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(71) Applicant: **ABB Schweiz AG**
5400 Baden (CH)

(72) Inventors:

- **GENTSCH, Dietmar**
40882 Ratingen (DE)
- **STEFANKA, Martin**
664 61 Rajhrad (CZ)
- **REUBER, Christian**
47877 Willich (DE)

(74) Representative: **Maiwald Patent- und
Rechtsanwalts-gesellschaft mbH**
Elisenhof
Elisenstraße 3
80335 München (DE)

(54) **DRIVE FOR A LOW, MEDIUM OR HIGH VOLTAGE SWITCH**

(57) The present invention relates to a drive for a low, medium or high voltage switch, comprising a pushrod (10); a sun cogwheel (30); at least one planetary cogwheel (40); a carrier (50); a cogwheel ring (60); and an energy provider (70, 120, 150). An axis of the pushrod is coaxial with an axis of the sun cogwheel, and a rotation of the sun cogwheel is configured to move the pushrod along the axis of the pushrod. An axis of the carrier is coaxial with the axis of the sun cogwheel. An axis of the cogwheel ring is coaxial with the axis of the sun cogwheel. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. Each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier. Each planetary cogwheel is configured to rotate about its own centre axis. The energy provider is coupled to the carrier. In a first switching action energy release from the energy provider is configured to rotate the carrier in a first rotational direction about the axis of the sun cogwheel to rotate the sun cogwheel in the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

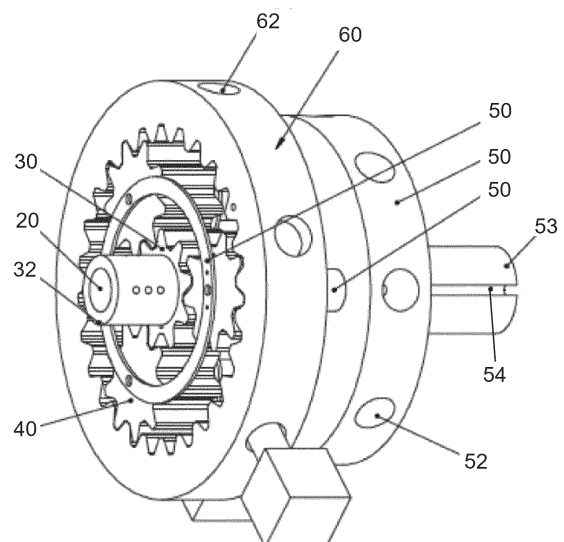


Fig. 2

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a drive for a low, medium or high voltage switch, a low, medium or high voltage switch such as a vacuum circuit breaker, and a switching system.

BACKGROUND OF THE INVENTION

[0002] Low, medium or high voltage switches such as switching poles or circuit breakers (CBs), generally use for example levers or shafts. For example, levers or shafts are used to connect several switching poles (usually 3) or other devices mechanically to one drive. The poles themselves require a translational movement (like SF6 poles or vacuum poles). With levers and shafts, it is difficult to connect several switching poles or devices unless they are arranged in one line.

[0003] For applications where an individual pole driving or a concentric device installed at the insulation part without a breaker housing is required, e.g. for synchronised switching or for having more freedom in the design of switchgears, the known mechanical CB drives are relatively large and complex. With magnetic drives, on the other hand, such solutions are possible, because these drives can be coupled relatively easily to Vacuum Interrupters (Vis) resulting in compact in-axis design for complete switching poles that already include the drive.

[0004] However, such magnetic drives are not always an optimal solution.

[0005] There is a need to address these issues.

SUMMARY OF THE INVENTION

[0006] Therefore, it would be advantageous to have an improved drive for a low, medium or high voltage switch.

[0007] The object of the present invention is solved with the subject matter of the independent claims, wherein further embodiments are incorporated in the dependent claims.

[0008] In a first aspect, there is provided a drive for a low, medium or high voltage switch, comprising:

- a pushrod;
- a sun cogwheel;
- at least one planetary cogwheel;
- a carrier;
- a cogwheel ring; and
- an energy provider.

An axis of the pushrod is coaxial with an axis of the sun cogwheel, and a rotation of the sun cogwheel is configured to move the pushrod along the axis of the pushrod. An axis of the carrier is coaxial with the axis of the sun cogwheel. An axis of the cogwheel ring is coaxial with

the axis of the sun cogwheel. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. Each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and each planetary cogwheel is configured to rotate about its own centre axis. The energy provider is coupled to the carrier. In a first switching action energy release from the energy provider is configured to rotate the carrier in a first rotational direction about the axis of the sun cogwheel to rotate the sun cogwheel in the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

[0009] In this manner, a triggered release of the carrier enables a rotational movement of the carrier and associated rotational movement of planetary cogwheels about a centre axis that leads to each planetary cogwheel also rotating about its own axis and this rotation is coupled to the sun cogwheel which then rotates and in doing so translates the pushrod along its axis as part of the switching mechanism of the vacuum interrupter.

[0010] In other words, the carrier can be a ring type structure to which is mounted the planetary cogwheels.

Then, the carrier can be stationary and the sun cogwheel and the cogwheel ring can rotate as the individual planetary cogwheels rotate about their own axes. Also, the carrier can rotate, and with the cogwheel ring stationary the individual planetary cogwheels rotate as the carrier rotates in this rotation is coupled to the sun cogwheel which then rotates. Also, the carrier can rotate, and with the sun cogwheel stationary the individual planetary cogwheels rotate as the carrier rotates in this rotation is coupled to the cogwheel ring which then rotates.

In an example, the pushrod is rotationally connected to or engaged with the sun cogwheel.

[0011] In an example, the sun cogwheel comprises a plurality of outward facing teeth.

[0012] In an example, the cogwheel ring comprises a plurality of inward facing teeth.

[0013] In an example, the pushrod comprises a threaded portion, and the sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel.

[0014] In an example, the at least one planetary cogwheel comprises a plurality of outward facing teeth, and wherein some teeth of the at least one planetary cogwheel are engaged with some teeth of the sun cogwheel and some other teeth of the at least one planetary cogwheel are engaged with some teeth of the cogwheel ring

[0015] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0016] In an example, the low, medium or high voltage switch is a vacuum circuit breaker.

[0017] In an example, the drive comprises a carrier locking device. The carrier comprises at least one latching feature. The carrier locking device is configured to engage with one latching feature of the at least one latch-

ing feature of the carrier to stop the carrier from rotating. The carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate. Initiation of the first switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0018] In an example, in the first switching action the drive is configured such that the cogwheel ring does not rotate.

[0019] In an example, the cogwheel ring comprises at least one latching feature. The drive comprises a cogwheel ring locking device. The cogwheel ring locking device is configured to engage with one latching feature of the at least one latching feature of the cogwheel ring to stop the cogwheel ring from rotating. The cogwheel ring locking device is configured to disengage from the at least one latching feature of the cogwheel ring to permit the cogwheel ring to rotate.

[0020] In an example, in the first switching action the rotation of the sun cogwheel in the first rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0021] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0022] In this way, because the pushrod is threaded and the sun cogwheel is threaded, rotation of the sun cogwheel whilst the pushrod cannot rotate necessarily leads to translation of the pushrod.

[0023] In an example, the energy provider comprises a closing spring, and a first end of the closing spring is coupled to the carrier.

[0024] In an example, in the first switching action the drive is configured such that a second end of the closing spring is held in a fixed position.

[0025] In an example, the energy provided comprises a motor or actuator, and the motor or actuator is coupled to the carrier.

[0026] In an example, the motor or actuator is a rotational motor or actuator, and a rotational shaft of the motor or actuator is coupled to the carrier.

[0027] In an example, the motor or actuator is coupled to a shaft of the carrier, wherein the shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0028] In an example, the motor or actuator is a linear motor or actuator, and a lever system of the motor or actuator is coupled to the carrier.

[0029] In an example, the lever system is coupled to a shaft of the carrier. The shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0030] In an example, the lever system is coupled to the shaft of the carrier via a roller clutch.

[0031] In an example, the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever

system for driving the first switching operation.

[0032] In an example, the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0033] In an example, at the end of the first switching action, the carrier locking device is configured to engage with a latching feature of the at least one latching feature of the carrier.

[0034] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring.

[0035] In this way, the first switching action can store energy required for a return or second switching action bringing the switch back to its original configuration.

[0036] In an example, in a second switching action energy release from the opening spring is configured to rotate the cogwheel ring. In the second switching action a rotation of the cogwheel ring about the axis of the sun cogwheel in the first rotational direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0037] In an example, initiation of the second switching action comprises a disengagement of the cogwheel ring locking device from a latching feature of the at least one latching feature of the cogwheel ring.

[0038] In an example, a first end of the opening spring is connected to the pushrod.

[0039] In an example, a second end of the opening spring is held in a fixed position.

[0040] In an example, in the second switching action the drive is configured such that the carrier does not rotate about the axis of the sun cogwheel.

[0041] In other words, the sun cogwheel rotates, but the individual planetary cogwheels are not rotating about the centre axis but are each rotating about their own axes, and this leads to the cogwheel ring rotating. Thus, in this manner the second switching movement is not constrained by storing energy in the closing spring used to drive the first switching movement because the planetary cogwheels are not rotating as a whole around a centre axis but only rotating about their own axes.

[0042] In an example, in the second switching action the drive is configured such that the second end of the closing spring is held in the fixed position.

[0043] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the closing spring in the first rotational direction is configured to store energy in the closing spring.

[0044] In this manner, a simple way of charging the drive for switching operation is enabled.

[0045] In a second aspect, there is provided a low, medium or high voltage switch comprising a drive according to the first aspect.

[0046] In a third aspect, there is provided a low, medi-

um or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage switch according to the first aspect;
- a second drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the second drive;
- a third drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the third drive;

Rotation of the carrier of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

[0047] In a fourth aspect, there is provided a drive for a low, medium or high voltage switch, comprising:

- a pushrod;
- a sun cogwheel;
- at least one planetary cogwheel;
- a carrier;
- a cogwheel ring; and
- an energy provider.

An axis of the pushrod is coaxial with an axis of the sun cogwheel, and a rotation of the sun cogwheel is configured to move the pushrod along the axis of the pushrod. An axis of the carrier is coaxial with the axis of the sun cogwheel. An axis of the cogwheel ring is coaxial with the axis of the sun cogwheel. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. Each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier. Each planetary cogwheel is configured to rotate about its own centre axis. The energy provider is coupled to the cogwheel ring. In a first switching action energy release from the energy provider is configured to rotate the cogwheel ring in a first rotational direction about the axis of the sun cogwheel to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

[0048] In this manner, a triggered release of the cogwheel ring enables a rotational movement of the cogwheel ring about a centre axis that leads to each planetary cogwheel also rotating about its own axis and this rotation is coupled to the sun cogwheel which then rotates and in doing so translates the pushrod along its axis as part of the switching mechanism of the vacuum interrupter.

[0049] In other words, the carrier can be a ring type structure to which is mounted the planetary cogwheels.

Then, the carrier can be stationary and the sun cogwheel and the cogwheel ring can rotate as the individual planetary cogwheels rotate about their own axes. Also, the carrier can rotate, and with the cogwheel ring stationary the individual planetary cogwheels rotate as the carrier rotates in this rotation is coupled to the sun cogwheel which then rotates. Also, the carrier can rotate, and with the sun cogwheel stationary the individual planetary cogwheels rotate as the carrier rotates in this rotation is coupled to the cogwheel ring which then rotates.

[0050] In an example, the pushrod is rotationally connected to or engaged with the sun cogwheel.

[0051] In an example, the pushrod comprises a threaded portion.

[0052] In an example, the sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel.

[0053] In an example, the sun cogwheel comprises a plurality of outward facing teeth.

[0054] In an example, the cogwheel ring comprises a plurality of inward facing teeth.

[0055] In an example, the at least one planetary cogwheel comprises a plurality of outward facing teeth, and wherein some teeth of the at least one planetary cogwheel are engaged with some teeth of the sun cogwheel and some other teeth of the at least one planetary cogwheel are engaged with some teeth of the cogwheel ring.

[0056] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0057] In an example, the low, medium or high voltage switch is a vacuum circuit breaker.

[0058] In an example, the drive comprises a cogwheel locking device. The cogwheel ring comprises at least one latching feature. The cogwheel ring locking device is configured to engage with one latching feature of the at least one latching feature of the cogwheel ring to stop the cogwheel ring from rotating. The cogwheel ring locking device is configured to disengage from the at least one latching feature of the cogwheel ring to permit the cogwheel ring to rotate. Initiation of the first switching action comprises a disengagement of the cogwheel ring locking device from a latching feature of the at least one latching feature of the cogwheel ring.

[0059] In an example, in the first switching action the drive is configured such that the carrier does not rotate about the pushrod axis.

[0060] In an example, the carrier comprises at least one latching feature. The drive comprises a carrier locking device. The carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating. The carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate.

[0061] In an example, in the first switching action the rotation of the sun cogwheel in the second rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun

cogwheel.

[0062] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0063] In this way, because the pushrod is threaded and the sun cogwheel is threaded, rotation of the sun cogwheel whilst the pushrod cannot rotate necessarily leads to translation of the pushrod.

[0064] In an example, the energy provider comprises a closing spring, and a first end of the closing spring is coupled to the cogwheel ring.

[0065] In an example, in the first switching action the drive is configured such that a second end of the closing spring is held in a fixed position.

[0066] In an example, the energy provided comprises a motor or actuator, and the motor or actuator is coupled to the cogwheel ring.

[0067] In an example, the motor or actuator is a rotational motor or actuator, and a rotational shaft of the motor or actuator is coupled to the cogwheel ring.

[0068] In an example, the motor or actuator is coupled to a shaft of the cogwheel ring. The shaft of the cogwheel ring is fixedly connected to the cogwheel ring such that the cogwheel ring and the shaft of the cogwheel ring rotate together.

