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(54) **DRIVE FOR A LOW, MEDIUM AND HIGH VOLTAGE VACUUM INTERRUPTER**

(57) The present invention relates to a drive for a low, medium and high voltage switch, comprising: a pushrod (10); a sun cogwheel (30); at least one planetary cogwheel (40); and a cogwheel ring (60): The pushrod comprises a threaded portion (20): The sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel. The pushrod is connected to the sun cogwheel such that an axis of the pushrod is coaxial with the axis of the sun cogwheel. The sun cogwheel comprises a plurality of outward facing teeth. An axis of the cogwheel ring is coaxial with the axis of the sun cogwheel. The cogwheel ring comprises a plurality of inward facing teeth. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. The at least one planetary cogwheel comprises a plurality of outward facing teeth, and 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. In a first switching action:
a rotation of the at least one planetary cogwheel about the axis of the sun cogwheel in a first rotational direction is configured to rotate the sun cogwheel in the first rotational direction; and
the rotation of the sun cogwheel in the first rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

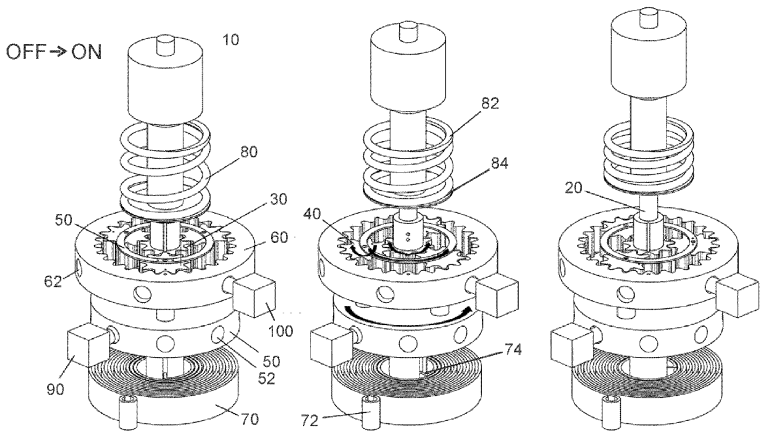

Fig. 1

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Description

FIELD OF THE INVENTION

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

BACKGROUND OF THE INVENTION

[0002] Low, medium and high voltage switching poles or circuit breakers (CBs) use for example levers or shafts 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 provide for an improved mechanical drive for a low, medium and high voltage vacuum interrupter.

SUMMARY OF THE INVENTION

[0006] Therefore, it would be advantageous to have an improved mechanical drive for a low, medium and high voltage vacuum interrupter or another switching device.

[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 and high voltage switch, comprising:

- a pushrod;
- a sun cogwheel;
- at least one planetary cogwheel; and
- a cogwheel ring;

[0009] The pushrod comprises a threaded portion. The sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel. The pushrod is connected to the sun cogwheel such that an axis of the pushrod is coaxial with the axis of the sun cogwheel. The sun cogwheel comprises a plurality of outward facing teeth. An axis of the cogwheel ring is coaxial with the axis of the sun cogwheel. The cogwheel ring comprises a plurality of inward facing teeth. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. The at least one planetary cogwheel comprises a plurality of outward facing teeth. 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. In a first switching action a rotation of the at least one planetary cogwheel about the axis of the sun cogwheel in a first rotational direction is configured to rotate the sun cogwheel in the first rotational direction. 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 a first direction.

[0010] In this manner, 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 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 or another switching device.

[0011] In an example, in the first switching action the drive is configured such that the cogwheel ring does not rotate.

[0012] 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.

[0013] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0014] 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.

[0015] In an example, the drive comprises a carrier. An axis of the carrier is coaxial with the axis of the sun cogwheel. Each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier. In the first switching action a rotation of the carrier about the axis of the sun cogwheel in the first rotational direction is configured to rotate the at least one planetary cogwheel in the first rotational direction.

[0016] 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 cog-

wheels rotate as the carrier rotates in this rotation is coupled to the cogwheel ring which then rotates.

[0017] In an example, a first end of a first spring is coupled to the at least one planetary cogwheel. In the first switching action energy release from the first spring is configured to rotate the at least one planetary cogwheel in the first rotational direction about the axis of the sun cogwheel.

[0018] In an example, in the first switching action the drive is configured such that a second end of the first spring is held in a fixed position.

[0019] In an example, the first end of the first spring is coupled to the at least one planetary cogwheel via the carrier.

[0020] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring.

[0021] 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 (initial position) configuration.

[0022] In an example, in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction. The movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction.

[0023] In an example, a first end of the second spring is connected to the pushrod or directly to a part of the planetary gear.

[0024] In an example, a second end of the second spring is held in a fixed position.

[0025] In an example, in the second switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel.

[0026] 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 first 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.

[0027] In an example, in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

[0028] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring.

[0029] In this manner, a simple way of charging the drive for switching operation is enabled.

[0030] In a second aspect, there is provided a low - medium and high voltage switch comprising a drive according to the first aspect.

[0031] In an third aspect, there is provided a medium 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 according to the first aspect;
- a third drive for a low - medium or high voltage switch according to the first aspect.

[0032] The first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each sun cogwheel in the first rotational direction is configured to move the pushrod (or another rod or threaded part to generate forward backward operation) of each drive along the axis of the pushrod in the first direction.

[0033] 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; and
- a cogwheel ring

[0034] The pushrod comprises a threaded portion. The sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel. The pushrod is connected to the sun cogwheel such that an axis of the pushrod is coaxial with the axis of the sun cogwheel.

[0035] The sun cogwheel comprises a plurality of outward facing teeth. An axis of the cogwheel ring is coaxial with the axis of the sun cogwheel. The cogwheel ring comprises a plurality of inward facing teeth. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. The at least one planetary cogwheel comprises a plurality of outward facing teeth. 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. In a first switching action a rotation of the cogwheel ring about the axis of the sun cogwheel in a first rotational direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction. 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 a first direction.

[0036] In this manner, rotational movement of a cogwheel ring about a centre axis 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.

[0037] It is also possible to use the planetary gear in the way that the sun cogwheel will be driven from the first

spring and the planetary carrier is coupled to the forward backward operation to the drive.

[0038] In an example, in the first switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the pushrod axis.

[0039] 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.

[0040] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0041] 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.

[0042] In an example, the drive comprises a carrier. An axis of the carrier is coaxial with the axis of the sun cogwheel. Each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier. The drive is configured such that in the first switching action the carrier is configured not to rotate about the axis of the sun cogwheel.

[0043] 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.

[0044] In an example, a first end of a first spring is coupled to the cogwheel ring. In the first switching action energy release from the first spring is configured to rotate the cogwheel ring in the first rotational direction about the axis of the sun cogwheel.

