding is triggered with a pushing element, which is pushed into the end switch by a rotatably mounted washer on an accessory on a rope guide, when the accessory of an end piece due to winding of the pulling rope reaches the washer and pushes it into its final position. The mechanism may be installed in winches with electric, hydraulic or mechanic steering of winding and unwinding of the pulling rope. The present invention differs from this disclosure as the termination of winding is not purely mechanical.

[0008] The solution of the stop switch described in patent JP6050697 is adapted for a winch installed in a car. Termination of the drive of the pulling rope is achieved mechanically, wherein on one side a switching element rotatable around one axis is provided, said switching element can be pushed by the end part of the rope. Upon pressure of the end part of the rope on the switching element, a coupling for turning on and off the PTO shaft is moved, so that the winch terminates winding of the rope. This solution differs from the present invention in that termination of winding is achieved in a different manner, as the invention is adapted for a forestry winch, the drum of which is not driven by the PTO shaft.

Description of the solution to the technical problem

[0009] The essence of the mechanical winch with a mechanical stop switch according to the invention is in that the mechanical stop switch has a Bowden inside which a wire rope is led, said wire rope being attached on one end to a pushing element installed at an orifice of a rope guide and on the other end to a switching mechanism, which upon contact of the end part of the rope with the pushing element moves from inactive to active position due to the translation through said wire rope.

[0010] The orifice of the rope guide is provided with a spring-supported pushing element, which is preferably

shaped as a washer or a plate with an opening for receiving the rope, which is with support elements connected to the inner part of the pushing element, or housing of the rope guide or the orifice, respectively, The Bowden, inside which the wire rope is led, is mounted on the pushing element or its inner part, respectively, wherein the wire rope is attached between the inner part and the outer washer or plate. The Bowden and the wire rope inside it are led to the switching mechanism and on the other end the Bowden is attached on the base plate or its accessory, while the wire rope is attached to the switching plate. When the end part of the pulling rope impacts the pushing element, this movement is transmitted to the switching plate in the interior of the winch due to said wire rope led in the Bowden. The stop switch mechanism in the interior or the exterior of the winch comprises:

- a base plate shaped like a washer with two legs or handles directed in opposite directions, wherein the upper leg is connected to the activation mechanism, i.e., the green rope for activation of pulling or winding of the rope on the winch drum, respectively,
- a switching plate, to which a wire rope is connected using an accessory and screws with nuts, said wire rope being led inside a Bowden, wherein the Bowden is additionally mounted on the longer, upper leg of the base plate or an accessory attached thereon,
- a housing shaped as a washer with one leg, which is approximately perpendicular or at any other angle relative to the axis of both legs of the base plate, wherein said housing leg is provided with a bore for connection with a coupling of the drum drive and an ear for mounting a spring, and wherein the housing may be welded onto optional bush for easier installation of the main axle of the winch,
- two springs for return movement of the base plate and the housing from their end position to their initial (null) position, wherein
 - the first spring is mounted on the housing leg and the winch frame, and
 - the second spring is mounted on the upper leg of the base plate, preferably via a holder, and to the switching plate,
- wherein all said plates are installed on the main winch axle, to which the main drum of the winch is mounted using suitable distancing elements and bearings, and
- between the base plate and the housing at least one restraining element is provided, which is preferably designed as at least three balls, said restraining element being arranged in suitable grooves or holes,
- the switching plate is provided with grooves or holes for receiving said restraining element, preferably balls, cylinders or pressure pins, and is arranged to rotate upon movement of the wire rope inside the Bowden, which causes the grooves to be covered

with the holes on the base plate, which leads to movement of the restraining element, preferably balls, and to disengagement of the connection between the base plate and the housing.

[0011] For reliable operation, at least three balls have to be provided, optimally five. Instead of balls suitable movable cylinders or pressure pins that operate in the same or similar manner as described balls can be used.