[0069] In an example, the motor or actuator is a linear motor or actuator, and a lever system of the motor or actuator is coupled to the cogwheel ring.

[0070] In an example, the lever system is coupled to a shaft of the cogwheel ring. The shaft of the cogwheel ring is fixedly connected to the cogwheel ring such that the cogwheel ring and the shaft of the cogwheel ring rotate together.

[0071] In an example, the lever system is coupled to the shaft of the cogwheel ring via a roller clutch.

[0072] In an example, the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0073] In an example, the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0074] In an example, at the end of the first switching action, the cogwheel ring locking device is configured to engage with a latching feature of the at least one latching feature of the cogwheel ring.

[0075] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring.

[0076] In this way, the first switching action can store energy required for a return or second switching action bringing the switch back to its original configuration.

[0077] In an example, in a second switching action energy release from the opening spring is configured to rotate the carrier. In the second switching action a rotation of the carrier about the axis of the sun cogwheel is con-

figured to rotate the sun cogwheel in a first rotational direction opposite to the second rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0078] In an example, initiation of the second switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0079] In an example, a first end of the opening spring is connected to the pushrod.

[0080] In an example, a second end of the opening spring is held in a fixed position.

[0081] In an example, in the second switching action the drive is configured such that the cogwheel ring does not rotate about the axis of the sun cogwheel.

[0082] In other words, the sun cogwheel rotates, and the planetary cogwheels rotate about the centre axis and each planetary cogwheel are each rotating about their own axes, and this with the cogwheel ring not rotating.

Thus, in this manner the second switching movement is not constrained by storing energy in the closing spring used to drive the first switching movement because the cogwheel ring is not rotating.

[0083] In an example, in the second switching action the drive is configured such that the second end of the closing spring is held in the fixed position.

[0084] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the closing spring in the first rotational direction is configured to store energy in the closing spring.

[0085] In this manner, a simple way of charging the drive for switching operation is enabled.

[0086] In a fifth aspect, there is provided a low, medium or high voltage switch comprising a drive according to the fourth aspect.

[0087] In a sixth aspect, there is provided a low, medium or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage switch according to the fourth aspect;
- a second drive for a low, medium or high voltage switch comprising a cogwheel ring coupled to the cogwheel ring of the first drive such that rotation of the cogwheel ring of the first drive leads to an associated rotation of the cogwheel ring of the second drive;
- a third drive for a low, medium or high voltage switch comprising a cogwheel ring coupled to the cogwheel ring of the first drive such that rotation of the cogwheel ring of the first drive leads to an associated rotation of the cogwheel ring of the third drive;

wherein, rotation of the cogwheel ring of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

[0088] In a seventh aspect, there is provided a drive for a low, medium or high voltage switch, comprising:

- a pushrod;
- a sun cogwheel;
- at least one planetary cogwheel;
- a carrier;
- a cogwheel ring; and
- an energy provider.

An axis of the pushrod is coaxial with the axis of the cogwheel ring, and a rotation of the cogwheel ring is configured to move the pushrod along the axis of the pushrod. An axis of the carrier is coaxial with the axis of the sun cogwheel. The axis of the cogwheel ring is coaxial with an axis of the sun cogwheel. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. Each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier. Each planetary cogwheel is configured to rotate about its own centre axis. The energy provider is coupled to the carrier. In a first switching action energy release from the energy provider is configured to rotate the carrier in a first rotational direction about the axis of the sun cogwheel to rotate the cogwheel ring in the first rotational direction to move the pushrod along the axis of the pushrod in the first direction.

[0089] In this manner, a triggered release of the carrier enables a rotational movement of the carrier and associated rotational movement of planetary cogwheels about a centre axis leads to each planetary cogwheel also rotating about its own axis and this rotation is coupled to the cogwheel ring which then rotates and in doing so translates the pushrod along its axis as part of the switching mechanism of the vacuum interrupter.

[0090] In other words, the carrier can be a ring type structure to which is mounted the planetary cogwheels. Then, the carrier can be stationary and the sun cogwheel and the cogwheel ring can rotate as the individual planetary cogwheels rotate about their own axes. Also, the carrier can rotate, and with the cogwheel ring stationary the individual planetary cogwheels rotate as the carrier rotates in this rotation is coupled to the sun cogwheel which then rotates. Also, the carrier can rotate, and with the sun cogwheel stationary the individual planetary cogwheels rotate as the carrier rotates in this rotation is coupled to the cogwheel ring which then rotates.

[0091] In an example, the pushrod comprises a threaded portion.

[0092] In an example, the cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring.

[0093] In an example, the sun cogwheel comprises a plurality of outward facing teeth.

[0094] In an example, the cogwheel ring comprises a plurality of inward facing teeth.

[0095] In an example, the at least one planetary cogwheel comprises a plurality of outward facing teeth, and wherein some teeth of the at least one planetary cog-

wheel are engaged with some teeth of the sun cogwheel and some other teeth of the at least one planetary cogwheel are engaged with some teeth of the cogwheel ring.

[0096] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0097] In an example, the low, medium or high voltage switch is a vacuum circuit breaker.

[0098] In an example, the drive comprises a carrier locking device. The carrier comprises at least one latching feature. The carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating. The carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate. Initiation of the first switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0099] In an example, in the first switching action the drive is configured such that the sun cogwheel does not rotate.

[0100] In an example, the sun cogwheel comprises at least one latching feature. The drive comprises a sun cogwheel locking device. The sun cogwheel locking device is configured to engage with one latching feature of the at least one latching feature of the sun cogwheel to stop the sun cogwheel from rotating. The sun cogwheel locking device is configured to disengage from the at least one latching feature of the sun cogwheel to permit the sun cogwheel to rotate.

[0101] In an example, in the first switching action the rotation of the cogwheel ring in the first rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0102] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0103] In this way, because the pushrod is threaded and the cogwheel ring has a threaded section that mates with the threaded pushrod, rotation of the cogwheel ring whilst the pushrod cannot rotate necessarily leads to translation of the pushrod.

[0104] In other words, the carrier can be a ring type structure to which is mounted the planetary cogwheels. Then, the carrier can be stationary and the sun cogwheel and the cogwheel ring can rotate as the individual planetary cogwheels rotate about their own axes. Also, the carrier can rotate, and with the cogwheel ring stationary the individual planetary cogwheels rotate as the carrier rotates in this rotation is coupled to the sun cogwheel which then rotates. Also, the carrier can rotate, and with the sun cogwheel stationary the individual planetary cogwheels rotate as the carrier rotates in this rotation is coupled to the cogwheel ring which then rotates.

[0105] In an example, the energy provider comprises a closing spring, and wherein a first end of the closing spring is coupled to the carrier.

[0106] In an example, in the first switching action the

drive is configured such that a second end of the closing spring is held in a fixed position.

[0107] In an example, the energy provided comprises a motor or actuator, and the motor or actuator is coupled to the carrier.

[0108] In an example, the motor or actuator is a rotational motor or actuator, and a rotational shaft of the motor or actuator is coupled to the carrier.

[0109] In an example, the motor or actuator is coupled to a shaft of the carrier. The shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0110] In an example, the motor or actuator is a linear motor or actuator, and a lever system of the motor or actuator is coupled to the carrier.

[0111] In an example, the lever system is coupled to a shaft of the carrier. The shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0112] In an example, the lever system is coupled to the shaft of the carrier via a roller clutch.

[0113] In an example, the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0114] In an example, the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0115] In an example, at the end of the first switching action, the carrier locking device is configured to engage with a latching feature of the at least one latching feature of the carrier.

[0116] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring.

[0117] In this way, the first switching action can store energy required for a return or second switching action bringing the switch back to its original configuration.

[0118] In an example, in a second switching action energy release from the opening spring is configured to rotate the sun cogwheel. In the second switching action a rotation of the sun cogwheel about the axis of the sun cogwheel is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0119] In an example, initiation of the second switching action comprises a disengagement of the sun cogwheel locking device from a latching feature of the at least one latching feature of the sun cogwheel.

[0120] In an example, a first end of the opening spring is connected to the pushrod.

[0121] In an example, a second end of the opening spring is held in a fixed position.

[0122] In an example, in the second switching action the drive is configured such that the carrier does not ro-

tate about the axis of the sun cogwheel.

[0123] In other words, the cogwheel ring rotates, but the individual planetary cogwheels are not rotating about the centre axis but are each rotating about their own axes, and this leads to the sun cogwheel rotating. Thus, in this manner the second switching movement is not constrained by storing energy in the closing spring used to drive the first switching movement because the planetary cogwheels are not rotating as a whole around a centre axis but only rotating about their own axes.

[0124] In an example, in the second switching action the drive is configured such that the second end of the closing spring is held in the fixed position.

[0125] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the closing spring in the first rotational direction is configured to store energy in the closing spring.

[0126] In this manner, a simple way of charging the drive for switching operation is enabled.

[0127] In an eighth aspect, there is provided a low, medium or high voltage switch comprising a drive according to the seventh aspect.

[0128] In ninth aspect, there is provided a drive for a low, medium or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage switch according to the seventh aspect;
- a second drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the second drive;
- a third drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the third drive.

Rotation of the carrier of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

[0129] In a tenth aspect, there is provided a drive for a low, medium and high voltage switch, comprising:

- a pushrod;
- a sun cogwheel;
- at least one planetary cogwheel;
 - a carrier;
- a cogwheel ring; and
 - an energy provider.

An axis of the pushrod is coaxial with the axis of the cogwheel ring, and a rotation of the cogwheel ring is configured to move the pushrod along the axis of the pushrod. An axis of the carrier is coaxial with the axis of the sun cogwheel. The axis of the cogwheel ring is coaxial with an axis of the sun cogwheel. The at least one planetary

cogwheel is located between the sun cogwheel and the cogwheel ring. Each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier. Each planetary cogwheel is configured to rotate about its own centre axis. The energy provider is coupled to the sun cogwheel. In a first switching action energy release from the energy provider is configured to rotate the sun cogwheel in a first rotational direction about the axis of the sun cogwheel rotate the cogwheel ring in a second rotational direction counter to the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

[0130] In an example, the pushrod comprises a threaded portion.

[0131] In an example, the cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring.

[0132] In an example, the sun cogwheel comprises a plurality of outward facing teeth.

[0133] In an example, the cogwheel ring comprises a plurality of inward facing teeth.

[0134] In an example, the at least one planetary cogwheel comprises a plurality of outward facing teeth, and wherein some teeth of the at least one planetary cogwheel are engaged with some teeth of the sun cogwheel and some other teeth of the at least one planetary cogwheel are engaged with some teeth of the cogwheel ring

[0135] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0136] In an example, the low, medium or high voltage switch is a vacuum interrupter.

[0137] In an example, the drive comprises a sun cogwheel locking device. The sun cogwheel comprises at least one latching feature. The sun cogwheel locking device is configured to engage with one latching feature of the at least one latching feature of the sun cogwheel to stop the sun cogwheel from rotating. The sun cogwheel locking device is configured to disengage from the at least one latching feature of the sun cogwheel to permit the sun cogwheel to rotate. Initiation of a first switching action comprises a disengagement of the sun cogwheel locking device from a latching feature of the at least one latching feature of the sun cogwheel.

[0138] In an example, in the first switching action the drive is configured such that the carrier does not rotate about the axis of the sun cogwheel.

[0139] In an example, the drive comprises a carrier locking device. The carrier comprises at least one latching feature. The carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating. The carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate.

[0140] In an example, in the first switching action the rotation of the cogwheel ring in the second rotational di-

rection is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0141] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0142] In an example, the energy provider comprises a closing spring, and a first end of the closing spring is coupled to the sun cogwheel.

[0143] In an example, in the first switching action the drive is configured such that a second end of the closing spring is held in a fixed position.

[0144] In an example, the energy provided comprises a motor or actuator, and the motor or actuator is coupled to the sun cogwheel.

[0145] In an example, the motor or actuator is a rotational motor or actuator, and a rotational shaft of the motor or actuator is coupled to the sun cogwheel.

[0146] In an example, the motor or actuator is coupled to a shaft of the sun cogwheel. The shaft of the sun cogwheel is fixedly connected to the sun cogwheel such that the sun cogwheel and the shaft of the sun cogwheel ring rotate.

[0147] In an example, the motor or actuator is a linear motor or actuator, and a lever system of the motor or actuator is coupled to the sun cogwheel.

[0148] In an example, the lever system is coupled to a shaft of the sun cogwheel. The shaft of the sun cogwheel is fixedly connected to the sun cogwheel such that the sun cogwheel and the shaft of the sun cogwheel rotate together.

[0149] In an example, the lever system is coupled to the shaft of the sun cogwheel ring via a roller clutch.

[0150] In an example, the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0151] In an example, the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0152] In an example, at the end of the first switching action, the sun cogwheel locking device is configured to engage with a latching feature of the at least one latching feature of the sun cogwheel.

[0153] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring.

[0154] In an example, in a second switching action energy release from the opening spring is configured to rotate the carrier. In the second switching action a rotation of the carrier about the axis of the sun cogwheel is configured to rotate the cogwheel ring in a first rotational direction opposite to the second rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0155] In an example, initiation of the second switching

action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0156] In an example, a first end of the opening spring is connected to the pushrod.

[0157] In an example, a second end of the opening spring is held in a fixed position.

[0158] In an example, in the second switching action the drive is configured such that the sun cogwheel does not rotate about the axis of the sun cogwheel.

[0159] In an example, in the second switching action the drive is configured such that the second end of the closing spring is held in the fixed position.

[0160] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the closing spring in the first rotational direction is configured to store energy in the closing spring.

[0161] In an eleventh aspect, there is provided a low, medium and high voltage switch comprising a drive according to the tenth aspect.