[0045] In an example, in the first switching action the drive is configured such that a second end of the first spring is held in a fixed position.

[0046] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring.

[0047] 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.

[0048] Even a step wise switching to a first position then to a further position or back position can be done that will be handled by the specific interlocking device and in combination with energy storage here provided from springs.

[0049] In an example, in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction (or in case of stepwise movement more positions are possible). The movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction.

[0050] In an example, a first end of the second spring is connected to the pushrod. A further possibility is to connect the second spring to one end of the planetary gear to provide the needed energy to drive the gear to operate.

[0051] In an example, a second end of the second spring is held in a fixed position.

[0052] 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.

[0053] In other words, the sun cogwheel rotates, and the planetary cogwheels rotate about the centre axis and each planetary cogwheel is each rotating about its own axes, and this occurs with the cogwheel ring not rotating. Thus, in this manner the second switching movement is not constrained by storing energy in the first spring used to drive the first switching movement because the cogwheel ring is not rotating.

[0054] In an example, in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

[0055] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring.

[0056] In this manner, a simple way of charging the drive for switching operation is enabled.

[0057] In a fifth aspect, there is provided a low - medium and high voltage switch comprising a drive according to the fourth aspect.

[0058] In a sixth aspect, there is provided a low, medium and high voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to the fourth aspect;
- a second drive for a low, medium and high voltage switch according to the fourth aspect;
- a third drive for a low, medium and high voltage switch according to the fourth aspect.

[0059] The first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each sun cogwheel in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

[0060] In a seventh aspect, there is provided a drive for a medium voltage switch, comprising:

- a pushrod;
- a sun cogwheel;
- at least one planetary cogwheel; and
- a cogwheel ring.

[0061] The pushrod comprises a threaded portion. The cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring. The pushrod is connected to the cogwheel ring such that an axis of the pushrod is coaxial with the axis of the cogwheel ring. The sun cogwheel comprises a plurality of outward facing teeth. The axis of the cogwheel ring is coaxial with an axis of the sun cogwheel. The cogwheel ring comprises a plurality of inward facing teeth. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. The at least one planetary cogwheel comprises a plurality of outward facing teeth. 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. In a first switching action a rotation of the at least one planetary cogwheel about the axis of the sun cogwheel in a first rotational direction is configured to rotate the cogwheel ring in a first rotational direction. 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 a first direction.

[0062] In this manner, 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.

[0063] In an example, in the first switching action the drive is configured such that the sun cogwheel does not rotate.

[0064] 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.

[0065] In an example in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0066] 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.

[0067] In an example the drive comprises a carrier. An axis of the carrier is coaxial with the axis of the sun cogwheel. Each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier. In the first switching action a rotation of the carrier about the axis of the sun cogwheel in the first rotational direction is configured to rotate the at least one planetary cogwheel in the first rotational direction.

[0068] 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.

[0069] In an example, in the first switching action energy release from a first spring is configured to rotate the at least one planetary cogwheel in the first rotational direction about the axis of the sun cogwheel.

[0070] In an example, in the first switching action the drive is configured such that a second end of the first spring is held in a fixed position.

[0071] In an example, the first end of the first spring is coupled to the at least one planetary cogwheel via the carrier.

[0072] In an example in the first switching action movement of the pushrod (or another rod part) along the axis of the pushrod is configured to store energy in a second spring.

[0073] 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 (position).

[0074] In an example, in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction. The movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction.

[0075] In an example, a first end of the second spring is connected to the pushrod or will be connected to one end of the planetary gear.

[0076] In an example a second end of the second spring is held in a fixed position.

[0077] In an example, in the second switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel.

[0078] 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 first 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.

[0079] In an example, in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

[0080] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring.

[0081] In this manner, a simple way of charging the drive for switching operation is enabled.

[0082] In an eighth aspect, there is provided a medium voltage switch comprising a drive according to the seventh aspect.

[0083] In a ninth aspect, there is provided a medium voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to the seventh aspect;
- a second drive for a low, medium and high voltage switch according to the seventh aspect;
- a third drive for a low, medium and high voltage switch according to the seventh aspect.

[0084] The first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each cogwheel ring in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

[0085] In a tenth aspect, there is provided a drive for a medium voltage switch, comprising:

- a pushrod;
- a sun cogwheel;
- at least one planetary cogwheel; and
- a cogwheel ring.

[0086] The pushrod comprises a threaded portion. The cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring. The pushrod is rotationally connected to the cogwheel ring such that an axis of the pushrod is coaxial with the axis of the cogwheel ring. The sun cogwheel comprises a plurality of outward facing teeth. The axis of the cogwheel ring is coaxial with an axis of the sun cogwheel. The cogwheel ring comprises a plurality of inward facing teeth. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. The at least one planetary cogwheel comprises a plurality of outward facing teeth. 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. In a first switching action a rotation of the sun cogwheel in a first rotational direction is configured to rotate the cogwheel ring in a second rotational direction counter to the first rotational direction. 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 a first direction.

[0087] In this manner, rotational movement of a sun cogwheel leads to rotation of each planetary cogwheel 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 a vacuum interrupter or other switch.

[0088] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0089] In an example, in the first switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel.

[0090] 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.

[0091] In an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

[0092] In an example, the drive comprises a carrier. An axis of the carrier is coaxial with the axis of the sun cogwheel. Each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier. The drive is configured such that in the first switching action the carrier is configured not to rotate about the axis of the sun cogwheel.

[0093] In an example, a first end of a first spring is coupled to the sun cogwheel. In the first switching action energy release from the first spring is configured to rotate the sun cogwheel in the first rotational direction about the axis of the sun cogwheel.

[0094] In an example, in the first switching action the drive is configured such that a second end of the first spring is held in a fixed position.

[0095] In an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring.

[0096] In an example, in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction. The movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in the first rotational direction opposite to the second rotational direction.

[0097] In an example, a first end of the second spring is connected to the pushrod.

[0098] In an example, a second end of the second spring is held in a fixed position.

[0099] 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.

[0100] In an example, in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

[0101] In an example, prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring.

[0102] The above aspects and examples will become apparent from and be elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0103] Exemplary embodiments will be described in the following with reference to the following drawings:

Fig. 1 shows a schematic view of three instances of the closing operation of the new drive;
Fig. 2 shows a schematic view of three instances of the opening operation of the new drive of Fig. 1; and
Fig. 3 shows a schematic view of three instances of the recharging of the new drive of Figs. 1-2.

DETAILED DESCRIPTION OF EMBODIMENTS

[0104] Figs. 1-3 relate to examples of a drive for a low - medium and high voltage switch. There are three embodiments, however only the first embodiment is shown.