[0012] The mechanical stop switch functions in the following way: the coupling is activated by pulling the green rope on the winch and consequently the base plate, which triggers operation of the winch (winding of the rope on the drum, i.e. pulling of the load). When the end part of the rope impacts the pushing element mounted on the pulley of the winch, preferably the spring-supported pushing plate on the orifice of the guide, the mechanical force is transferred through the wire rope in the Bowden to the switching plate, which is rotated and releases momentum or locking force between the base plate and the housing or the handle of the base plate and the handle of the housing. The latter is connected to the coupling mechanism via a rod installed in a bearing of the housing, which consequently jumps to the zero position and terminates pulling with the winch. When the green rope is released to activate the base plate and the red rope is released to release the brake to allow the wire rope to pull the load out of the winch, the base plate and the housing are returned to the zero-position due to activity of the spring. With the rotation of the cut-off plate, the balls or the restraining element move from the grooves in the switching plate to the grooves in the housing, which means that the positions of the base plate and the housing are locked again, so that the base plate and the housing are again movable together. Thus, the coupling mechanism is prepared for activation or pulling of a load with the winch. The return to the initial position, in which winding is again possible, can be done with another handle or a lever instead of springs, which is obvious to an expert in the field of machine components and the above description of the invention.

[0013] The mechanical winch with the mechanical switch for terminating winding of the rope onto the drum of the winch according to the invention will be described in further detail based on exemplary embodiments and figures, which show:

- Figure 1 An orifice of the guide part of the pulling rope with a spring-supported pushing element
- Figure 2 An explosion view of the switching mechanism in the interior of the mechanical winch according to a possible embodiment from an angle, which shows grooves in the housing
- Figure 3 An explosion view of the switching mechanism as shown in figure 2 from a different angle that shows grooves in the switching plate
- Figure 4 The switching mechanism shown in figures

2 and 3 in an assembled state
 Figure 5 A cross-section of the switching mechanism shown in figure 4

[0014] Figure 1 shows an orifice 1 of the pulley, which is provided with a spring-supported pushing element shaped as a washer or a plate 11 with an opening for receiving the rope, which is with supporting elements 12 connected to an inner part 13 of the pushing element, housing of the guide or the orifice. Bowden B, inside which the wire rope Z is installed, is mounted on the inner part 13 of the pushing element, while the wire rope is attached in the middle between the inner part 13 and the outer washer or the plate 11. The Bowden B and the wire rope Z are then led to the switching mechanism shown in figures 2, 3 and 4. Figure 4 shows an assembled switching mechanism, while figures 2 and 3 show intermediate bearings for installation on a winch axle, a distancing bush and distancing elements. The switching mechanism in the interior of the winch according to the preferred embodiment comprises:

- a base plate 3 shaped like a washer with two legs 31, 32 directed in opposite directions, wherein the upper leg 31 is connected to the activation mechanism, i.e., the green rope for activation of winding of the rope on the winch drum,
- a switching plate 2, to which the wire rope Z is connected using an accessory and screws with nuts, said wire rope being led inside the Bowden B, wherein the Bowden B is additionally mounted on the longer, upper leg 31 of the base plate 3 or an accessory 33 attached thereon,
- a housing 4 shaped as a washer with one leg 41, which is approximately perpendicular or at any other angle relative to the axis of both legs 31, 32 of the base plate 3, wherein said housing leg 41 is provided with a bore for a bearing 42 for connection with a coupling of the drum drive and an ear for mounting a spring 43,
- two springs for return movement of the base plate and the housing from their end position to their initial (null) position, wherein
 - the first spring is mounted on the housing 4 leg 41 and the winch frame, and
 - the second spring is mounted on a holder attached on a leg of the base plate 3 and to the switching plate,
- wherein plates 2, 3 and the housing 4 are installed on a winch main axle, to which the drum of the winch is mounted using suitable distancing elements 6, distancing bush 7 and two bearings 8 for installation on the winch axle, and
- wherein between the base plate 3 and the housing 4 five balls 5 are arranged in suitable grooves 2a, 4a or holes 3a,

- the switching plate 2 is provided with grooves 2a or holes for receiving said balls, and is arranged to rotate upon movement of the wire rope inside the Bowden, which causes the grooves 2a to be covered with the holes 3a on the base plate 3, which leads to movement of the balls 5, and to disengagement of the connection between the base plate 3 and the housing 4.