[0162] In a twelfth aspect, there is provided a drive for a low, medium or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage switch according to the tenth aspect;
- a second drive for a low, medium or high voltage switch comprising a sun cogwheel coupled to the sun cogwheel of the first drive such that rotation of the sun cogwheel of the first drive leads to an associated rotation of the sun cogwheel of the second drive;
- a third drive for a low, medium or high voltage switch comprising a sun cogwheel coupled to the sun cogwheel of the first drive such that rotation of the sun cogwheel of the first drive leads to an associated rotation of the sun cogwheel of the third drive;

[0163] Rotation of the sun cogwheel of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

[0164] The above aspects and examples will become apparent from and be elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0165] Exemplary embodiments will be described in the following with reference to the following drawings:

Fig. 1 shows a schematic view of a drive for a low, medium or high voltage switch;

Fig. 2 shows the drive of Fig. 1 without the closing and opening springs as energy providers;

Fig. 3 shows a schematic view of a drive for a low, medium or high voltage switch with a rotational motor

as the energy provider for a closing operation;

Fig. 4 shows an example of a drive system with three phases; and

Figs. 5-7 show a schematic view of a drive for a low, medium or high voltage switch with a linear motor or actuator as the energy provider for a closing operation, with the figures showing the drive transitioning from an off position of a switch to an intermediate position of the switch to an on position of the switch.

DETAILED DESCRIPTION OF EMBODIMENTS

[0166] Figs. 1-7 relate to examples of drives for a low, medium or high voltage switch, and to switches and switch systems having such drives. Not every embodiment described below is actually shown in the figures.

Embodiment 1

[0167] In an example a drive for a low, medium or high voltage switch comprises a pushrod 10, a sun cogwheel 30, at least one planetary cogwheel 40, a carrier 50, a cogwheel ring 60, and an energy provider 70, 120, 150. An axis of the pushrod is coaxial with an axis of the sun cogwheel, and a rotation of the sun cogwheel is configured to move the pushrod along the axis of the pushrod. An axis of the carrier is coaxial with the axis of the sun cogwheel. An axis of the cogwheel ring is coaxial with the axis of the sun cogwheel. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. Each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and each planetary cogwheel is configured to rotate about its own centre axis. The energy provider is coupled to the carrier. In a first switching action energy release from the energy provider is configured to rotate the carrier in a first rotational direction about the axis of the sun cogwheel to rotate the sun cogwheel in the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

[0168] In an example, the sun cogwheel comprises a plurality of outward facing teeth.

[0169] In an example, the cogwheel ring comprises a plurality of inward facing teeth.

[0170] In an example, the pushrod comprises a threaded portion 20, and the sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel.

[0171] In an example, the at least one planetary cogwheel comprises a plurality of outward facing teeth, and wherein some teeth of the at least one planetary cogwheel are engaged with some teeth of the sun cogwheel and some other teeth of the at least one planetary cogwheel are engaged with some teeth of the cogwheel ring

[0172] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0173] In an example, the low, medium or high voltage switch is a vacuum circuit breaker.

[0174] In an example, the drive comprises a carrier locking device 90. The carrier comprises at least one latching feature 52. The carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating. The carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate. Initiation of the first switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0175] In an example, in the first switching action the drive is configured such that the cogwheel ring does not rotate.

[0176] In an example, the cogwheel ring comprises at least one latching feature 62. The drive comprises a cogwheel ring locking device 100. The cogwheel ring locking device is configured to engage with one latching feature of the at least one latching feature of the cogwheel ring to stop the cogwheel ring from rotating. The cogwheel ring locking device is configured to disengage from the at least one latching feature of the cogwheel ring to permit the cogwheel ring to rotate.

[0177] In an example, in the first switching action the rotation of the sun cogwheel in the first rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0178] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0179] In this way, because the pushrod is threaded and the sun cogwheel is threaded, rotation of the sun cogwheel whilst the pushrod cannot rotate necessarily leads to translation of the pushrod.

[0180] In an example, the energy provider comprises a closing spring, and a first end 74 of the closing spring 70 is coupled to the carrier.

[0181] In an example, in the first switching action the drive is configured such that a second end 72 of the closing spring is held in a fixed position.

[0182] In an example, the energy provided comprises a motor or actuator 120, 150, and the motor or actuator is coupled to the carrier.

[0183] In an example, the motor or actuator is a rotational motor or actuator 120, and a rotational shaft of the motor or actuator is coupled to the carrier.

[0184] In an example, the motor or actuator is coupled to a shaft 53 of the carrier, wherein the shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0185] In an example, the motor or actuator is a linear motor or actuator 150, and a lever system 160 of the motor or actuator is coupled to the carrier.

[0186] In an example, the lever system is coupled to a

shaft 53 of the carrier. The shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0187] In an example, the lever system is coupled to the shaft of the carrier via a roller clutch 170.

[0188] In an example, the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0189] In an example, the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0190] In an example, at the end of the first switching action, the carrier locking device is configured to engage with a latching feature of the at least one latching feature of the carrier.

[0191] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring 80.

[0192] In an example, in a second switching action energy release from the opening spring is configured to rotate the cogwheel ring. In the second switching action a rotation of the cogwheel ring about the axis of the sun cogwheel in the first rotational direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0193] In an example, initiation of the second switching action comprises a disengagement of the cogwheel ring locking device from a latching feature of the at least one latching feature of the cogwheel ring.

[0194] In an example, a first end 84 of the opening spring is connected to the pushrod.

[0195] In an example, a second end 82 of the opening spring is held in a fixed position.

[0196] In an example, in the second switching action the drive is configured such that the carrier does not rotate about the axis of the sun cogwheel.

[0197] In other words, the sun cogwheel rotates, but the individual planetary cogwheels are not rotating about the centre axis but are each rotating about their own axes, and this leads to the cogwheel ring rotating. Thus, in this manner the second switching movement is not constrained by storing energy in the closing spring used to drive the first switching movement because the planetary cogwheels are not rotating as a whole around a centre axis but only rotating about their own axes.

[0198] In an example, in the second switching action the drive is configured such that the second end of the closing spring is held in the fixed position.

[0199] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the closing spring in the first rotational direction is configured to store energy in the closing spring.

[0200] The above described drive of embodiment 1 can

be used with a low, medium or high voltage switch such as a vacuum circuit breaker.

[0201] The above described drive of embodiment 1 can also be coupled to two further pared down drives. A first drive can have an energy provided that drives a first switching or closing operation. The other two drives don't then need to have their own energy providers but can be coupled to the first drive such that rotation of the carrier of the first drive drives the rotation of the carriers of the other two drives such that all carry out a first switching operation at the same time.

Embodiment 2

[0202] In an example a drive for a low, medium or high voltage switch comprises a pushrod 10, a sun cogwheel 30, at least one planetary cogwheel 40, a carrier 50, a cogwheel ring 60, and an energy provider 70. An axis of the pushrod is coaxial with an axis of the sun cogwheel, and a rotation of the sun cogwheel is configured to move the pushrod along the axis of the pushrod. An axis of the carrier is coaxial with the axis of the sun cogwheel. An axis of the cogwheel ring is coaxial with the axis of the sun cogwheel. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. Each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier. Each planetary cogwheel is configured to rotate about its own centre axis. The energy provider is coupled to the cogwheel ring. In a first switching action energy release from the energy provider is configured to rotate the cogwheel ring in a first rotational direction about the axis of the sun cogwheel to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

[0203] In an example, the pushrod is rotationally connected to or engaged with the sun cogwheel.

[0204] In an example, the pushrod comprises a threaded portion.

[0205] In an example, the sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel.

[0206] In an example, the sun cogwheel comprises a plurality of outward facing teeth.

[0207] In an example, the cogwheel ring comprises a plurality of inward facing teeth.

[0208] In an example, the at least one planetary cogwheel comprises a plurality of outward facing teeth, and wherein some teeth of the at least one planetary cogwheel are engaged with some teeth of the sun cogwheel and some other teeth of the at least one planetary cogwheel are engaged with some teeth of the cogwheel ring.

[0209] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0210] In an example, the low, medium or high voltage

switch is a vacuum circuit breaker.

[0211] In an example, the drive comprises a cogwheel locking device 100. The cogwheel ring comprises at least one latching feature 62. The cogwheel ring locking device is configured to engage with one latching feature of the at least one latching feature of the cogwheel ring to stop the cogwheel ring from rotating. The cogwheel ring locking device is configured to disengage from the at least one latching feature of the cogwheel ring to permit the cogwheel ring to rotate. Initiation of the first switching action comprises a disengagement of the cogwheel ring locking device from a latching feature of the at least one latching feature of the cogwheel ring.

[0212] In an example, in the first switching action the drive is configured such that the carrier does not rotate about the pushrod axis.

[0213] In an example, the carrier comprises at least one latching feature 52. The drive comprises a carrier locking device 90. The carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating. The carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate.

[0214] In an example, in the first switching action the rotation of the sun cogwheel in the second rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0215] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0216] In this way, because the pushrod is threaded and the sun cogwheel is threaded, rotation of the sun cogwheel whilst the pushrod cannot rotate necessarily leads to translation of the pushrod.

[0217] In an example, the energy provider comprises a closing spring, and a first end 74 of the closing spring 70 is coupled to the cogwheel ring.

[0218] In an example, in the first switching action the drive is configured such that a second end 72 of the closing spring is held in a fixed position.

[0219] In an example, the energy provided comprises a motor or actuator 120, 150, and the motor or actuator is coupled to the cogwheel ring.

[0220] In an example, the motor or actuator is a rotational motor or actuator 120, and a rotational shaft of the motor or actuator is coupled to the cogwheel ring.

[0221] In an example, the motor or actuator is coupled to a shaft of the cogwheel ring. The shaft of the cogwheel ring is fixedly connected to the cogwheel ring such that the cogwheel ring and the shaft of the cogwheel ring rotate together.

[0222] In an example, the motor or actuator is a linear motor or actuator 150, and a lever system 160 of the motor or actuator is coupled to the cogwheel ring.

[0223] In an example, the lever system is coupled to a shaft of the cogwheel ring. The shaft of the cogwheel ring

is fixedly connected to the cogwheel ring such that the cogwheel ring and the shaft of the cogwheel ring rotate together.

[0224] In an example, the lever system is coupled to the shaft of the cogwheel ring via a roller clutch 170.

[0225] In an example, the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0226] In an example, the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0227] In an example, at the end of the first switching action, the cogwheel ring locking device is configured to engage with a latching feature of the at least one latching feature of the cogwheel ring.

[0228] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring 80.

[0229] In an example, in a second switching action energy release from the opening spring is configured to rotate the carrier. In the second switching action a rotation of the carrier about the axis of the sun cogwheel is configured to rotate the sun cogwheel in a first rotational direction opposite to the second rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0230] In an example, initiation of the second switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0231] In an example, a first end 84 of the opening spring is connected to the pushrod.

[0232] In an example, a second end 82 of the opening spring is held in a fixed position.

[0233] In an example, in the second switching action the drive is configured such that the cogwheel ring does not rotate about the axis of the sun cogwheel.

[0234] In other words, the sun cogwheel rotates, and the planetary cogwheels rotate about the centre axis and each planetary cogwheel are each rotating about their own axes, and this with the cogwheel ring not rotating. Thus, in this manner the second switching movement is not constrained by storing energy in the closing spring used to drive the first switching movement because the cogwheel ring is not rotating.

[0235] In an example, in the second switching action the drive is configured such that the second end of the closing spring is held in the fixed position.

[0236] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the closing spring in the first rotational direction is configured to store energy in the closing spring.

[0237] The above described drive of embodiment 2 can be used with a low, medium or high voltage switch such as a circuit breaker.

[0238] The above described drive of embodiment 2 can also be coupled to two further pared down drives. A first drive can have an energy provided that drives a first switching or closing operation. The other two drives don't then need to have their own energy providers but can be coupled to the first drive such that rotation of the cogwheel ring of the first drive drives the rotation of the cogwheel rings of the other two drives such that all carry out a first switching operation at the same time.

Embodiment 3

[0239] In an example a drive for a low, medium or high voltage switch comprises a pushrod 10, a sun cogwheel 30, at least one planetary cogwheel 40, a carrier 50, a cogwheel ring 60, and an energy provider 70, 120, 150. An axis of the pushrod is coaxial with the axis of the cogwheel ring, and a rotation of the cogwheel ring is configured to move the pushrod along the axis of the pushrod. An axis of the carrier is coaxial with the axis of the sun cogwheel. The axis of the cogwheel ring is coaxial with an axis of the sun cogwheel. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. Each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier. Each planetary cogwheel is configured to rotate about its own centre axis. The energy provider is coupled to the carrier. In a first switching action energy release from the energy provider is configured to rotate the carrier in a first rotational direction about the axis of the sun cogwheel to rotate the cogwheel ring in the first rotational direction to move the pushrod along the axis of the pushrod in the first direction.

[0240] In an example, the pushrod comprises a threaded portion 20.

[0241] In an example, the cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring.

[0242] In an example, the sun cogwheel comprises a plurality of outward facing teeth.

[0243] In an example, the cogwheel ring comprises a plurality of inward facing teeth.

[0244] In an example, the at least one planetary cogwheel comprises a plurality of outward facing teeth, and wherein some teeth of the at least one planetary cogwheel are engaged with some teeth of the sun cogwheel and some other teeth of the at least one planetary cogwheel are engaged with some teeth of the cogwheel ring

[0245] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0246] In an example, the low, medium or high voltage switch is a vacuum interrupter.

[0247] In an example, the drive comprises a carrier locking device 90. The carrier comprises at least one latching feature 52. The carrier locking device is configured to engage with one latching feature of the at least

one latching feature of the carrier to stop the carrier from rotating. The carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate. Initiation of the first switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0248] In an example, in the first switching action the drive is configured such that the sun cogwheel does not rotate.