Embodiment 1

[0105] In an example the drive for a low - medium and high voltage switch comprises a pushrod 10, a sun cogwheel 30, at least one planetary cogwheel 40, and a cogwheel ring 60. The pushrod comprises a threaded portion 20. The sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel. The pushrod is rotationally connected to the sun cogwheel such that an axis of the pushrod is coaxial with the axis of the sun cogwheel. The sun cogwheel comprises a plurality of outward facing teeth. An axis of the cogwheel ring is coaxial with the axis of the sun cogwheel. The cogwheel ring comprises a plurality of inward facing teeth. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. The at least one planetary cogwheel comprises a plurality of outward facing teeth. 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. In a first switching action:

- a rotation of the at least one planetary cogwheel about the axis of the sun cogwheel in a first rotational direction is configured to rotate the sun cogwheel in the first rotational direction; and
- the rotation of the sun cogwheel in the first rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

[0106] Thus, the pushrod of the drive can be the pushrod of for example a movable connector that is moved up against a stationary connector of a vacuum interrupter or circuit breaker.

[0107] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0108] In an example, the low - medium and high voltage switch is a circuit breaker with a vacuum interrupter.

[0109] According to an example, in the first switching action the drive is configured such that the cogwheel ring does not rotate. This can be achieved by it being locked in position for example.

[0110] According to 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.

[0111] According to an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis. This can be achieved for example through a protrusion on the pushrod sliding within a groove of the drive, or a protrusion in the drive sliding within a groove of the pushrod, thereby inhibiting the pushrod from rotating but enabling it to move longitudinally along its axis.

[0112] According to an example, the drive comprises a carrier 50. An axis of the carrier is coaxial with the axis of the sun cogwheel. Each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier. In the first switching action a rotation of the carrier about the axis of the sun cogwheel in the first rotational direction is configured to rotate the at least one planetary cogwheel in the first rotational direction.

[0113] According to an example, a first end 74 of a first spring 70 is coupled to the at least one planetary cogwheel. In the first switching action energy release from the first spring 70 is configured to rotate the at least one planetary cogwheel in the first rotational direction about the axis of the sun cogwheel.

[0114] According to an example, in the first switching action the drive is configured such that a second end 72 of the first spring is held in a fixed position. This can be achieved by it being locked in position for example.

[0115] According to an example, the first end of the first spring is coupled to the at least one planetary cogwheel via the carrier 50.

[0116] According to an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring 80.

[0117] According to an example, in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction. The movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction.

[0118] According to an example, a first end 84 of the second spring is connected to the pushrod.

[0119] According to an example, a second end 82 of the second spring is held in a fixed position. This can be achieved by it being locked in position for example.

[0120] According to an example, in the second switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel.

[0121] According to an example, in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

[0122] According to an example, prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring. Thus, the second end of the first spring is released from its fixed state, moved rotationally about the centre axis of the drive to store energy in the first spring and then fixed in position again.

[0123] The drive of any of the examples of embodiment 1 can also be part of a low - medium and high voltage switch, e.g. a CB with a vacuum interrupter on another moving device.

[0124] The drives as described in any of the examples of embodiment 1 can also be part of a low - medium and high voltage switching system, for example a three phase system. Such as system then comprises a first drive for a low - medium and high voltage switch according to any of the examples of embodiment 1, a second drive for a low - medium and high voltage switch according to any of the examples of embodiment 1, and a third drive for a low - medium and high voltage switch according to any of the examples of embodiment 1. The first, second and third drives can then be configured to be driven by a single motor such that simultaneous rotation of each sun cogwheel in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

Embodiment 2

[0125] In an example the drive for a low - medium and high voltage switch comprises a pushrod 10, a sun cogwheel 30, at least one planetary cogwheel 40, and a cogwheel ring 60. The pushrod comprises a threaded portion 20. The sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel. The pushrod is rotationally connected to the sun cogwheel such that an axis of the pushrod is coaxial with the axis of the sun cogwheel. The sun cogwheel comprises a plurality of outward facing teeth. An axis of the cogwheel ring is coaxial with the axis of the sun cogwheel. The cogwheel ring comprises a plurality of inward facing teeth. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. The at least one planetary cogwheel comprises a plurality of outward facing teeth. 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. In a first switching action:

- a rotation of the cogwheel ring about the axis of the sun cogwheel in a first rotational direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction; and
- the rotation of the sun cogwheel in the second rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

[0126] Thus, the pushrod of the drive can be the pushrod of for example a movable connector that is moved up against a stationary connector of a vacuum interrupter or circuit breaker.

[0127] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0128] In an example, the low - medium and high voltage switch is a CB with a vacuum interrupter or another switching device.

[0129] According to an example, in the first switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the pushrod axis. This can be achieved by it being locked in position for example.

[0130] According to 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.

[0131] According to an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis. This can be achieved for example through a protrusion on the pushrod sliding within a groove of the drive, or a protrusion in the drive sliding within a groove of the pushrod, thereby inhibiting the pushrod from rotating but enabling it to move longitudinally along its axis.

[0132] According to an example, the drive comprises a carrier 50. An axis of the carrier is coaxial with the axis of the sun cogwheel. Each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier. The drive is configured such that in the first switching action the carrier is configured not to rotate about the axis of the sun cogwheel. This can be achieved by it being locked in position for example.

[0133] According to an example, a first end 74 of a first spring 70 is coupled to the cogwheel ring. In the first switching action energy release from the first spring 70 is configured to rotate the cogwheel ring in the first rotational direction about the axis of the sun cogwheel.

[0134] According to an example, in the first switching action the drive is configured such that a second end 72 of the first spring is held in a fixed position. This can be achieved by it being locked in position for example.

[0135] According to an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring 80.

[0136] According to an example, in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction. The movement of the pushrod (or another switching element a rod or a wheel) along the axis of the pushrod in the

second direction is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction.

[0137] According to an example, a first end 84 of the second spring is connected to the pushrod.

[0138] According to an example, a second end 82 of the second spring is held in a fixed position. This can be achieved by it being locked in position for example.

[0139] According to 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.

[0140] According to an example, in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

[0141] According to an example, prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring. Thus, the second end of the first spring is released from its fixed state, moved rotationally about the centre axis of the drive to store energy in the first spring and then fixed in position again.

[0142] The drive of any of the examples of embodiment 1 can also be part of a low - medium and high voltage switch, e.g. a CB with a vacuum interrupter or another switching device.