[0015] Figure 5 shows a cross-section of the switching mechanism, wherein the ball is between the base plate 3 and the housing 4, so that they are connected and pulling is enabled. The switching plate 2 has the groove, which is upon rotation of the switching plate 2 due to impact of the end part of the rope to the pushing element 11 moved in such a manner to align with holes of the base plate 3, which moves the balls 5 between the base plate 3 and the switching plate 2 and terminates winding. In this state, pulling the green rope does not activate in pulling, as the elements are disengaged. For return into the initial state in which activation is enabled, the elements have to be returned into their initial state, i.e. both plate 3 and housing 4 have to be connected. The spring attached to the frame and the leg 32 of the plate 3 ensures the first step, while the plate 3 is pulled into its initial position by pulling the winch red rope. This initial position is needed for any new working cycle (load pulling) that has been terminated using the described switching mechanism.

Claims

1. A mechanical winch with a mechanical switch for terminating winding of a rope onto a drum of the winch, which has a pulley comprising a guide of the rope with an orifice provided with a spring-supported pushing element, preferably shaped as a washer or a plate with a hole for receiving the rope, said washer or plate being connected with supporting elements to an inner part of the pushing element, housing of the guide or the orifice, wherein a Bowden inside which a wire rope is installed, is mounted on the pushing element or its inner part, respectively, while the wire rope is attached between the inner part and an outer washer or a plate, and wherein the Bowden and the wire rope are led to a switching mechanism inside or outside the winch, said switching mechanism comprising:

- a base plate (3) shaped like a washer with two legs (31, 32) directed in opposite directions, wherein the upper leg (31) is connected to the activation mechanism, i.e., the green rope for activation of winding of the rope on the winch drum,
- a switching plate (2), to which the wire rope (Z) is connected using an accessory (33) and

screws with nuts, said wire rope being led inside the Bowden (B),

- a housing (4) shaped as a washer with one leg (41), which is approximately perpendicular or at any other angle relative to an axis of both legs (31, 32) of the base plate (3), wherein said housing leg (41) is provided with a bore (42) for a bearing for connection with a coupling of the drum drive and an ear for mounting a spring (43),
- two springs for return movement of the base plate (3) and the housing (4) from their end position to their initial (null) position, wherein

- the first spring is mounted on the housing (4) leg and the winch frame, and
- the second spring is mounted on a holder attached on a leg of the base plate (3) and to the switching plate (2),

wherein plates (2, 3) and the housing (4) are installed on a winch main axle, to which the drum of the winch is mounted using suitable distancing elements (6, 7) and bearings (8), and

- between the base plate (3) and the housing (4) at least one restraining element (5) is arranged in suitable grooves or holes (3a, 4a),

- the switching plate (2) is provided with grooves or holes (2a) for receiving said restraining element (5), and is arranged to rotate upon movement of the wire rope (Z) inside the Bowden (B), which causes the grooves (2a) to align with the holes (3a) on the base plate (3), which leads to movement of the restraining element (5), and to disengagement of the connection between the base plate (3) and the housing (4).

2. The mechanical winch with the mechanical switch for terminating winding of the rope onto the winch drum according to claim 1, wherein the Bowden (B) is additionally mounted on the longer, upper leg (31) of the base plate (3) or an attachment (33) mounted thereon.
3. The mechanical winch with the mechanical switch for terminating winding of the rope onto the winch drum according to any of the preceding claims, wherein the limiting element (5) is selected in the group consisting of balls, cylinders or push pins.
4. The mechanical winch with the mechanical switch for terminating winding of the rope onto the winch drum according to any of the preceding claims, wherein the limiting element (5) is designed as at least three balls, preferably five balls.
5. The mechanical winch with the mechanical switch for terminating winding of the rope onto the winch drum according to any of the preceding claims,

wherein upon impact of an end part of the rope on the pushing element the mechanical force is translated via the wire rope in the Bowden to the switching plate, which is arranged to rotate and consequently release momentum or locking force between the base plate (3) and the housing (4) or the leg of the base plate (3) and the leg of the housing (4), which is via a rod installed in a bearing of the housing (4) connected to the coupling mechanism, which is arranged to move into a null-position and terminates pulling with the winch.