[0249] In an example, the sun cogwheel comprises at least one latching feature. The drive comprises a sun cogwheel locking device. The sun cogwheel locking device is configured to engage with one latching feature of the at least one latching feature of the sun cogwheel to stop the sun cogwheel from rotating. The sun cogwheel locking device is configured to disengage from the at least one latching feature of the sun cogwheel to permit the sun cogwheel to rotate.

[0250] In an example, in the first switching action the rotation of the cogwheel ring in the first rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0251] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0252] In an example, the energy provider comprises a closing spring, and wherein a first end 74 of the closing spring 70 is coupled to the carrier.

[0253] In an example, in the first switching action the drive is configured such that a second end 72 of the closing spring is held in a fixed position.

[0254] In an example, the energy provided comprises a motor or actuator 120, 150, and the motor or actuator is coupled to the carrier.

[0255] In an example, the motor or actuator is a rotational motor or actuator 120, and a rotational shaft of the motor or actuator is coupled to the carrier.

[0256] In an example, the motor or actuator is coupled to a shaft 53 of the carrier. The shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0257] In an example, the motor or actuator is a linear motor or actuator 150, and a lever system 160 of the motor or actuator is coupled to the carrier.

[0258] In an example, the lever system is coupled to a shaft 53 of the carrier. The shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0259] In an example, the lever system is coupled to the shaft of the carrier via a roller clutch 170.

[0260] In an example, the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0261] In an example, the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original posi-

tion, that it had before the first switching operation, without rotating the shaft.

[0262] In an example, at the end of the first switching action, the carrier locking device is configured to engage with a latching feature of the at least one latching feature of the carrier.

[0263] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring 80.

[0264] In an example, in a second switching action energy release from the opening spring is configured to rotate the sun cogwheel. In the second switching action a rotation of the sun cogwheel about the axis of the sun cogwheel is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0265] In an example, initiation of the second switching action comprises a disengagement of the sun cogwheel locking device from a latching feature of the at least one latching feature of the sun cogwheel.

[0266] In an example, a first end 84 of the opening spring is connected to the pushrod.

[0267] In an example, a second end 82 of the opening spring is held in a fixed position.

[0268] In an example, in the second switching action the drive is configured such that the carrier does not rotate about the axis of the sun cogwheel.

[0269] In an example, in the second switching action the drive is configured such that the second end of the closing spring is held in the fixed position.

[0270] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the closing spring in the first rotational direction is configured to store energy in the closing spring.

[0271] The above described drive of embodiment 3 can be used with a low, medium or high voltage switch such as a circuit breaker.

[0272] The above described drive of embodiment 3 can also be coupled to two further pared down drives. A first drive can have an energy provided that drives a first switching or closing operation. The other two drives don't then need to have their own energy providers but can be coupled to the first drive such that rotation of the carrier of the first drive drives the rotation of the carriers of the other two drives such that all carry out a first switching operation at the same time.

Embodiment 4

[0273] In an example a drive for a low, medium and high voltage switch comprises a pushrod 10, a sun cogwheel 30, at least one planetary cogwheel 40, a carrier 50, a cogwheel ring 60, and a sun cogwheel locking device 90. An axis of the pushrod is coaxial with the axis of the cogwheel ring, and a rotation of the cogwheel ring is configured to move the pushrod along the axis of the pushrod. An axis of the carrier is coaxial with the axis of

the sun cogwheel. The axis of the cogwheel ring is coaxial with an axis of the sun cogwheel. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. Each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier. Each planetary cogwheel is configured to rotate about its own centre axis. The energy provider is coupled to the sun cogwheel. In a first switching action energy release from the energy provider is configured to rotate the sun cogwheel in a first rotational direction about the axis of the sun cogwheel to rotate the cogwheel ring in a second rotational direction counter to the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

[0274] In an example, the pushrod comprises a threaded portion.

[0275] In an example, the cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring.

[0276] In an example, the sun cogwheel comprises a plurality of outward facing teeth.

[0277] In an example, the cogwheel ring comprises a plurality of inward facing teeth.

[0278] In an example, the at least one planetary cogwheel comprises a plurality of outward facing teeth, and wherein some teeth of the at least one planetary cogwheel are engaged with some teeth of the sun cogwheel and some other teeth of the at least one planetary cogwheel are engaged with some teeth of the cogwheel ring.

[0279] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0280] In an example, the low, medium or high voltage switch is a vacuum circuit breaker.

[0281] In an example, the drive comprises a sun cogwheel locking device 90. The sun cogwheel comprises at least one latching feature. The sun cogwheel locking device is configured to engage with one latching feature of the at least one latching feature of the sun cogwheel to stop the sun cogwheel from rotating. The sun cogwheel locking device is configured to disengage from the at least one latching feature of the sun cogwheel to permit the sun cogwheel to rotate. Initiation of a first switching action comprises a disengagement of the sun cogwheel locking device from a latching feature of the at least one latching feature of the sun cogwheel.

[0282] In an example, in the first switching action the drive is configured such that the carrier does not rotate about the axis of the sun cogwheel.

[0283] In an example, the drive comprises a carrier locking device 90. The carrier comprises at least one latching feature 52. The carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating. The carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate.

[0284] In an example, in the first switching action the rotation of the cogwheel ring in the second rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0285] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0286] In an example, the energy provider comprises a closing spring, and a first end 74 of the closing spring 70 is coupled to the sun cogwheel.

[0287] In an example, in the first switching action the drive is configured such that a second end 72 of the closing spring is held in a fixed position.

[0288] In an example, the energy provided comprises a motor or actuator 120, 150, and the motor or actuator is coupled to the sun cogwheel.

[0289] In an example, the motor or actuator is a rotational motor or actuator 120, and a rotational shaft of the motor or actuator is coupled to the sun cogwheel.

[0290] In an example, the motor or actuator is coupled to a shaft of the sun cogwheel. The shaft of the sun cogwheel is fixedly connected to the sun cogwheel such that the sun cogwheel and the shaft of the sun cogwheel rotate.

[0291] In an example, the motor or actuator is a linear motor or actuator 150, and a lever system 160 of the motor or actuator is coupled to the sun cogwheel.

[0292] In an example, the lever system is coupled to a shaft of the sun cogwheel. The shaft of the sun cogwheel is fixedly connected to the sun cogwheel such that the sun cogwheel and the shaft of the sun cogwheel rotate together.

[0293] In an example, the lever system is coupled to the shaft of the sun cogwheel ring via a roller clutch 170.

[0294] In an example, the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0295] In an example, the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0296] In an example, at the end of the first switching action, the sun cogwheel locking device is configured to engage with a latching feature of the at least one latching feature of the sun cogwheel.

[0297] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring 80.

[0298] In an example, in a second switching action energy release from the opening spring is configured to rotate the carrier. In the second switching action a rotation of the carrier about the axis of the sun cogwheel is configured to rotate the cogwheel ring in a first rotational direction opposite to the second rotational direction to move the pushrod along the axis of the pushrod in a sec-

and direction opposite to the first direction.

[0299] In an example, initiation of the second switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0300] In an example, a first end 84 of the opening spring is connected to the pushrod.

[0301] In an example, a second end 82 of the opening spring is held in a fixed position.

[0302] In an example, in the second switching action the drive is configured such that the sun cogwheel does not rotate about the axis of the sun cogwheel.

[0303] In an example, in the second switching action the drive is configured such that the second end of the closing spring is held in the fixed position.

[0304] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the closing spring in the first rotational direction is configured to store energy in the closing spring.

[0305] The above described drive of embodiment 4 can be used with a low, medium or high voltage switch such as a circuit breaker.

[0306] The above described drive of embodiment 4 can also be coupled to two further pared down drives. A first drive can have an energy provided that drives a first switching or closing operation. The other two drives don't then need to have their own energy providers but can be coupled to the first drive such that rotation of the sun cogwheel of the first drive drives the rotation of the sun cogwheel of the other two drives such that all carry out a first switching operation at the same time.

[0307] Continuing with the figures, the drive for the low, medium or high voltage switch, and the switch and switching system with such a drive are described in further detail, with respect to specific embodiments.

[0308] The following relates primarily to embodiment 1 described above, but with the driving of different cogwheels whilst other cogwheels are held stationary, with respect to rotation about a centre axis of the drive, provides for the other embodiments, as briefly referred to below.

[0309] The new technical development described here relates to a planetary drive with different selectable energy providers for driving the closing operation of a switch such as a circuit breaker (CB) pole.

[0310] Figure 1 shows a switch drive that is generally intended for several kinds of switches, like earthing switches, 3 position switches, load break switches and circuit breakers. For ease of viewing no specific parts for a certain switch, like a pushrod 10 that is typical for a CB application, are shown in figure 1. However, the sun cogwheel 30 can have an internal thread and the pushrod 10 can have a thread 20 that matches the thread of the sun cogwheel. The pushrod 10 can be mounted in a manner such that it can translate in an axial direction but not rotate. Then when the sun cogwheel rotates, the threads rotate with respect to each other, and without rotating the pushrod 10 is driven in the axial direction for example

away from the sun cogwheel in order to perform a first switching action to close a switch.

[0311] The opening spring 80 is a clock spring in this embodiment; as it supports rotational movement, it can be coupled with its inner end 84 directly to a groove 34 in the shaft of the sun cogwheel. The outer end 82 of the opening spring is fixed.

[0312] Figure 2 shows the switch drive without the closing spring 70. The groove 54 in the shaft of the carrier 50 represents with its actual dimensions the defined interface, together with the dimensions of the shaft 53 of the carrier 50 and with defined mechanical fixation points for the drive 1 and its energy provider, which can be a closing spring 70 as shown in fig. 1 or motors as discussed below.

[0313] It is to be noted that the opening spring 80 is not shown in figure 2.

[0314] Different kinds of opening springs can be chosen depending on the application of the switch drive, for example compression springs as shown in figure 4 where a translational motion is available.

[0315] Figure 3 shows the switch drive with a motor 120 as energy provider, for example an electric motor. Alternatively, also other kinds of motors or actuator can be used, for example pneumatic motors and hydraulic motors.

[0316] Figure 4 shows how several, for example three phases, can be connected to one energy provider in parallel using toothed wheels 200 and a toothed chain or belt 210. In fig. 4, the energy provider is directly linked to the shaft 53 of the carrier of one of the phases; alternatively, it is also possible to use a separate energy provider that is only linked with an own toothed wheel to the common toothed belt 210 (not shown).

[0317] Figures 5 to 7 show the application of a linear energy provider 150, for example a linear magnetic actuator or pneumatic or hydraulic drive, or a compression spring or a pull spring. When the switch drive 1 operates the switch from a first position in a first switching action, for example from an OFF position, to a second position, for example ON, the energy provider 150 is pulling the lever 160 with high force and relatively high speed, where the required speed depends on the application of the switch. The roller clutch 170 permits the transfer of torque in this rotational direction. Figure 5 shows the OFF position, figure 6 shows an intermediate position and figure 7 shows the ON position. OFF and ON positions of the carrier 50 can be locked by the locking device 90 and locking features 52. It is also possible to block and lock an intermediate position in-between OFF and ON, e.g. for driving a position switch that could for example be a three position switch, as shown in figure 6 where a locking feature 52 is located opposite to the locking device 90. To be prepared for the next closing operation of the switch drive 1, the linear energy provider 150 moves back to its original position as shown in figure 5. This is enabled by the roller clutch, as it does not transfer torque in the second rotational direction, i.e. the roller clutch permits a

free travel of the energy source back to its original position without rotating the shaft of the switch drive. The energy provider 150 can also return slowly if necessary. The return movement can be driven in a known way depending on the operating principle; for example via a magnetic actuator that can be bi-stable or mono-stable with a return spring. Pneumatic or hydraulic drives can usually be driven forth and back. Springs can be re-charged mechanically.

[0318] The switch drive can return to its OFF position independently from the energy provider, as the switch drive will not rotate the carrier 50 with its shaft 53 for the opening operation. The shaft is blocked in this phase by the locking device 90. The return to the OFF position is driven by the opening spring 80, e.g. a compression spring as shown in figure 4 or a spiral spring as shown in figure 1. The opening operation is initiated when the locking device 100 releases the hollow cogwheel ring 60. The opening operation can be stopped when the locking device 100 engages with the next locking feature 62. When a locking feature 62 is provided also for intermediate position, the opening operation can also be performed partly, e.g. for three position switches. When combining e.g. locking features 52 for ON, intermediate and OFF positions of the planetary carrier 50 and locking features 62 for ON, intermediate and OFF positions of the hollow cogwheel ring 60, the switch drive can operate from OFF to intermediate position, and then further to ON or back to OFF. The switch drive can also operate from ON to intermediate and further to OFF or back to ON. Using linkages to other switch drives, this principle can also be applied to switches with more than one phase, e.g. CBs with three phases that are to be operated in parallel.

[0319] The following examples provide specific details of how technical features, in certain embodiments, can be combined.

[0320] Example 1. A drive for a low, medium or high voltage switch, comprising:

- a pushrod 10;
- a sun cogwheel 30;
- at least one planetary cogwheel 40;
- a carrier 50;
- a cogwheel ring 60; and
- an energy provider 70, 120, 150;

wherein, an axis of the pushrod is coaxial with an axis of the sun cogwheel, and wherein a rotation of the sun cogwheel is configured to move the pushrod along the axis of the pushrod;

wherein an axis of the carrier is coaxial with the axis of the sun cogwheel;

wherein, an axis of the cogwheel ring is coaxial with the axis of the sun cogwheel;

wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring, wherein each planetary cogwheel of the at least one planetary

cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and wherein each planetary cogwheel is configured to rotate about its own centre axis;

wherein, the energy provider is coupled to the carrier; and wherein, in a first switching action energy release from the energy provider is configured to rotate the carrier in a first rotational direction about the axis of the sun cogwheel to rotate the sun cogwheel in the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

[0321] Example 2. Drive according to Example 1, wherein the drive comprises a carrier locking device 90, wherein the carrier comprises at least one latching feature 52, wherein the carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating, and wherein the carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate; and wherein initiation of the first switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0322] Example 3. Drive according to any of Examples 1-2, wherein in the first switching action the drive is configured such that the cogwheel ring does not rotate.