[0143] The drives as described in any of the examples of embodiment 2 can also be part of a low - medium and high voltage switching system, for example a three phase system. Such as system then comprises a first drive for a low - medium and high voltage switch according to any of the examples of embodiment 2, a second drive for a low - medium and high voltage switch according to any of the examples of embodiment 2, and a third drive for a low - medium and high voltage switch according to any of the examples of embodiment 2. The first, second and third drives can then be configured to be driven by a single motor such that simultaneous rotation of each sun cogwheel in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

Embodiment 3

[0144] In an example the drive for a medium voltage switch comprises a pushrod 10, a sun cogwheel 30, at least one planetary cogwheel 40, and a cogwheel ring 60. The pushrod comprises a threaded portion 20. The cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring. The pushrod is rotationally connected to the cogwheel ring such that an axis of the pushrod is coaxial with the axis of the cogwheel ring. The sun cogwheel comprises a plurality of outward facing teeth. The axis of the cogwheel ring is coaxial with an axis of the sun cogwheel. The cogwheel ring comprises a plurality of inward facing teeth. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. The at least one planetary cogwheel comprises a plurality of outward facing teeth. 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. In a first switching action:

- a rotation of the at least one planetary cogwheel about the axis of the sun cogwheel in a first rotational direction is configured to rotate the cogwheel ring in a first rotational direction; and
- the rotation of the cogwheel ring in the first rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

[0145] Thus, the pushrod of the drive can be the pushrod of for example a movable connector that is moved up against a stationary connector of a vacuum interrupter or circuit breaker.

[0146] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0147] In an example, the low - medium and high voltage switch is a CB with a vacuum interrupter or the other switching element.

[0148] According to an example, in the first switching action the drive is configured such that the sun cogwheel does not rotate. This can be achieved by it being locked in position for example.

[0149] According to 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.

[0150] According to an example, in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis. This can be achieved for example through a protrusion on the pushrod sliding within a groove of the drive, or a protrusion in the drive sliding within a groove of the pushrod, thereby inhibiting the pushrod from rotating but enabling it to move longitudinally along its axis.

[0151] According to an example, the drive comprises a carrier 50. An axis of the carrier is coaxial with the axis of the sun cogwheel. Each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier. The drive is configured such that in the first switching action a rotation of the carrier about the axis of the sun cogwheel in the first rotational direction is configured to rotate the at least one planetary cogwheel in the first rotational direction. This operation can be even achieved by using the planetary gear from the other direction where the sun cogwheel is connected to the first spring 70 and the cogwheel ring is connected to the movable device to switch on and of even if the movement will be done stepwise forward or backward. This is discussed with respect to embodiment 4.

[0152] According to an example, a first end 74 of a first spring 70 is coupled to the at least one planetary cog-

wheel. In the first switching action energy release from the first spring 70 is configured to rotate the at least one planetary cogwheel in the first rotational direction about the axis of the sun cogwheel.

[0153] According to an example, in the first switching action the drive is configured such that a second end 72 of the first spring is held in a fixed position. This can be achieved by it being locked in position for example.

[0154] According to an example, the first end of the first spring is coupled to the at least one planetary cogwheel via the carrier.

[0155] According to an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring 80.

[0156] According to an example, in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction. The movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction.

[0157] According to an example, a first end 84 of the second spring is connected to the pushrod.

[0158] According to an example, a second end 82 of the second spring is held in a fixed position. This can be achieved by it being locked in position for example.

[0159] According to an example, in the second switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel.

[0160] According to an example, in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

[0161] According to an example, prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring. Thus, the second end of the first spring is released from its fixed state, moved rotationally about the centre axis of the drive to store energy in the first spring and then fixed in position again.

[0162] The drive of any of the examples of embodiment 3 can also be part of a low - medium and high voltage switch.

[0163] The drives as described in any of the examples of embodiment 3 can also be part of a low - medium and high voltage switching system, for example a three phase system. Such as system then comprises a first drive for a low - medium and high voltage switch according to any of the examples of embodiment 3, a second drive for a low - medium and high voltage switch according to any of the examples of embodiment 3, and a third drive for a medium voltage switch according to any of the examples of embodiment 3. The first, second and third drives can be configured to be driven by a single motor such that simultaneous rotation of each cogwheel ring in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

Embodiment 4

[0164] In an example the drive for a medium voltage switch comprises a pushrod 10, a sun cogwheel 30, at least one planetary cogwheel 40, and a cogwheel ring 60. The pushrod comprises a threaded portion 20. The cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring. The pushrod is rotationally connected to the cogwheel ring such that an axis of the pushrod is coaxial with the axis of the cogwheel ring. The sun cogwheel comprises a plurality of outward facing teeth. The axis of the cogwheel ring is coaxial with an axis of the sun cogwheel. The cogwheel ring comprises a plurality of inward facing teeth. The at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring. The at least one planetary cogwheel comprises a plurality of outward facing teeth. 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. In a first switching action:

- a rotation of the sun cogwheel in a first rotational direction is configured to rotate the cogwheel ring in a second rotational direction counter to the first rotational direction; and
- the rotation of the cogwheel ring in the second rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

[0165] Thus, the pushrod of the drive can be the pushrod of for example a movable connector that is moved up against a stationary connector of a vacuum interrupter or circuit breaker.

[0166] In an example, the at least one planetary cogwheel comprises three planetary cogwheels.

[0167] In an example, the low, medium and high voltage switch is a CB with a vacuum interrupter or another switching element.

[0168] According to an example, in the first switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel. This can be achieved by it being locked in position for example. Thus the individual planetary cogwheels can rotate about their own axes, but they do not rotate as a group around the central axis.

[0169] According to 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.

[0170] According to an example, in the first switching action the drive is configured such that the pushrod does

not rotate about the pushrod axis. This can be achieved for example through a protrusion on the pushrod sliding within a groove of the drive, or a protrusion in the drive sliding within a groove of the pushrod, thereby inhibiting the pushrod from rotating but enabling it to move longitudinally along its axis.

[0171] According to an example, the drive comprises a carrier 50. An axis of the carrier is coaxial with the axis of the sun cogwheel. Each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier. The drive is configured such that in the first switching action the carrier is configured not to rotate about the axis of the sun cogwheel. This can be achieved by it being locked in position for example.

[0172] According to an example, a first end 74 of a first spring 70 is coupled to the sun cogwheel. In the first switching action energy release from the first spring 70 is configured to rotate the sun cogwheel in the first rotational direction about the axis of the sun cogwheel.

[0173] According to an example, in the first switching action the drive is configured such that a second end 72 of the first spring is held in a fixed position. This can be achieved by it being locked in position for example.

[0174] According to an example, in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring 80.

[0175] According to an example, in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction. The movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in the first rotational direction opposite to the second rotational direction.

[0176] According to an example, a first end 84 of the second spring is connected to the pushrod.

[0177] According to an example, a second end 82 of the second spring is held in a fixed position. This can be achieved by it being locked in position for example.

[0178] According to 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.

[0179] According to an example, in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

[0180] According to an example, prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring. Thus, the second end of the first spring is released from its fixed state, moved rotationally about the centre axis of the drive to store energy in the first spring and then fixed in position again.