6. The mechanical winch with the mechanical switch for terminating winding of the rope onto the winch drum according to any of the preceding claims, wherein the plate is arranged to return into its initial position due to a spring for return movement and pull of the red rope of the winch, which is arranged for rotation of the switching plate, thus ensuring that the restraining element is moved from the grooves in the switching plate (2) into the grooves of the housing (4), thereby locking the positions of the base plate (3) and the housing (4).
7. The mechanical winch with the mechanical switch for terminating winding of the rope onto the winch drum according to any of the preceding claims, wherein the plate is arranged to return into its initial position via an additional handle or a lever arranged for rotation of the switching plate, which ensures that the restraining element is moved from the grooves in the switching plate (2) into the grooves of the housing (4), thus locking the position of the base plate (3) and the housing (4).

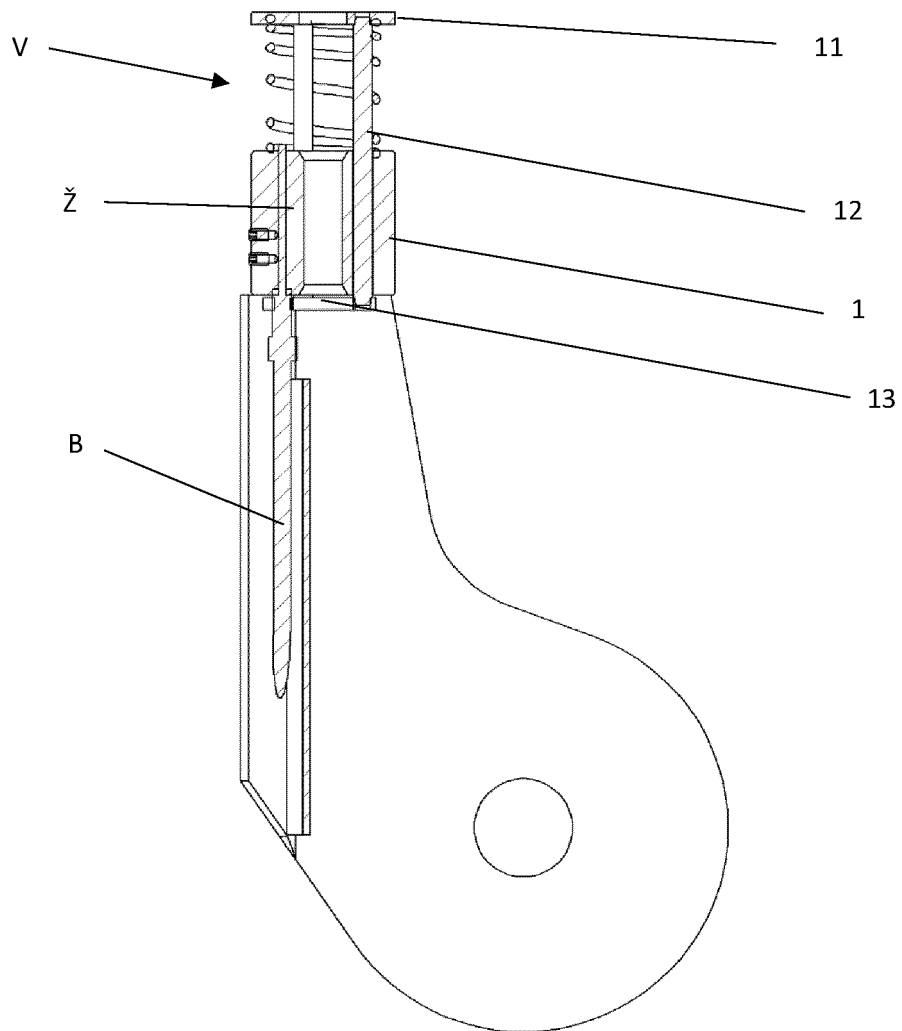


Figure 1

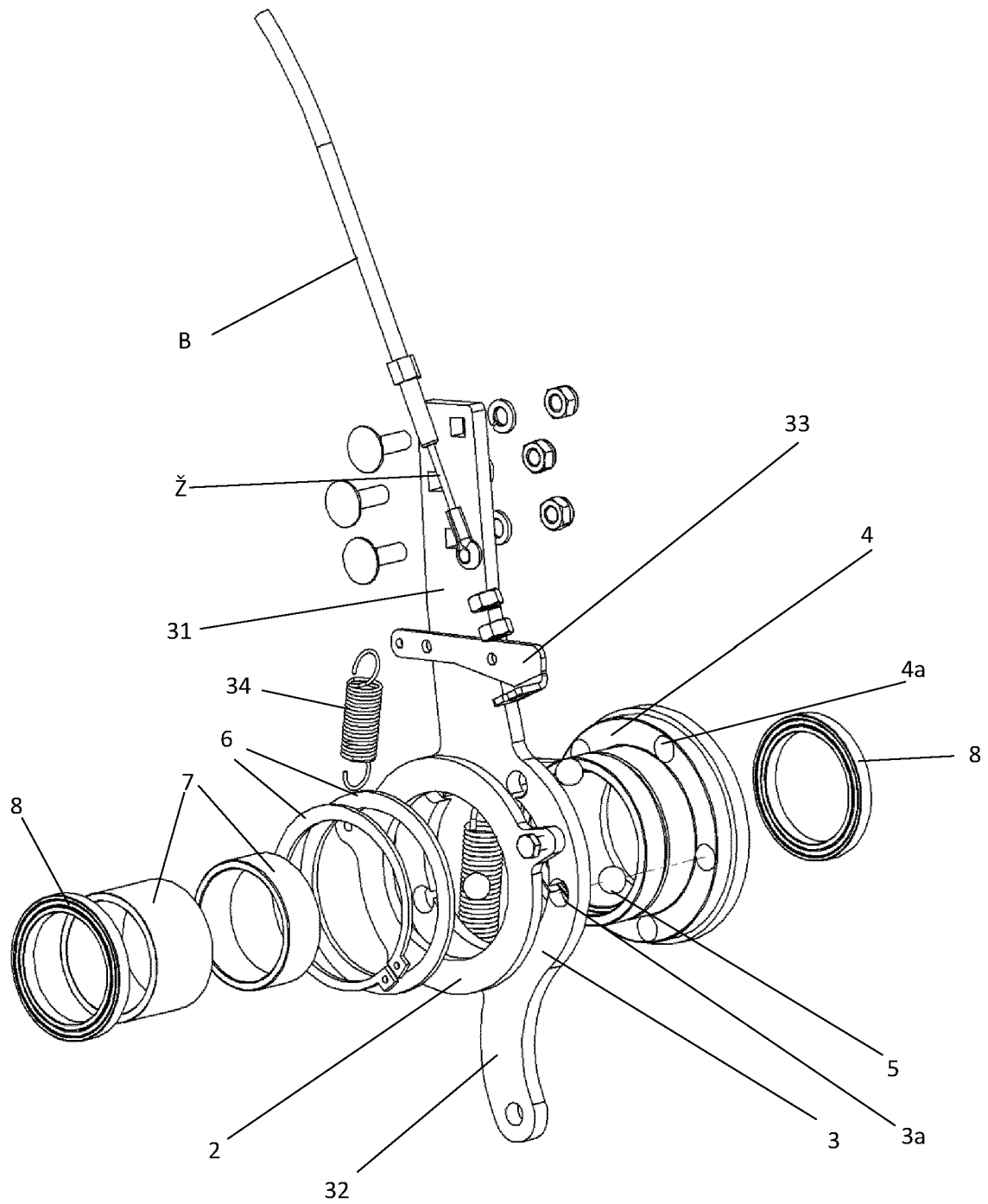


Figure 2

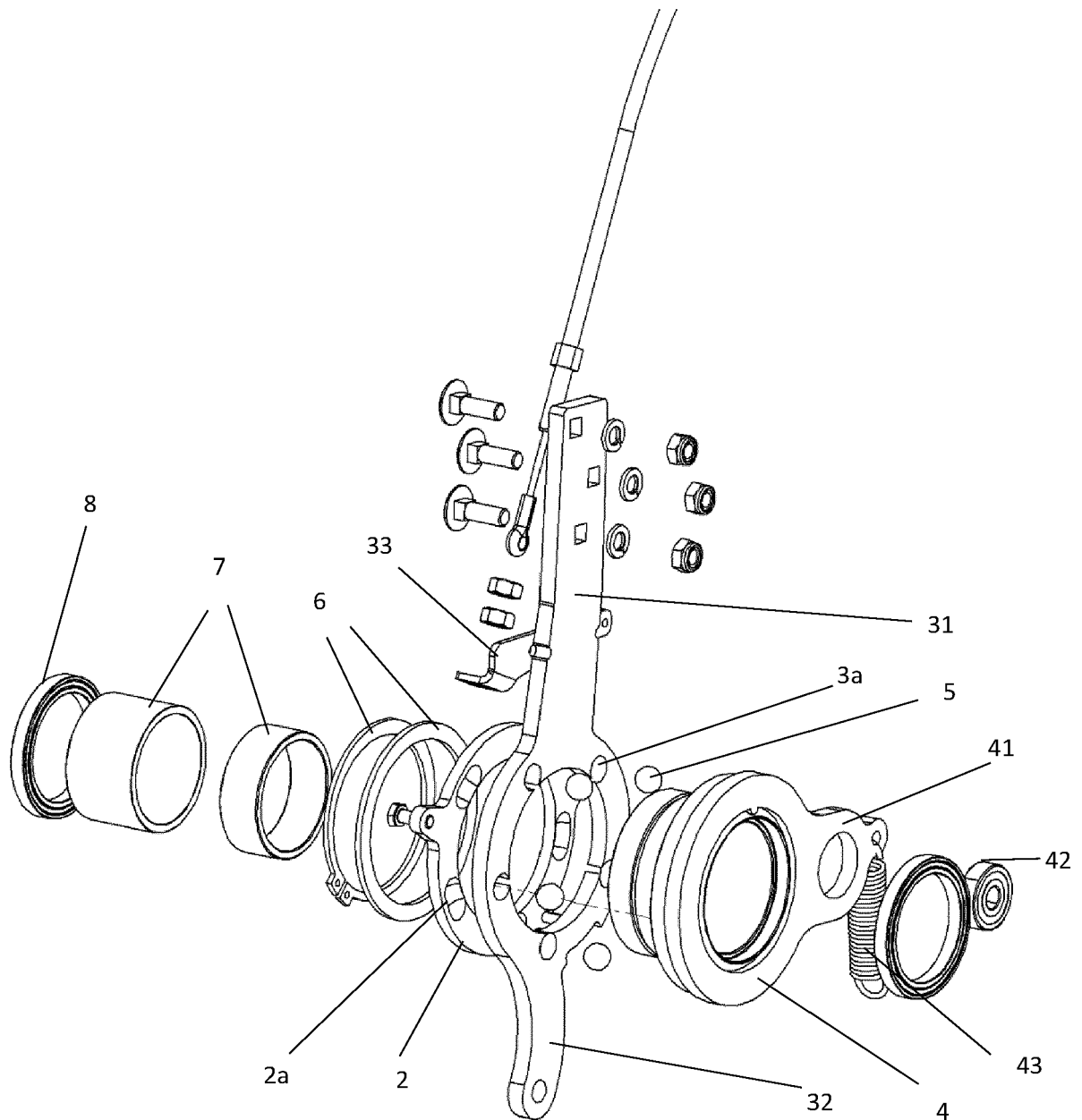


Figure 3