[0323] Example 4. Drive according to any of Examples 1-3, wherein, the cogwheel ring comprises at least one latching feature 62, wherein the drive comprises a cogwheel ring locking device 100, wherein the cogwheel ring locking device is configured to engage with one latching feature of the at least one latching feature of the cogwheel ring to stop the cogwheel ring from rotating, and wherein the cogwheel ring locking device is configured to disengage from the at least one latching feature of the cogwheel ring to permit the cogwheel ring to rotate.

[0324] Example 5. Drive according to any of Examples 1-4, wherein in the first switching action the rotation of the sun cogwheel in the first rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0325] Example 6. Drive according to any of Examples 1-5, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0326] Example 7. Drive according to any of Examples 1-6, wherein the energy provider comprises a closing spring, and wherein a first end 74 of the closing spring 70 is coupled to the carrier.

[0327] Example 8. Drive according to Example 7, wherein in the first switching action the drive is configured such that a second end 72 of the closing spring is held in a fixed position.

[0328] Example 9. Drive according to any of Examples 1-6, wherein the energy provided comprises a motor or actuator 120, 150, and wherein the motor or actuator is coupled to the carrier.

[0329] Example 10. Drive according to Example 9, wherein the motor or actuator is a rotational motor or actuator 120, and wherein a rotational shaft of the motor or actuator is coupled to the carrier.

[0330] Example 11. Drive according to Example 10, wherein the motor or actuator is coupled to a shaft 53 of the carrier, wherein the shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0331] Example 12. Drive according to Example 9, wherein the motor or actuator is a linear motor or actuator 150, and wherein a lever system 160 of the motor or actuator is coupled to the carrier.

[0332] Example 13. Drive according to Example 12, wherein the lever system is coupled to a shaft 53 of the carrier, wherein the shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.

[0333] Example 14. Drive according to Example 13, wherein the lever system is coupled to the shaft of the carrier via a roller clutch 170.

[0334] Example 15. Drive according to Example 14, wherein the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0335] Example 16. Drive according to any of Examples 14-15, wherein the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0336] Example 17. Drive according to any of Examples 2-16, wherein at the end of the first switching action, the carrier locking device is configured to engage with a latching feature of the at least one latching feature of the carrier.

[0337] Example 18. Drive according to any of Examples 1-17, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring (80).

[0338] Example 19. Drive according to Example 18, wherein in a second switching action energy release from the opening spring is configured to rotate the cogwheel ring, and wherein in the second switching action a rotation of the cogwheel ring about the axis of the sun cogwheel in the first rotational direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0339] Example 20. Drive according to Example 19, wherein initiation of the second switching action comprises a disengagement of the cogwheel ring locking device from a latching feature of the at least one latching feature of the cogwheel ring.

[0340] Example 21. Drive according to any of Examples 18-20, wherein a first end 84 of the opening spring

is connected to the pushrod.

[0341] Example 22. Drive according to Example 21, wherein a second end 82 of the opening spring is held in a fixed position.

[0342] Example 23. Drive according to any of Examples 19-22, wherein in the second switching action the drive is configured such that the carrier does not rotate about the axis of the sun cogwheel.

[0343] Example 24. A low, medium or high voltage switch comprising a drive according to any of Examples 1-22.

[0344] Example 25. A low, medium or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage switch according to any of Examples 1-23;
- a second drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the second drive;
- a third drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the third drive;

wherein, rotation of the carrier of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

[0345] Example 26. A drive for a low, medium or high voltage switch, comprising:

- a pushrod 10;
- a sun cogwheel 30;
- at least one planetary cogwheel 40;
- a carrier 50;
- a cogwheel ring 60; and
- an energy provider 70;

wherein, an axis of the pushrod is coaxial with an axis of the sun cogwheel, and wherein a rotation of the sun cogwheel is configured to move the pushrod along the axis of the pushrod;

wherein an axis of the carrier is coaxial with the axis of the sun cogwheel;

wherein, an axis of the cogwheel ring is coaxial with the axis of the sun cogwheel;

wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring, wherein each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and wherein each planetary cogwheel is configured to rotate about its own centre axis;

wherein, the energy provider is coupled to the cogwheel ring; and

wherein, in a first switching action energy release from the energy provider is configured to rotate the cogwheel ring in a first rotational direction about the axis of the sun cogwheel;

to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

[0346] Example 27. Drive according to Example 26, wherein the drive comprises a cogwheel locking device 100, wherein the cogwheel ring comprises at least one latching feature 62, wherein the cogwheel ring locking device is configured to engage with one latching feature of the at least one latching feature of the cogwheel ring to stop the cogwheel ring from rotating, and wherein the cogwheel ring locking device is configured to disengage from the at least one latching feature of the cogwheel ring to permit the cogwheel ring to rotate, and wherein initiation of the first switching action comprises a disengagement of the cogwheel ring locking device from a latching feature of the at least one latching feature of the cogwheel ring.

[0347] Example 28. Drive according to any of Examples 26-27, wherein in the first switching action the drive is configured such that the carrier does not rotate about the pushrod axis.

[0348] Example 29. Drive according to any of Examples 26-28, wherein the carrier comprises at least one latching feature 52, wherein the drive comprises a carrier locking device 90, wherein the carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating, and wherein the carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate.

[0349] Example 30. Drive according to any of Examples 26-29, wherein in the first switching action the rotation of the sun cogwheel in the second rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0350] Example 31. Drive according to any of Examples 26-30, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0351] Example 32. Drive according to any of Examples 26-31, wherein the energy provider comprises a closing spring, and wherein a first end 74 of the closing spring 70 is coupled to the cogwheel ring.

[0352] Example 33. Drive according to Example 32, wherein in the first switching action the drive is configured such that a second end 72 of the closing spring is held in a fixed position.

[0353] Example 34. Drive according to any of Examples 26-33, wherein the energy provided comprises a motor or actuator 120, 150, and wherein the motor or actuator is coupled to the cogwheel ring.

[0354] Example 35. Drive according to Example 34, wherein the motor or actuator is a rotational motor or actuator 120, and wherein a rotational shaft of the motor

or actuator is coupled to the cogwheel ring.

[0355] Example 36. Drive according to Example 35, wherein the motor or actuator is coupled to a shaft of the cogwheel ring, wherein the shaft of the cogwheel ring is fixedly connected to the cogwheel ring such that the cogwheel ring and the shaft of the cogwheel ring rotate together.

[0356] Example 37. Drive according to Example 34, wherein the motor or actuator is a linear motor or actuator 150, and wherein a lever system 160 of the motor or actuator is coupled to the cogwheel ring.

[0357] Example 38. Drive according to Example 37, wherein the lever system is coupled to a shaft of the cogwheel ring, wherein the shaft of the cogwheel ring is fixedly connected to the cogwheel ring such that the cogwheel ring and the shaft of the cogwheel ring rotate together.

[0358] Example 39. Drive according to Example 38, wherein the lever system is coupled to the shaft of the cogwheel ring via a roller clutch 170.

[0359] Example 40. Drive according to Example 39 wherein the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0360] Example 41. Drive according to any of Examples 39-49, wherein the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0361] Example 42. Drive according to any of Examples 27-41, wherein at the end of the first switching action, the cogwheel ring locking device is configured to engage with a latching feature of the at least one latching feature of the cogwheel ring.

[0362] Example 43. Drive according to any of Examples 26-42, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring 80.

[0363] Example 44. Drive according to Example 43, wherein in a second switching action energy release from the opening spring is configured to rotate the carrier, and wherein in the second switching action a rotation of the carrier about the axis of the sun cogwheel is configured to rotate the sun cogwheel in a first rotational direction opposite to the second rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0364] Example 45. Drive according to Example 44, wherein initiation of the second switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0365] Example 46. Drive according to any of Examples 44-45, wherein a first end 84 of the opening spring is connected to the pushrod.

[0366] Example 47. Drive according to Example 46,

wherein a second end 82 of the opening spring is held in a fixed position.

[0367] Example 48. Drive according to any of Examples 44-47, wherein in the second switching action the drive is configured such that the cogwheel ring does not rotate about the axis of the sun cogwheel.

[0368] Example 49. A low, medium or high voltage switch comprising a drive according to any of Examples 26-48.

[0369] Example 50. A low, medium or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage switch according to any of Examples 26-48;
- a second drive for a low, medium or high voltage switch comprising a cogwheel ring coupled to the cogwheel ring of the first drive such that rotation of the cogwheel ring of the first drive leads to an associated rotation of the cogwheel ring of the second drive;
- a third drive for a low, medium or high voltage switch comprising a cogwheel ring coupled to the cogwheel ring of the first drive such that rotation of the cogwheel ring of the first drive leads to an associated rotation of the cogwheel ring of the third drive;

wherein, rotation of the cogwheel ring of the first drive in the first rotational direction is configured implement a first switching action associated with each drive.

[0370] Example 51. A drive for a low, medium or high voltage switch, comprising:

- a pushrod 10;
- a sun cogwheel 30;
- at least one planetary cogwheel 40;
- a carrier 50;
- a cogwheel ring 60; and
- an energy provider 70, 120, 150;

wherein, an axis of the pushrod is coaxial with the axis of the cogwheel ring, and wherein a rotation of the cogwheel ring is configured to move the pushrod along the axis of the pushrod;

wherein an axis of the carrier is coaxial with the axis of the sun cogwheel;

wherein, the axis of the cogwheel ring is coaxial with an axis of the sun cogwheel;

wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring, wherein each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and wherein each planetary cogwheel is configured to rotate about its own centre axis;

wherein, the energy provider is coupled to the carrier; and wherein, in a first switching action energy release from the energy provider is configured to rotate the carrier in

a first rotational direction about the axis of the sun cogwheel to rotate the cogwheel ring in the first rotational direction to move the pushrod along the axis of the pushrod in the first direction.

[0371] Example 52. Drive according to Example 51, wherein the drive comprises a carrier locking device 90, wherein the carrier comprises at least one latching feature 52, wherein the carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating, and wherein the carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate; and wherein initiation of the first switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0372] Example 53. Drive according to any of Examples 51-52, wherein in the first switching action the drive is configured such that the sun cogwheel does not rotate.

[0373] Example 54. Drive according to any of Examples 51-53, wherein, the sun cogwheel comprises at least one latching feature, wherein the drive comprises a sun cogwheel locking device, wherein the sun cogwheel locking device is configured to engage with one latching feature of the at least one latching feature of the sun cogwheel to stop the sun cogwheel from rotating, and wherein the sun cogwheel locking device is configured to disengage from the at least one latching feature of the sun cogwheel to permit the sun cogwheel to rotate.

[0374] Example 55. Drive according to any of Examples 51-54, wherein in the first switching action the rotation of the cogwheel ring in the first rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0375] Example 56. Drive according to any of Examples 51-55, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0376] Example 57. Drive according to any of Examples 51-56, wherein the energy provider comprises a closing spring, and wherein a first end 74 of the closing spring 70 is coupled to the carrier.

[0377] Example 58. Drive according to Example 57, wherein in the first switching action the drive is configured such that a second end 72 of the closing spring is held in a fixed position.

[0378] Example 59. Drive according to any of Examples 51-58, wherein the energy provided comprises a motor or actuator 120, 150, and wherein the motor or actuator is coupled to the carrier.

[0379] Example 60. Drive according to Example 59, wherein the motor or actuator is a rotational motor or actuator 120, and wherein a rotational shaft of the motor or actuator is coupled to the carrier.

[0380] Example 61. Drive according to Example 60, wherein the motor or actuator is coupled to a shaft 53 of the carrier, wherein the shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft

of the carrier rotate together.

[0381] Example 62. Drive according to Example 59, wherein the motor or actuator is a linear motor or actuator 150, and wherein a lever system 160 of the motor or actuator is coupled to the carrier.

[0382] Example 63. Drive according to Example 62, wherein the lever system is coupled to a shaft 53 of the carrier, wherein the shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together. **문**

[0383] Example 64. Drive according to Example 63, wherein the lever system is coupled to the shaft of the carrier via a roller clutch 170.

[0384] Example 65. Drive according to Example 64, wherein the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0385] Example 66. Drive according to any of Examples 64-65, wherein the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0386] Example 67. Drive according to any of Examples 52-66, wherein at the end of the first switching action, the carrier locking device is configured to engage with a latching feature of the at least one latching feature of the carrier.

[0387] Example 68. Drive according to any of Examples 69-91, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring 80.

[0388] Example 69. Drive according to Example 68, wherein in a second switching action energy release from the opening spring is configured to rotate the sun cogwheel, and wherein in the second switching action a rotation of the sun cogwheel about the axis of the sun cogwheel is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0389] Example 70. Drive according to Example 69, wherein initiation of the second switching action comprises a disengagement of the sun cogwheel locking device from a latching feature of the at least one latching feature of the sun cogwheel.

[0390] Example 71. Drive according to any of Examples 68-70, wherein a first end 84 of the opening spring is connected to the pushrod.

[0391] Example 72. Drive according to Example 71, wherein a second end 82 of the opening spring is held in a fixed position.

[0392] Example 73. Drive according to any of Examples 51-72, wherein in the second switching action the drive is configured such that the carrier does not rotate about the axis of the sun cogwheel.

[0393] Example 74. A low, medium or high voltage switch comprising a drive according to any of Examples 51-73.