[0181] The drive of any of the examples of embodiment 4 can also be part of a low, medium and high voltage switch.

[0182] The drives as described in any of the examples of embodiment 4 can also be part of a low, medium and high voltage switching system, for example a three phase system. Such as system then comprises a first drive for a low, medium and high voltage switch according to any of the examples of embodiment 4, a second drive for a low, medium and high voltage switch according to any of the examples of embodiment 4, and a third drive for a medium voltage switch according to any of the examples of embodiment 4. The first, second and third drives can be configured to be driven by a single motor such that simultaneous rotation of each cogwheel ring in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

[0183] Continuing with the figures, the drive for a low, medium and high voltage vacuum interrupter, the low, medium and high voltage circuit breaker switching pole, and the low, medium and high voltage switching system are described in further detail, with respect to specific embodiments.

[0184] 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.

[0185] Figure 1 shows three instants of the closing operation, from left to right: OFF position, intermediate position, ON position. The energy for the operation is stored in the closing spring 70.

[0186] In the OFF position, both the planetary cogwheel carrier 50 and the hollow cogwheel ring 60 are locked against rotation by their relevant locking features shown as 52, 62 and locking devices shown as 90,100.

[0187] The closing spring 70 is charged to drive the closing operation while the opening spring 80 is discharged.

[0188] For closing, the locking device 90 is unlocked, so that the closing spring 70 can drive the carrier 50 counter-clockwise. The outer end 72 of the closing spring 70 is currently locked in the shown position. The counter-clockwise rotation of 50, while the hollow cogwheel ring 60 is locked, results in a counter clockwise rotation of the sun cogwheel 30.

[0189] The sun cogwheel 30 is connected or coupled to the pushrod 10 by for example a high helix thread 20 (or another thread type) so that a counter-clockwise rotation of the sun cogwheel 30 shifts the pushrod 10 away from the OFF-position towards the ON-position. This motion of the pushrod 10 charges the opening spring 80, as its upper end 82 is permanently locked in the shown position while the lower end of 80 is connected to the pushrod 10.

[0190] The sun cogwheel 30 can have a male thread and the pushrod 10 have a female thread, or the sun cogwheel 30 can have a female thread and the pushrod 10 have a male thread.

[0191] In the intermediate position shown in the centre

of figure 1, the closing spring 70 has rotated the carrier 50 by 45° counter-clockwise. According to the chosen number of teeth, this corresponds to a counter-clockwise rotation of 180° of the sun cogwheel 30. Due to the high helix thread 20, the pushrod was moved half of its way upwards from OFF to ON. The opening spring was charged by the movement of the pushrod. In the ON-position shown at the right side of figure 1, the closing spring 70 has rotated the planetary carrier 50 by 90° counter-clockwise. According to the chosen number of teeth, this corresponds to a rotation of 360° counter-clockwise of the sun cogwheel 30. Due to the high helix thread 20 (or another thread type), the pushrod was moved its complete way upwards from OFF to ON. The opening spring was fully charged. Now the next locking feature 52 is in a position where the locking device 90 can push a pin, e.g. driven by a spring, into the locking feature 52 and so stop and latch the closing operation. Alternatively, the closing operation can also be stopped and latched by separate devices.

[0192] In figure 1, where the closing operation is shown, locking features 52 are not only provided at the OFF and the ON positions of the cogwheel planetary carrier 50, but also in the intermediate position.

[0193] It is to be noted that in a different embodiment, not shown, the pushrod 10 is again threaded but is not connected or coupled to the sun cogwheel 30. Rather, the hollow cogwheel ring 60 has a top cover that can be for example a disk, and a centre of this disk is threaded. Thus looking at figure 1, the sun cogwheel 30 and planetary cogwheels 40 in this example are underneath the top cover of the cogwheel ring 60. Then, the closing spring 70 can again drive the carrier 50 and the planetary cogwheels 40 around the axis of the sun cogwheel 30. However, the sun cogwheel 30 can then be locked in position and not rotate and the hollow cogwheel ring 60 then rotates in a clockwise direction. The pushrod 10 can then be threaded in the opposite direction to that described above, and again the pushrod moves away from the off position towards the on position. Rather than having pushrod 10 threaded in the opposite direction, the closing spring 70 can be in effect rotated 180° and the energy release can rotate the carrier in the opposite direction to that described above and again rotation of the cogwheel ring 60 now again in the counter clockwise direction leads to movement of the pushrod from the opposition to the on position.

[0194] The cogwheel ring 60 can have a male thread and the pushrod 10 have a female thread, or the cogwheel ring 60 can have a female thread and the pushrod 10 have a male thread.

[0195] Also, in a different embodiment, the pushrod 10 is again threaded and connected or coupled to the sun cogwheel 30. However now, the closing spring 70 is coupled to the cogwheel ring 60 and now drives rotation of the cogwheel ring 60 rather than driving rotation of the carrier 50 of the planetary cogwheels 40. The carrier 50 of the planetary cogwheels 40 is then held in a fixed position, and does not rotate, but the individual planetary cogwheels 40 then rotate about their axes with rotation of the cogwheel ring 60 then rotating the sun cogwheel 30, which then drives the pushrod 10.

[0196] Figure 2 shows three instants of the opening operation, from left to right: ON position, intermediate position, OFF position. The energy for the operation is stored in the opening spring 80. In the ON position, both the planetary cogwheel carrier 50 and the hollow cogwheel ring 60 are locked against rotation by their relevant locking features shown as 52, 62 and locking devices shown as 90,100.

[0197] The closing spring 70 is discharged, and the opening spring 80 is charged to drive the opening operation. For opening, the locking device 100 is unlocked, so that the hollow cogwheel ring 60 is freely rotatable. The opening spring 80 can drive the pushrod 10 downwards, away from the ON position towards the OFF-position. The pushrod is connected by a high helix thread 20 (or another thread type) to the sun cogwheel 30, so that a downward movement of 10 results in a clockwise rotation of 30. The planetary cogwheel carrier 50 is not rotating, as it is locked by locking device 90, 52, but the planetary cogwheels 40 are rotating then counter-clockwise. Also the hollow cogwheel ring 60 is rotating counter-clockwise. The closing spring 70 is idle in this phase.

[0198] In the intermediate position shown in the centre of figure 2, the opening spring 80 has moved the pushrod 10 half of its way downwards from ON to OFF. Due to the high helix thread 20 (or another thread type), the sun cogwheel 30 was rotated by 180° clockwise. According to the chosen number of teeth, this corresponds to a counter-clockwise rotation of 60° of the hollow cogwheel ring 60.