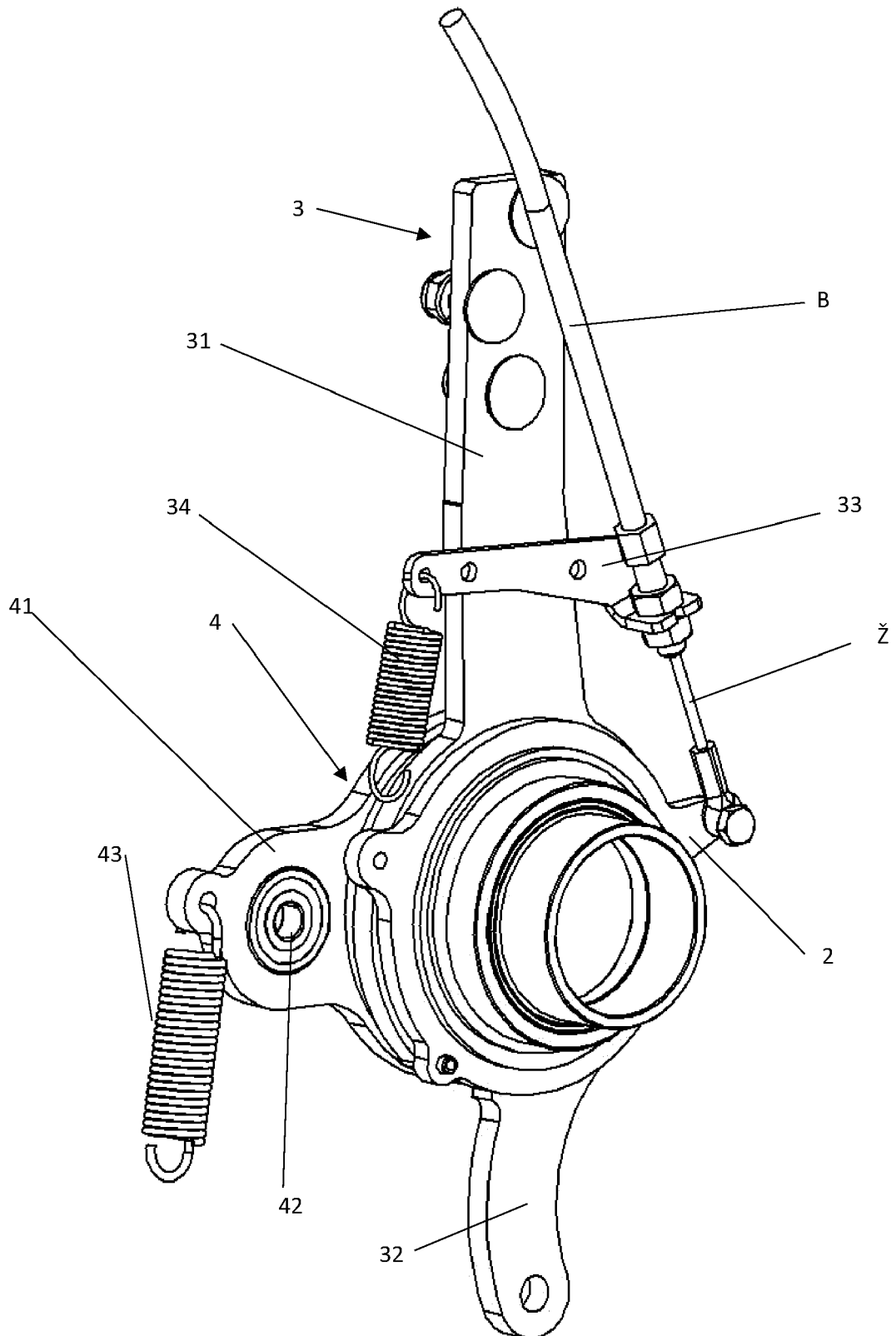


Figure 4

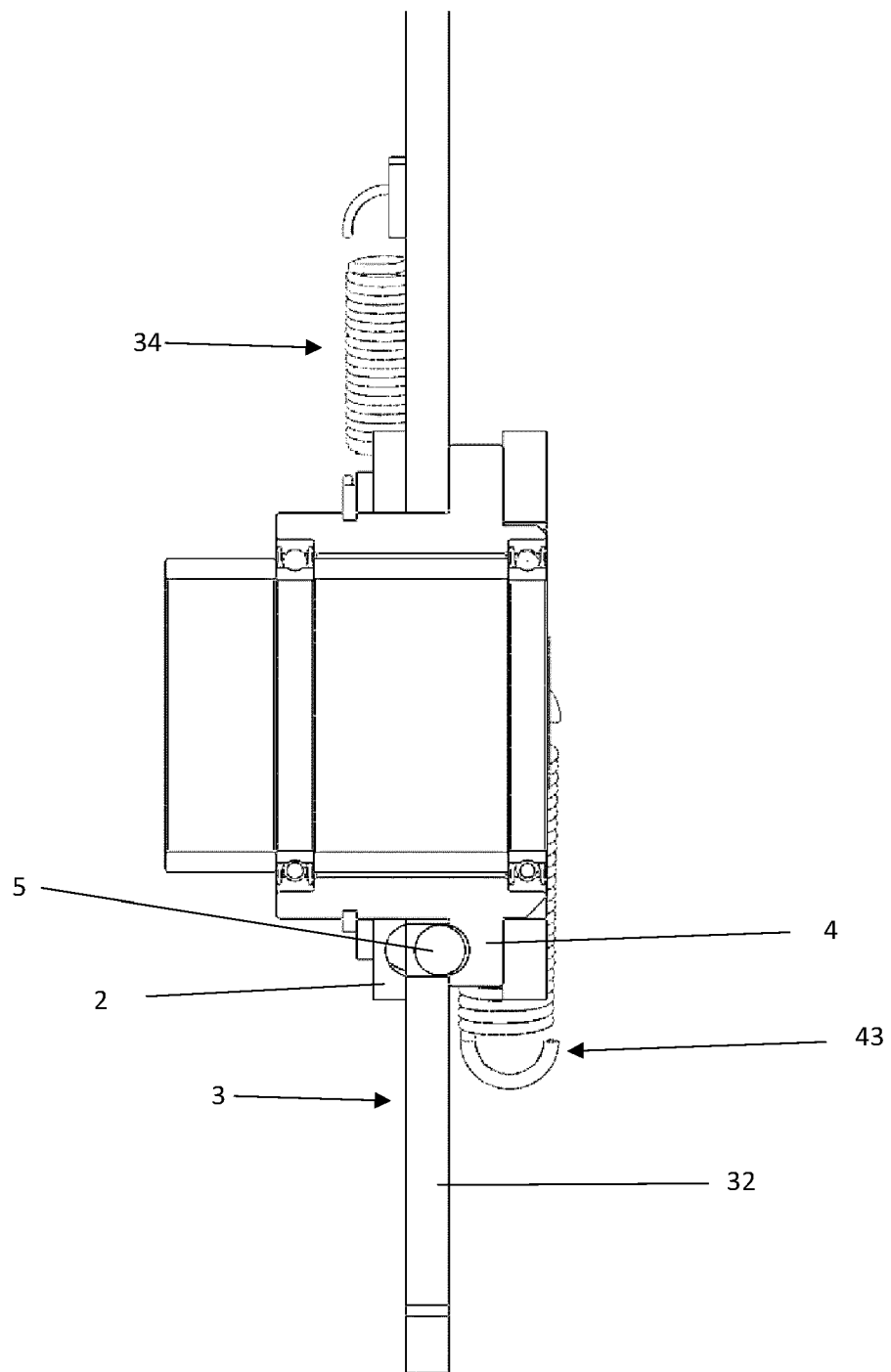


Figure 5



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			B66D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 11 May 2023	Examiner Delval, Stéphane
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