[0394] Example 75. A low, medium or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage switch according to any of Examples 51-73;
- a second drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the second drive;
- a third drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the third drive;

wherein, rotation of the carrier of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

[0395] Example 76. A drive for a low, medium and high voltage switch, comprising:

- a pushrod 10;
- a sun cogwheel 30;
- at least one planetary cogwheel 40;
- a carrier 50;
- a cogwheel ring 60; and
- a sun cogwheel locking device 90;

wherein, an axis of the pushrod is coaxial with the axis of the cogwheel ring, and wherein a rotation of the cogwheel ring is configured to move the pushrod along the axis of the pushrod;

wherein an axis of the carrier is coaxial with the axis of the sun cogwheel;

wherein, the axis of the cogwheel ring is coaxial with an axis of the sun cogwheel;

wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring, wherein each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and wherein each planetary cogwheel is configured to rotate about its own centre axis;

wherein, the energy provider is coupled to the sun cogwheel; and

wherein, in a first switching action energy release from the energy provider is configured to rotate the sun cogwheel in a first rotational direction about the axis of the sun cogwheel to rotate the cogwheel ring in a second rotational direction counter to the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

[0396] Example 77. Drive according to Example 76,

wherein the drive comprises a sun cogwheel locking device 90, wherein the sun cogwheel comprises at least one latching feature, wherein, the sun cogwheel locking device is configured to engage with one latching feature of the at least one latching feature of the sun cogwheel to stop the sun cogwheel from rotating, and wherein the sun cogwheel locking device is configured to disengage from the at least one latching feature of the sun cogwheel to permit the sun cogwheel to rotate, and wherein initiation of a first switching action comprises a disengagement of the sun cogwheel locking device from a latching feature of the at least one latching feature of the sun cogwheel.

[0397] Example 78. Drive according to any of Examples 76-77, wherein in the first switching action the drive is configured such that the carrier does not rotate about the axis of the sun cogwheel.

[0398] Example 79. Drive according to any of Examples 76-78, wherein the drive comprises a carrier locking device 90, wherein the carrier comprises at least one latching feature 52, wherein, the carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating, and wherein the carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate.

[0399] Example 80. Drive according to any of Examples 76-79, wherein in the first switching action the rotation of the cogwheel ring in the second rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.

[0400] Example 81. Drive according to any of Examples 76-80, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0401] Example 82. Drive according to any of Examples 76-81, wherein the energy provider comprises a closing spring, and wherein a first end 74 of the closing spring (70) is coupled to the sun cogwheel.

[0402] Example 83. Drive according to claim 82, wherein in the first switching action the drive is configured such that a second end 72 of the closing spring is held in a fixed position.

[0403] Example 84. Drive according to any of Examples 76-83, wherein the energy provided comprises a motor or actuator 120, 150, and wherein the motor or actuator is coupled to the sun cogwheel.

[0404] Example 85. Drive according to Example 84, wherein the motor or actuator is a rotational motor or actuator 120, and wherein a rotational shaft of the motor or actuator is coupled to the sun cogwheel.

[0405] Example 86. Drive according to Example 85, wherein the motor or actuator is coupled to a shaft of the sun cogwheel, wherein the shaft of the sun cogwheel is fixedly connected to the sun cogwheel such that the sun cogwheel and the shaft of the sun cogwheel ring rotate.

[0406] Example 87. Drive according to Example 84, wherein the motor or actuator is a linear motor or actuator

150, and wherein a lever system 160 of the motor or actuator is coupled to the sun cogwheel.

[0407] Example 88. Drive according to Example 87, wherein the lever system is coupled to a shaft of the sun cogwheel, wherein the shaft of the sun cogwheel is fixedly connected to the sun cogwheel such that the sun cogwheel and the shaft of the sun cogwheel rotate together.

[0408] Example 89. Drive according to Example 88, wherein the lever system is coupled to the shaft of the sun cogwheel ring via a roller clutch 170.

[0409] Example 90. Drive according to claim 89 wherein the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or actuator is pulling at the lever system for driving the first switching operation.

[0410] Example 91. Drive according to any of Examples 89-90, wherein the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.

[0411] Example 92. Drive according to any of Examples 87-91, wherein at the end of the first switching action, the sun cogwheel locking device is configured to engage with a latching feature of the at least one latching feature of the sun cogwheel.

[0412] Example 93. Drive according to any of Examples 76-92, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring 80.

[0413] Example 94. Drive according to Example 93, wherein in a second switching action energy release from the opening spring is configured to rotate the carrier, and wherein in the second switching action a rotation of the carrier about the axis of the sun cogwheel is configured to rotate the cogwheel ring in a first rotational direction opposite to the second rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.

[0414] Example 95. Drive according to Example 94, wherein initiation of the second switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.

[0415] Example 96. Drive according to any of Examples 94-95, wherein a first end 84 of the opening spring is connected to the pushrod.

[0416] Example 97. Drive according to Example 96, wherein, a second end 82 of the opening spring is held in a fixed position.

[0417] Example 98. Drive according to any of Examples 94-97, wherein in the second switching action the drive is configured such that the sun cogwheel does not rotate about the axis of the sun cogwheel.

[0418] Example 99. A low, medium and high voltage switch comprising a drive according to any of Examples 76-98.

[0419] Example 100. A low, medium or high voltage

switching system, comprising:

- a first drive for a low, medium or high voltage switch according to any of Examples 76-98;
- a second drive for a low, medium or high voltage switch comprising a sun cogwheel coupled to the sun cogwheel of the first drive such that rotation of the sun cogwheel of the first drive leads to an associated rotation of the sun cogwheel of the second drive;
- a third drive for a low, medium or high voltage switch comprising a sun cogwheel coupled to the sun cogwheel of the first drive such that rotation of the sun cogwheel of the first drive leads to an associated rotation of the sun cogwheel of the third drive;

wherein, rotation of the sun cogwheel of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

Reference Numerals

[0420]

1	Drive for switch	
10	Pushrod incl. contact pressure springs	
20	High-Helix thread	
30	Sun cogwheel	
34	Groove in the shaft of 30	
40	Planetary cogwheels	
50	Carrier of 40	
52	Locking feature in 50	
53	Shaft of 50	
54	Groove in 53	
60	Hollow cogwheel ring	
62	Locking feature in 60	
70	Closing spring as energy provider	
72	Outer end of 70	
74	Inner end of 70	
80	Opening spring	
82	Outer end of 80	
84	Inner end of 80	
90	Locking devices for 50	
100	Locking devices for 60	
120	Rotational motor or actuator as energy provider	
150	Linear energy provider	
160	Lever	
170	Roller clutch	
200	Toothed wheel	
210	Toothed belt	

Claims

1. A drive for a low, medium or high voltage switch, comprising:
 - a pushrod (10);

- a sun cogwheel (30);
- at least one planetary cogwheel (40);
- a carrier (50);
- a cogwheel ring (60); and
- an energy provider (70, 120, 150);

wherein, an axis of the pushrod is coaxial with an axis of the sun cogwheel, and wherein a rotation of the sun cogwheel is configured to move the pushrod along the axis of the pushrod;

wherein an axis of the carrier is coaxial with the axis of the sun cogwheel;

wherein, an axis of the cogwheel ring is coaxial with the axis of the sun cogwheel;

wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring, wherein each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and wherein each planetary cogwheel is configured to rotate about its own centre axis;

wherein, the energy provider is coupled to the carrier; and

wherein, in a first switching action energy release from the energy provider is configured to rotate the carrier in a first rotational direction about the axis of the sun cogwheel to rotate the sun cogwheel in the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

2. Drive according to claim 1, wherein the drive comprises a carrier locking device (90), wherein the carrier comprises at least one latching feature (52), wherein the carrier locking device is configured to engage with one latching feature of the at least one latching feature of the carrier to stop the carrier from rotating, and wherein the carrier locking device is configured to disengage from the at least one latching feature of the carrier to permit the carrier to rotate; and wherein initiation of the first switching action comprises a disengagement of the carrier locking device from a latching feature of the at least one latching feature of the carrier.
3. Drive according to any of claims 1-2, wherein in the first switching action the drive is configured such that the cogwheel ring does not rotate.
4. Drive according to any of claims 1-3, wherein, the cogwheel ring comprises at least one latching feature (62), wherein the drive comprises a cogwheel ring locking device (100), wherein the cogwheel ring locking device is configured to engage with one latching feature of the at least one latching feature of the cogwheel ring to stop the cogwheel ring from rotating, and wherein the cogwheel ring locking de-

vice is configured to disengage from the at least one latching feature of the cogwheel ring to permit the cogwheel ring to rotate.

5. Drive according to any of claims 1-4, wherein in the first switching action the rotation of the sun cogwheel in the first rotational direction is configured to move the pushrod along the axis of the pushrod in the first direction away from the sun cogwheel.
6. Drive according to any of claims 1-5, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.
7. Drive according to any of claims 1-6, wherein the energy provider comprises a closing spring, and wherein a first end (74) of the closing spring (70) is coupled to the carrier.
8. Drive according to claim 7, wherein in the first switching action the drive is configured such that a second end (72) of the closing spring is held in a fixed position.
9. Drive according to any of claims 1-6, wherein the energy provided comprises a motor or actuator (120, 150), and wherein the motor or actuator is coupled to the carrier.
10. Drive according to claim 9, wherein the motor or actuator is a rotational motor or actuator (120), and wherein a rotational shaft of the motor or actuator is coupled to the carrier.
11. Drive according to claim 10, wherein the motor or actuator is coupled to a shaft (53) of the carrier, wherein the shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.
12. Drive according to claim 9, wherein the motor or actuator is a linear motor or actuator (150), and wherein a lever system (160) of the motor or actuator is coupled to the carrier.
13. Drive according to claim 12, wherein the lever system is coupled to a shaft (53) of the carrier, wherein the shaft of the carrier is fixedly connected to the carrier such that the carrier and the shaft of the carrier rotate together.
14. Drive according to claim 13, wherein the lever system is coupled to the shaft of the carrier via a roller clutch (170).
15. Drive according to claim 14, wherein the roller clutch is configured to force the shaft being rotated in the first rotational direction when the linear motor or ac-

tuator is pulling at the lever system for driving the first switching operation.

16. Drive according to any of claims 14-15, wherein the roller clutch is configured to permit the linear motor or actuator, after having driven the first switching operation, to return to its original position, that it had before the first switching operation, without rotating the shaft.
17. Drive according to any of claims 2-16, wherein at the end of the first switching action, the carrier locking device is configured to engage with a latching feature of the at least one latching feature of the carrier.
18. Drive according to any of claims 1-17, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in an opening spring (80).
19. Drive according to claim 18, wherein in a second switching action energy release from the opening spring is configured to rotate the cogwheel ring, and wherein in the second switching action a rotation of the cogwheel ring about the axis of the sun cogwheel in the first rotational direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction.
20. Drive according to claim 19, wherein initiation of the second switching action comprises a disengagement of the cogwheel ring locking device from a latching feature of the at least one latching feature of the cogwheel ring.
21. Drive according to any of claims 18-20, wherein a first end (84) of the opening spring is connected to the pushrod.
22. Drive according to claim 21, wherein a second end (82) of the opening spring is held in a fixed position.
23. Drive according to any of claims 19-22, wherein in the second switching action the drive is configured such that the carrier does not rotate about the axis of the sun cogwheel.
24. A low, medium or high voltage switch comprising a drive according to any of claims 1-23.
25. A low, medium or high voltage switching system, comprising:
 - a first drive for a low, medium or high voltage switch according to any of claims 1-23;
 - a second drive for a low, medium or high volt-

age switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the second drive;

- a third drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the third drive;

wherein, rotation of the carrier of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

26. A drive for a low, medium or high voltage switch, comprising:

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40);
- a carrier (50);
- a cogwheel ring (60); and
- an energy provider (70);

wherein, an axis of the pushrod is coaxial with an axis of the sun cogwheel, and wherein a rotation of the sun cogwheel is configured to move the pushrod along the axis of the pushrod;

wherein an axis of the carrier is coaxial with the axis of the sun cogwheel;

wherein, an axis of the cogwheel ring is coaxial with the axis of the sun cogwheel;

wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring, wherein each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and wherein each planetary cogwheel is configured to rotate about its own centre axis;

wherein, the energy provider is coupled to the cogwheel ring; and

wherein, in a first switching action energy release from the energy provider is configured to rotate the cogwheel ring in a first rotational direction about the axis of the sun cogwheel to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

27. A low, medium or high voltage switch comprising a drive according to claim 26.

28. A low, medium or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage

switch according to claim 26;

- a second drive for a low, medium or high voltage switch comprising a cogwheel ring coupled to the cogwheel ring of the first drive such that rotation of the cogwheel ring of the first drive leads to an associated rotation of the cogwheel ring of the second drive;

- a third drive for a low, medium or high voltage switch comprising a cogwheel ring coupled to the cogwheel ring of the first drive such that rotation of the cogwheel ring of the first drive leads to an associated rotation of the cogwheel ring of the third drive;

wherein, rotation of the cogwheel ring of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

29. A drive for a low, medium or high voltage switch, comprising:

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40);
- a carrier (50);
- a cogwheel ring (60); and
- an energy provider (70, 120, 150);

wherein, an axis of the pushrod is coaxial with the axis of the cogwheel ring, and wherein a rotation of the cogwheel ring is configured to move the pushrod along the axis of the pushrod;

wherein an axis of the carrier is coaxial with the axis of the sun cogwheel;

wherein, the axis of the cogwheel ring is coaxial with an axis of the sun cogwheel;

wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring, wherein each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and wherein each planetary cogwheel is configured to rotate about its own centre axis;

wherein, the energy provider is coupled to the carrier; and

wherein, in a first switching action energy release from the energy provider is configured to rotate the carrier in a first rotational direction about the axis of the sun cogwheel to rotate the cogwheel ring in the first rotational direction to move the pushrod along the axis of the pushrod in the first direction.