[0199] In the OFF-position shown at the right side of figure 2, the opening spring 80 has moved the pushrod 10 its complete way downwards from ON to OFF. Due to the high helix thread 20 (or another thread type), the sun cogwheel 30 was rotated by 360° clockwise. According to the chosen number of teeth, this corresponds to a counter-clockwise rotation of 120° of the hollow cogwheel ring 60. Now the next locking feature 62 is in a position where the locking device 100 can push a pin, e.g. driven by a spring, into the locking feature 62 and so stop and latch the opening operation. Alternatively, the opening operation can also be stopped and latched by separate devices.

[0200] Thus in an example, the closing spring drives the planetary cogwheel carrier 50 and the pushrod 10 is driven by the sun cogwheel 30. However, in other embodiments using the same principle of the planetary gear, the planetary cogwheel 50 can be driven with the closing spring to drive pushrod 10 with the hollow cogwheel ring 60, and alternatively the hollow cogwheel ring 60 can be driven with the closing spring to drive the pushrod 10 with the sun cogwheel 30.

[0201] As shown in figure 2, additional locking features 62 are provided in the hollow cogwheel ring 60. When

the corresponding locking device 90 (or 100) is pushing its pin against the side wall of 50 (or 60), the drive will be stopped when the pin of the locking device finds the next locking feature 52 (or 62).

[0202] Thus, using the above described and shown principles of the planetary gear, it is therefore possible to have intermediate positions in-between of the total closing or opening stroke of the drive 1.

[0203] The intermediate position can for example be in the middle of the total stroke, or it can be closer to the OFF position or closer to the ON position.

[0204] The drive 1 could then e.g. operate from the OFF position to an intermediate position, and then further to ON or back to OFF. The switch drive could then also operate from the ON position to said intermediate position and further to OFF or back to ON.

[0205] It is also to be noted, that the drive can have more than one intermediate position.

[0206] It is to be noted that the drive can be utilized in a circuit breaker or two position switch, and having an intermediate position can also be used as the drive for a three-position switch.

[0207] Referring to the figures 1 and 2, from the above detailed descriptions of embodiments the drive for a drive for a low, medium and high voltage vacuum interrupter uses a planter gear system, where there are three main elements of the planetary gear. These are the sun cogwheel 30, the at least one planetary cogwheel 40 (and planetary carrier 50) and the cogwheel ring 60.

[0208] A number of embodiments are described above, but there are further embodiments for the drive using a planetary drive system that have not been fully described for conciseness, but from the above described principles of the above described embodiments the new embodiments can also be understood and implemented. In summary the embodiments, including those described in detail above, and those further embodiments that can be realised are:

A) The drive of an embodiment described above operates in the following manner:

- the cogwheel ring 60 is fixed during the closing operation (and released for opening);
- the planetary carrier 50 is driven by the closing spring 70 for closing (and blocked for opening)
- the sun cogwheel 30 is connected to the pushrod 10.

B) The drive of an embodiment not described above, but a derivation of embodiment A) operates with the the fixed part during closing the same, but the roles of the planetary carrier and the sun cogwheel are exchanged compared to the embodiment A). Thus this embodiment operates in the following manner:

- the cogwheel ring 60 is fixed during the closing operation (and released for opening)
- the sun cogwheel 30 is driven by the closing spring 70 for closing (and blocked for opening)
- the planetary carrier 50 is connected to the pushrod 10.

C) The drive of an embodiment described above operates in the following manner:

- the planetary carrier 50 is fixed during the closing operation (and released for opening)
- the cogwheel ring 60 is driven by the closing spring 70 for closing (and blocked for opening)
- the sun cogwheel 30 is connected to the pushrod 10.

D) The drive of an embodiment described above, that is a derivation of embodiment C) operates with the the fixed part during closing the same, but the roles of the cogwheel ring and the sun cogwheel are exchanged compared to the embodiment C). Thus this embodiment operates in the following manner:

- the planetary carrier 50 is fixed during the closing operation (and released for opening)
- the sun cogwheel 30 is driven by the closing spring 70 for closing (and blocked for opening)
- the cogwheel ring 60 is connected to the pushrod 10.

E) The drive of an embodiment described above operates in the following manner:

- the sun cogwheel 30 is fixed during the closing operation (and released for opening)
- the planetary carrier 50 is driven by the closing spring 70 for closing (and blocked for opening)
- the cogwheel ring 60 is connected to the pushrod 10.

F) The drive of an embodiment not described above, but a derivation of embodiment E) operates with the the fixed part during closing the same, but the roles of the planetary carrier and the cogwheel ring are exchanged compared to the embodiment E). Thus this embodiment operates in the following manner:

- the sun cogwheel 30 is fixed during the closing operation (and released for opening)
- the cogwheel ring 60 is driven by the closing spring 70 for closing (and blocked for opening)
- the planetary carrier 50 is connected to the pushrod 10.

[0209] Figure 3 shows the recharging of the closing spring 70 from left to right: discharged, intermediate, charged. For charging, the outer end 72 is rotated counter-clockwise.

[0210] It is to be noted that the angular rotations de-

scribed above are only examples, and other angular rotations are possible.

[0211] Due to the combination of high-helix thread (or another thread type or even directly a rotary wheel) and planetary gear, the main axis of the drive can be in line with the main axis of the switching pole, so that compact designs of complete switching poles including the mechanical drives are possible and derived from it the switchgear will be smaller.

[0212] Due to the features of the planetary gear, the drive does not require means for driving forth and back - the rotation of springs and main drive parts is always the same. This reduces the complexity of the drive, and so also overall costs and size.

[0213] Furthermore, depending upon the required motion of the pushrod with respect to motion of driving motor, different embodiments 1, 2 or 3 can be chosen. Also, dependent upon the torque or force required, different embodiments can be chosen. Also, dependent upon the control of movement of the pushrod, indifferent switching situations, different embodiments 1, 2 or 3 can be chosen.

[0214] In summary, a planetary gear system is used for driving a switching device such as an interruption device e.g. a vacuum interrupter with springs, for obtaining a small and less complex in-axis design of drive and pole.

[0215] The following examples provide specific details of how techncail features, in certain embodiments, can be combined.

Example 1. A drive for a low, medium and high voltage switch, comprising:

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40); and
- a cogwheel ring (60);

wherein, the pushrod comprises a threaded portion (20);
wherein, the sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel;
wherein, the pushrod is connected to the sun cogwheel such that an axis of the pushrod is coaxial with the axis of the sun cogwheel;
wherein, the sun cogwheel comprises a plurality of outward facing teeth;
wherein, an axis of the cogwheel ring is coaxial with the axis of the sun cogwheel;
wherein, the cogwheel ring comprises a plurality of inward facing teeth;
wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring;
wherein, 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; and
wherein, in a first switching action:

a rotation of the at least one planetary cogwheel about the axis of the sun cogwheel in a first rotational direction is configured to rotate the sun cogwheel in the first rotational direction; and
the rotation of the sun cogwheel in the first rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

Example 2. Drive according to Example 1, wherein in the first switching action the drive is configured such that the cogwheel ring does not rotate.