30. A low, medium or high voltage switch comprising a drive according to claim 29.

31. A low, medium or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage switch according to claim 29;
- a second drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the second drive;
- a third drive for a low, medium or high voltage switch comprising a carrier coupled to the carrier of the first drive such that rotation of the carrier of the first drive leads to an associated rotation of the carrier of the third drive;

wherein, rotation of the carrier of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

32. A drive for a low, medium and high voltage switch, comprising:

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40);
- a carrier (50);
- a cogwheel ring (60); and
- a sun cogwheel locking device (90);

wherein, an axis of the pushrod is coaxial with the axis of the cogwheel ring, and wherein a rotation of the cogwheel ring is configured to move the pushrod along the axis of the pushrod;

wherein an axis of the carrier is coaxial with the axis of the sun cogwheel;

wherein, the axis of the cogwheel ring is coaxial with an axis of the sun cogwheel;

wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring, wherein each planetary cogwheel of the at least one planetary cogwheel is connected to the carrier such that when the carrier rotates about the axis of the sun cogwheel a centre axis of each planetary cogwheel rotates with the carrier, and wherein each planetary cogwheel is configured to rotate about its own centre axis;

wherein, the energy provider is coupled to the sun cogwheel; and

wherein, in a first switching action energy release from the energy provider is configured to rotate the sun cogwheel in a first rotational direction about the axis of the sun cogwheel rotate the cogwheel ring in a second rotational direction counter to the first rotational direction to move the pushrod along the axis of the pushrod in a first direction.

33. A low, medium and high voltage switch comprising

a drive according to claim 32.

34. A low, medium or high voltage switching system, comprising:

- a first drive for a low, medium or high voltage switch according to claim 32;
- a second drive for a low, medium or high voltage switch comprising a sun cogwheel coupled to the sun cogwheel of the first drive such that rotation of the sun cogwheel of the first drive leads to an associated rotation of the sun cogwheel of the second drive;
- a third drive for a low, medium or high voltage switch comprising a sun cogwheel coupled to the sun cogwheel of the first drive such that rotation of the sun cogwheel of the first drive leads to an associated rotation of the sun cogwheel of the third drive;

wherein, rotation of the sun cogwheel of the first drive in the first rotational direction is configured to implement a first switching action associated with each drive.

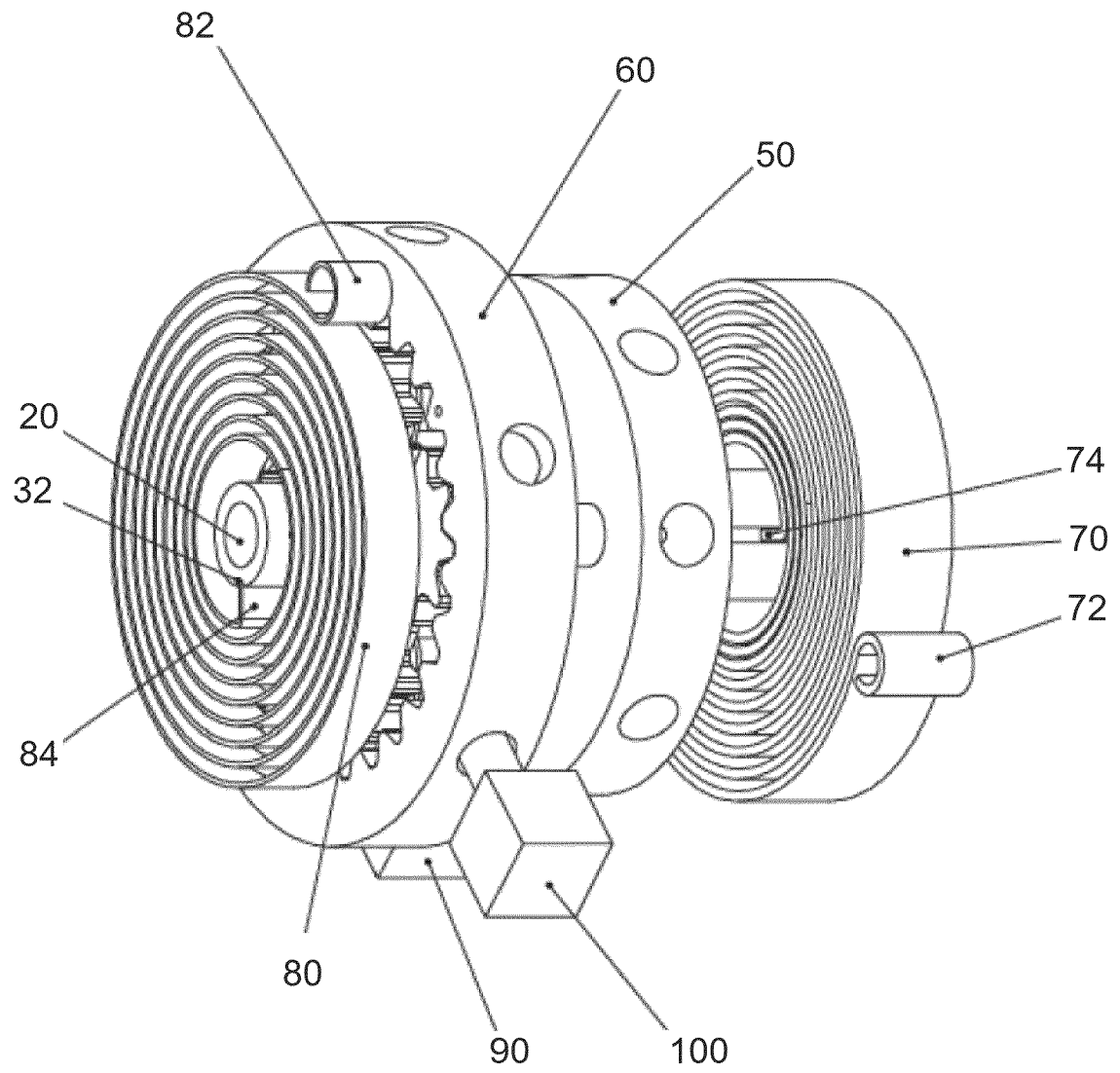


Fig. 1

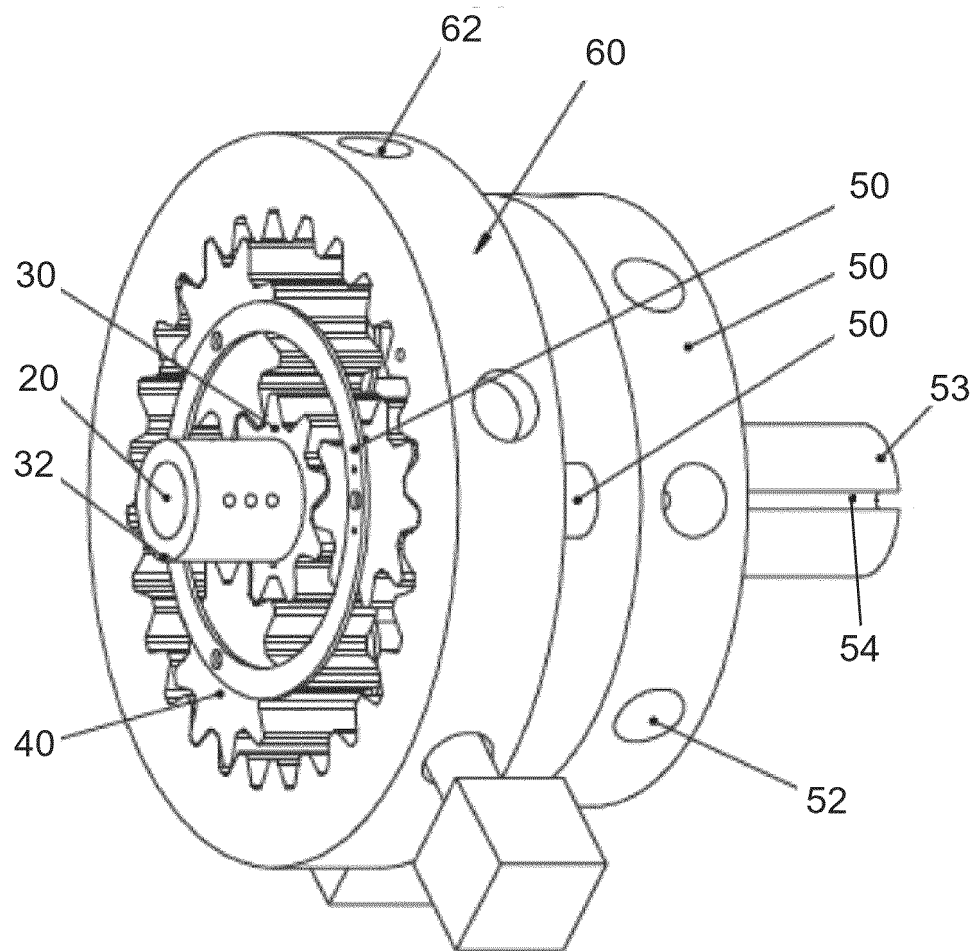


Fig. 2

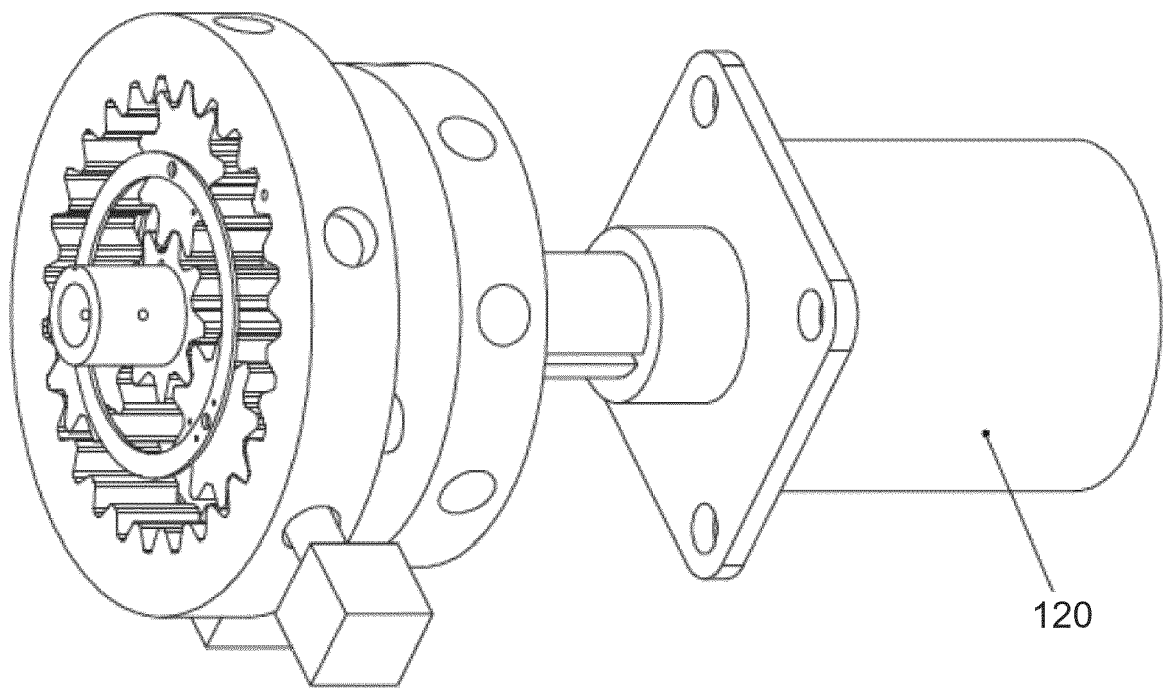


Fig. 3

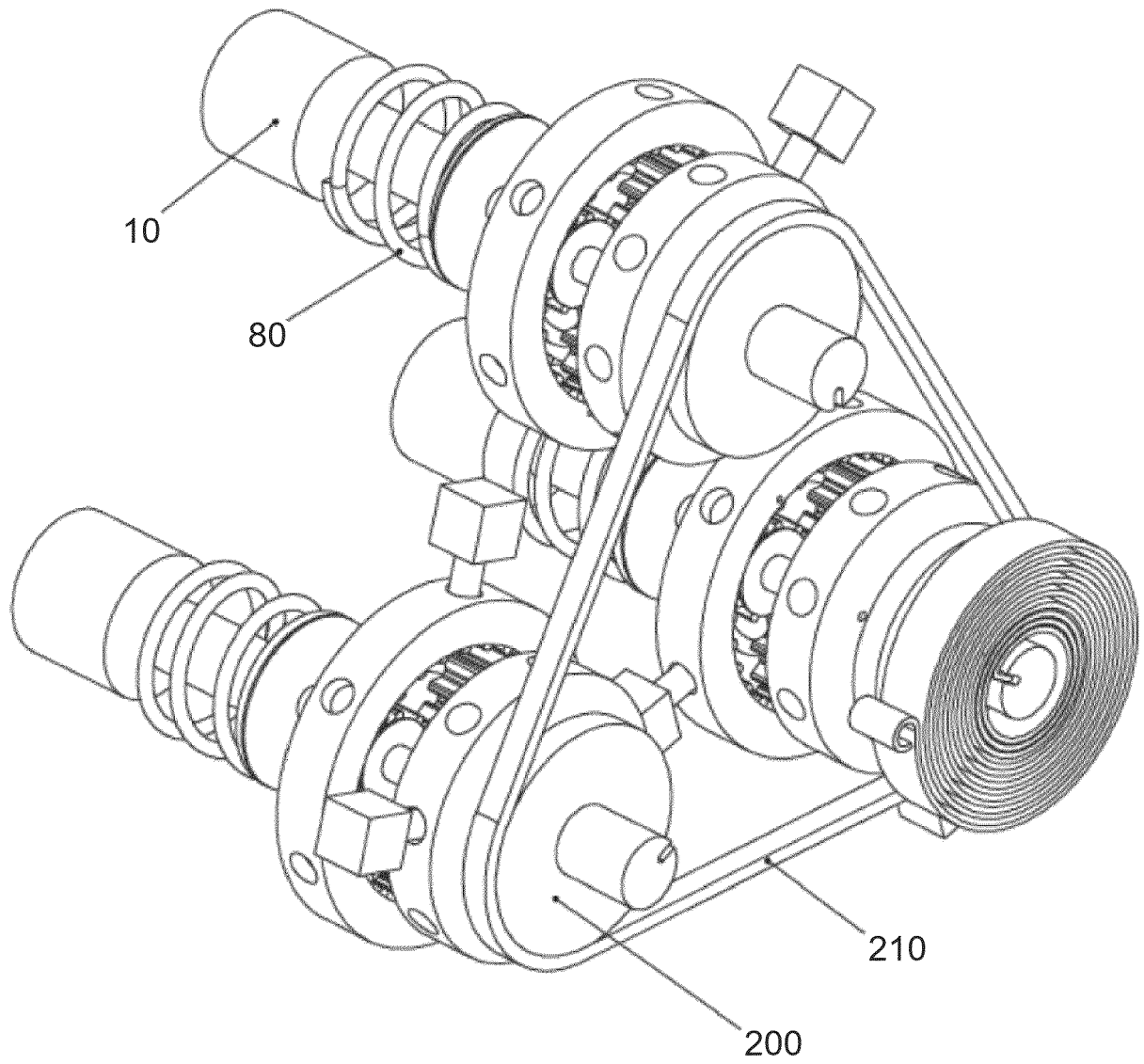


Fig. 4

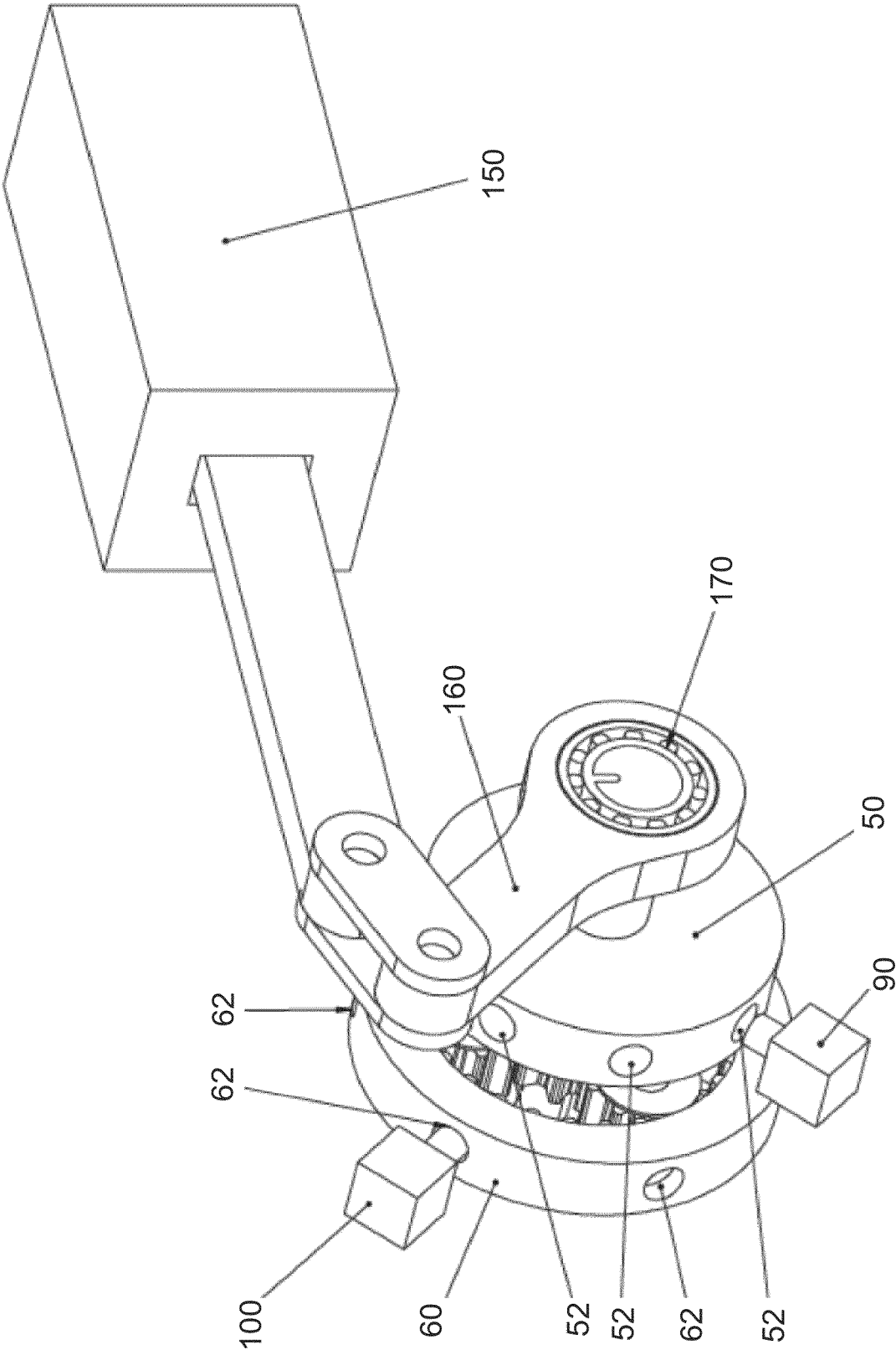


Fig. 5

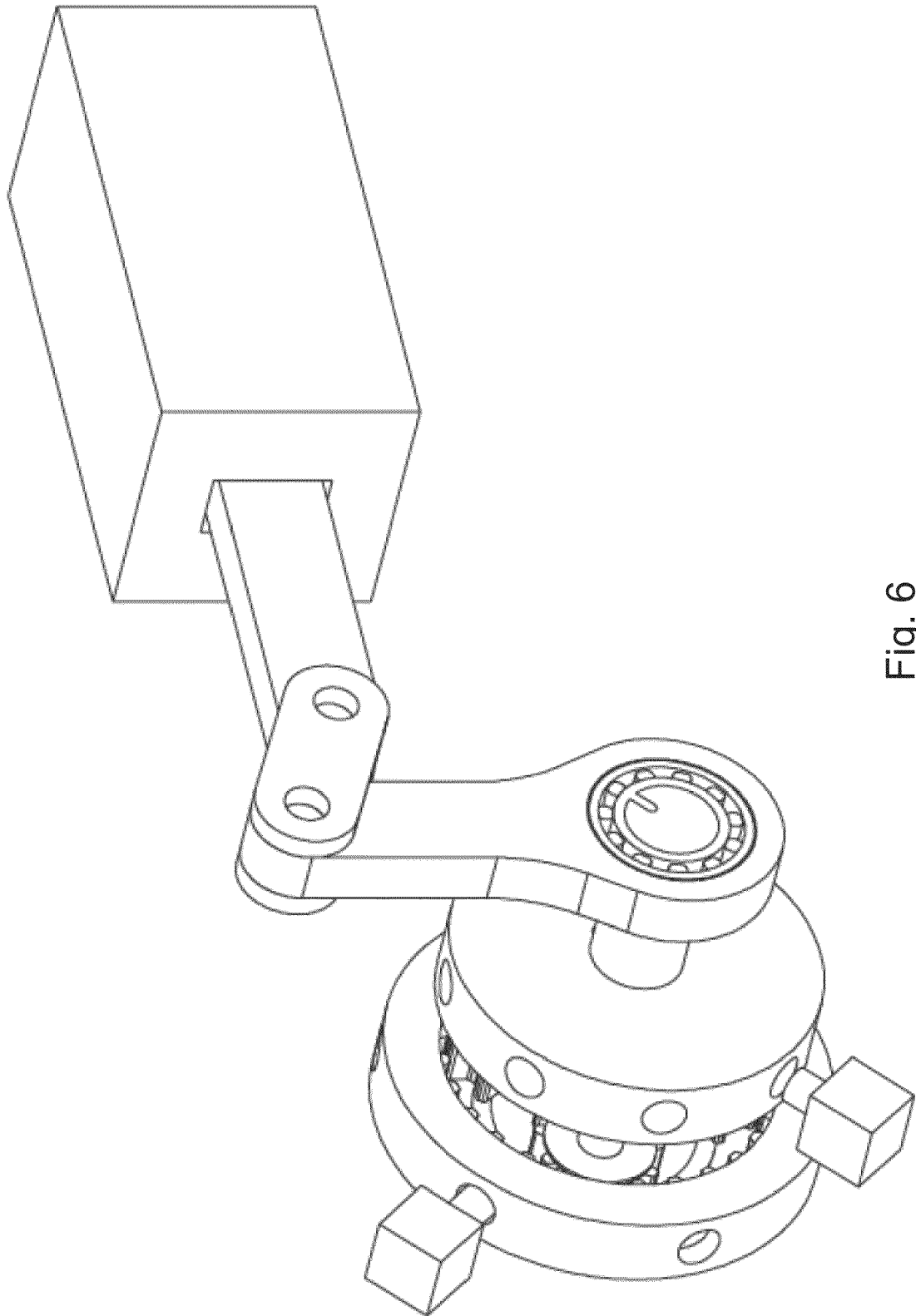


Fig. 6

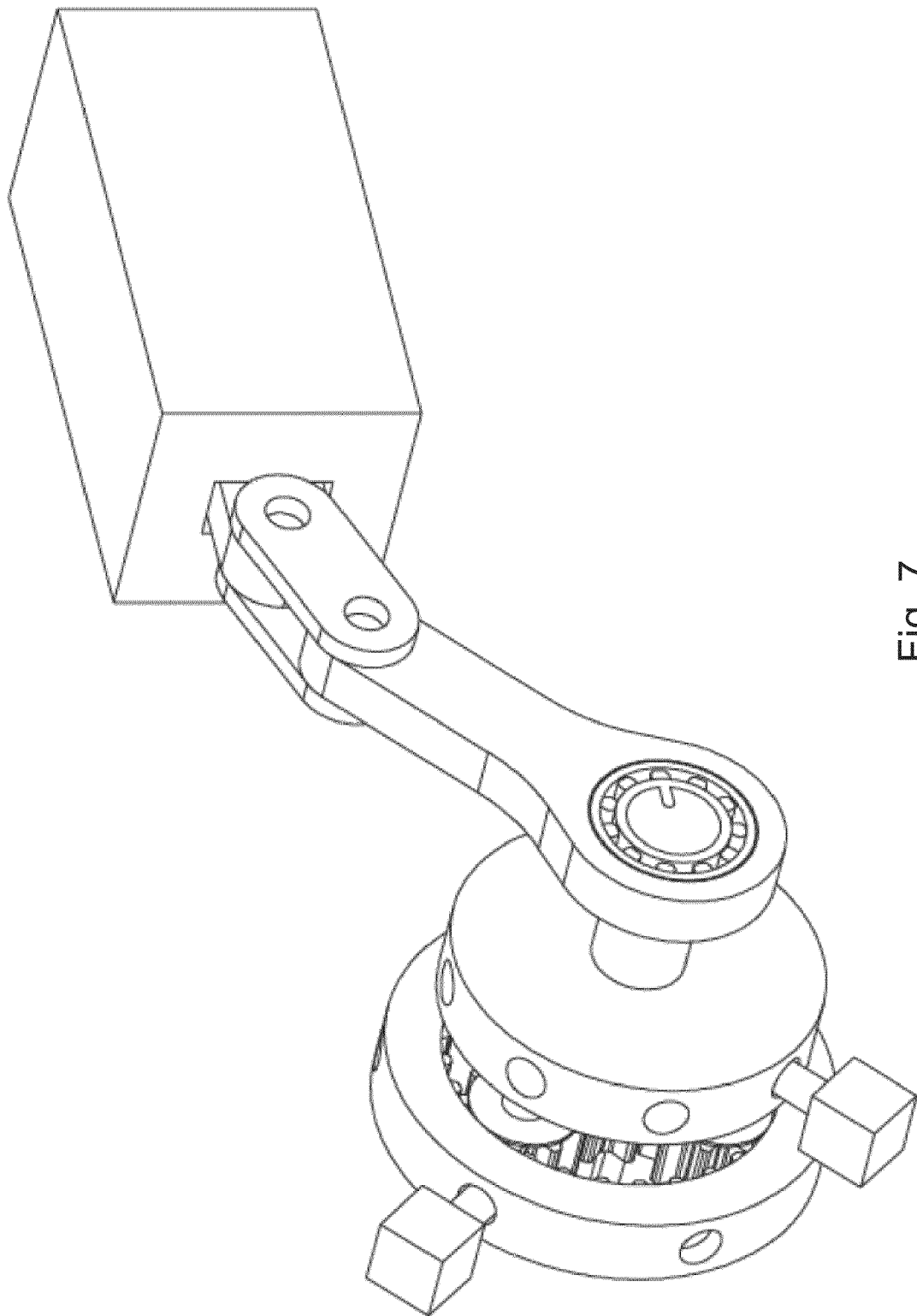


Fig. 7



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 19 6271

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	AT 339 417 B (NAIMER H L [AT]) 25 October 1977 (1977-10-25) * page 4, lines 16-31; figure 6 * * page 2, lines 1-30 * * page 2, line 40 - page 4, line 15; figures 1-5 *	1-34	INV. H01H33/42 ADD. H01H3/30 H01H3/34 H01H3/36 H01H3/40 H01H3/46 H01H3/58 H01H33/40 H01H33/52 H01H33/666
Y	US 2003/089683 A1 (THURESSON PER-OLOF [SE] ET AL) 15 May 2003 (2003-05-15) * paragraphs [0045] - [0054], [0001], [0002]; figures 1, 2 * -----	1-34	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 February 2021	Examiner Meyer, Jan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 19 6271

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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05-02-2021

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