Example 3. Drive according to any of Examples 1-2, 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.

Example 4. Drive according to any of Examples 1-3, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

Example 5. Drive according to any of Examples 1-4, wherein the drive comprises a carrier (50), wherein an axis of the carrier is coaxial with the axis of the sun cogwheel, wherein each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier, and wherein in the first switching action a rotation of the carrier about the axis of the sun cogwheel in the first rotational direction is configured to rotate the at least one planetary cogwheel in the first rotational direction.

Example 6. Drive according to any of Examples 1-5, wherein a first end (74) of a first spring (70) is coupled to the at least one planetary cogwheel, and wherein in the first switching action energy release from the first spring (70) is configured to rotate the at least one planetary cogwheel in the first rotational direction about the axis of the sun cogwheel.

Example 7. Drive according to Example 6, wherein in the first switching action the drive is configured such that a second end (72) of the first spring is held in a fixed position.

Example 8. Drive according to any of Examples 6-7 when dependent upon Example 5, wherein the first end of the first spring is coupled to the at least one planetary cogwheel via the carrier.

Example 9. Drive according to any of Examples 1-8, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring (80).

Example 10. Drive according to Example 9, wherein in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction, and wherein the movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction.

Example 11. Drive according to any of Examples 9-10, wherein a first end (84) of the second spring is connected to the pushrod.

Example 12. Drive according to Example 11, wherein a second end (82) of the second spring is held in a fixed position.

Example 13. Drive according to any of Examples 10-12, wherein in the second switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel.

Example 14. Drive according to Example 10 when dependent upon Example 7 or any of Examples 11-13 when dependent upon Example 7, wherein in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

Example 15. Drive according to Example 10 when dependent upon Example 7 or any of Example s 11-14 when dependent upon Example 7, wherein prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring.

Example 16. A low, medium and high voltage switch comprising a drive according to any of Examples 1-15.

Example 17. A low, medium and high voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to any of Examples 1-15;
- a second drive for a low, medium and high voltage switch according to any of Examples 1-15;
- a third drive for a low, medium and high voltage switch according to any of Examples 1-15; and

wherein, the first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each sun cogwheel in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

Example 18. A drive for a low, medium and high voltage switch, comprising:

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40); and
- a cogwheel ring (60);

wherein, the pushrod comprises a threaded portion (20);
wherein, the sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel;
wherein, the pushrod is connected to the sun cogwheel such that an axis of the pushrod is coaxial with the axis of the sun cogwheel;
wherein, the sun cogwheel comprises a plurality of outward facing teeth;
wherein, an axis of the cogwheel ring is coaxial with the axis of the sun cogwheel;
wherein, the cogwheel ring comprises a plurality of inward facing teeth;
wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring;
wherein, 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; and
wherein, in a first switching action:

a rotation of the cogwheel ring about the axis of the sun cogwheel in a first rotational direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction; and
the rotation of the sun cogwheel in the second rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

Example 19. Drive according to Example 18, wherein in the first switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the pushrod axis.

Example 20. Drive according to any of Examples 18-19, wherein in the first switching action the rota-

tion 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.

Example 21. Drive according to any of Examples 18-20, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

Example 22. Drive according to any of Examples 18-21, wherein the drive comprises a carrier (50), wherein an axis of the carrier is coaxial with the axis of the sun cogwheel, wherein each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier, and wherein the drive is configured such that in the first switching action the carrier is configured not to rotate about the axis of the sun cogwheel.

Example 23. Drive according to any of Examples 18-22, wherein a first end (74) of a first spring (70) is coupled to the cogwheel ring, and wherein in the first switching action energy release from the first spring (70) is configured to rotate the cogwheel ring in the first rotational direction about the axis of the sun cogwheel.

Example 24. Drive according to Example 23, wherein in the first switching action the drive is configured such that a second end (72) of the first spring is held in a fixed position.

Example 25. Drive according to any of Examples 18-24, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring (80).

Example 26. Drive according to Example 25, wherein in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction, and wherein the movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction.

Example 27. Drive according to any of Examples 25-26, wherein a first end (84) of the second spring is connected to the pushrod.

Example 28. Drive according to Example 27, wherein a second end (82) of the second spring is held in a fixed position.

Example 29. Drive according to any of Examples 26-28, 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.

Example 30. Drive according to Example 26 when dependent upon Example 24 or any of Example s 27-29 when dependent upon Example 24, wherein in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

Example 31. Drive according to Example 26 when dependent upon Example 24 or any of Examples 27-30 when dependent upon Example 24, wherein prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring.

Example 32. A low, medium and high voltage switch comprising a drive according to any of Examples 18-31.

Example 33. A low, medium and high voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to any of Example s 18-31;
- a second drive for a low, medium and high voltage switch according to any of Examples 18-31;
- a third drive for a low, medium and high voltage switch according to any of Examples 18-31; and

wherein, the first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each sun cogwheel in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

Example 34. A drive for a low, medium and high voltage switch, comprising:

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40); and
- a cogwheel ring (60);

wherein, the pushrod comprises a threaded portion (20);
wherein, the cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring;
wherein, the pushrod is connected to the cogwheel ring such that an axis of the pushrod is coaxial with the axis of the cogwheel ring;
wherein, the sun cogwheel comprises a plurality of outward facing teeth;
wherein, the axis of the cogwheel ring is coaxial with

an axis of the sun cogwheel;
wherein, the cogwheel ring comprises a plurality of inward facing teeth;
wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring;
wherein, 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; and
wherein, in a first switching action:

a rotation of the at least one planetary cogwheel about the axis of the sun cogwheel in a first rotational direction is configured to rotate the cogwheel ring in a first rotational direction; and
the rotation of the cogwheel ring in the first rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

Example 35. Drive according to Example 34, wherein in the first switching action the drive is configured such that the sun cogwheel does not rotate.

Example 36. Drive according to any of Examples 34-35, 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.

Example 37. Drive according to any of Examples 34-36, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

Example 38. Drive according to any of Examples 34-37, wherein the drive comprises a carrier (50), wherein an axis of the carrier is coaxial with the axis of the sun cogwheel, wherein each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier, and wherein in the first switching action a rotation of the carrier about the axis of the sun cogwheel in the first rotational direction is configured to rotate the at least one planetary cogwheel in the first rotational direction.

Example 39. Drive according to any of Examples 34-38, wherein a first end (74) of a first spring (70) is coupled to the at least one planetary cogwheel, and wherein in the first switching action energy release from a first spring (70) is configured to rotate the at least one planetary cogwheel in the first rotational direction about the axis of the sun cogwheel.

Example 40. Drive according to Example 39, wherein in the first switching action the drive is configured such that a second end (72) of the first spring is held in a fixed position.

Example 41. Drive according to any of Examples 39-40 when dependent upon Example 38, wherein the first end of the first spring is coupled to the at least one planetary cogwheel via the carrier.

Example 42. Drive according to any of Examples 34-41, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring (80).

Example 43. Drive according to Example 42, wherein in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction, and wherein the movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction.

Example 44. Drive according to any of Examples 42-43, wherein a first end (84) of the second spring is connected to the pushrod.

Example 45. Drive according to Example 44, wherein a second end (82) of the second spring is held in a fixed position.

Example 46. Drive according to any of Examples 44-45, wherein in the second switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel.

Example 47. Drive according to Example 43 when dependent upon Example 40 or any of Examples 44-46 when dependent upon Example 40, wherein in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

Example 48. Drive according to Example 43 when dependent upon Example 40 or any of Examples 44-47 when dependent upon Example 40, wherein prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring.

Example 49. A low, medium and high voltage switch comprising a drive according to any of Examples 34-48.

Example 50. A low, medium and high voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to any of Examples 34-48;
- a second drive for a low, medium and high voltage switch according to any of Examples 34-38;
- a third drive for a low, medium and high voltage switch according to any of Examples 34-38; and

wherein, the first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each cogwheel ring in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

Example 51. A drive for a low, medium and high voltage switch, comprising:

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40); and
- a cogwheel ring (60);

wherein, the pushrod comprises a threaded portion (20);
wherein, the cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring;
wherein, the pushrod is rotationally connected to the cogwheel ring such that an axis of the pushrod is coaxial with the axis of the cogwheel ring;
wherein, the sun cogwheel comprises a plurality of outward facing teeth;
wherein, the axis of the cogwheel ring is coaxial with an axis of the sun cogwheel;
wherein, the cogwheel ring comprises a plurality of inward facing teeth;
wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring;
wherein, 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; and
wherein, in a first switching action:

a rotation of the sun cogwheel in a first rotational direction is configured to rotate the cogwheel ring in a second rotational direction counter to the first rotational direction; and
the rotation of the cogwheel ring in the second rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

Example 52. Drive according to Example 51, wherein the at least one planetary cogwheel comprises three planetary cogwheels.

Example 53. Drive according to any of Examples 51-52, wherein in the first switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel.

Example 54. Drive according to any of Examples 51-53, 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.

Example 55. Drive according to any of Examples 51-54, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

Example 56. Drive according to any of Examples 51-55, wherein the drive comprises a carrier (50); wherein an axis of the carrier is coaxial with the axis of the sun cogwheel; wherein each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier; and wherein the drive is configured such that in the first switching action the carrier is configured not to rotate about the axis of the sun cogwheel.

Example 57. Drive according to any of Examples 51-56, wherein a first end (74) of a first spring (70) is coupled to the sun cogwheel; and wherein in the first switching action energy release from the first spring (70) is configured to rotate the sun cogwheel in the first rotational direction about the axis of the sun cogwheel.

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 first spring is held in a fixed position.

Example 59. Drive according to any of Examples 51-58, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring (80).

Example 60. Drive according to Example 59, wherein in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction. The movement of the pushrod along the axis of the pushrod in the second

direction is configured to rotate the cogwheel ring in the first rotational direction opposite to the second rotational direction.

Example 61. Drive according to any of Examples 59-60, wherein, a first end 84 of the second spring is connected to the pushrod.

Example 62. Drive according to any of Examples 59-61, wherein, a second end (82) of the second spring is held in a fixed position.

Example 63. Drive according to any of Examples 60-62, 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.

Example 64. Drive according to any of Examples 60-63, wherein in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

Example 65. Drive according to any of Examples 57-64, wherein prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring.

Example 66. A low, medium and high voltage switch comprising a drive according to any of Examples 51-65.

Example 67. A low, medium and high voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to any of Examples 51-65;
- a second drive for a low, medium and high voltage switch according to any of Example s 51-65;
- a third drive for a low, medium and high voltage switch according to any of Examples 51-65; and

wherein, the first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each cogwheel ring in the second rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

Reference Numerals

[0216]

1 Drive for Vacuum Interrupter or another switching device
10 Pushrod incl. contact pressure springs
20 High-Helix thread
30 Sun cogwheel
40 Planetary cogwheels
50 Carrier of 40
52 Locking feature in 50
60 Hollow cogwheel ring
62 Locking feature in 60
70 Closing spring
72 Outer end of 70
74 inner end of 70
80 Opening spring
82 Upper end of 80
84 Lower end of 80
90 Locking devices for 50
100 Locking devices for 60

Claims

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

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40); and
- a cogwheel ring (60);

wherein, the pushrod comprises a threaded portion (20);
wherein, the sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel;
wherein, the pushrod is connected to the sun cogwheel such that an axis of the pushrod is coaxial with the axis of the sun cogwheel;
wherein, the sun cogwheel comprises a plurality of outward facing teeth;
wherein, an axis of the cogwheel ring is coaxial with the axis of the sun cogwheel;
wherein, the cogwheel ring comprises a plurality of inward facing teeth;
wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring;
wherein, 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; and
wherein, in a first switching action:

a rotation of the at least one planetary cogwheel about the axis of the sun cogwheel in a first rotational direction is configured to rotate the sun cogwheel in the first rotational direction; and
the rotation of the sun cogwheel in the first rotational direction is configured to move the pushrod along the axis of the pushrod in a first direc-

tion.

2. Drive according to claim 1, wherein in the first switching action the drive is configured such that the cogwheel ring does not rotate.

3. Drive according to any of claims 1-2, 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.

4. Drive according to any of claims 1-3, wherein in the first switching action the drive is configured such that the pushrod does not rotate about the pushrod axis.

5. Drive according to any of claims 1-4, wherein the drive comprises a carrier (50), wherein an axis of the carrier is coaxial with the axis of the sun cogwheel, wherein each planetary cogwheel of the at least one planetary cogwheel is rotational connected to the carrier, and wherein in the first switching action a rotation of the carrier about the axis of the sun cogwheel in the first rotational direction is configured to rotate the at least one planetary cogwheel in the first rotational direction.

6. Drive according to any of claims 1-5, wherein a first end (74) of a first spring (70) is coupled to the at least one planetary cogwheel, and wherein in the first switching action energy release from the first spring (70) is configured to rotate the at least one planetary cogwheel in the first rotational direction about the axis of the sun cogwheel.

7. Drive according to claim 6, wherein in the first switching action the drive is configured such that a second end (72) of the first spring is held in a fixed position.

8. Drive according to any of claims 6-7 when dependent upon claim 5, wherein the first end of the first spring is coupled to the at least one planetary cogwheel via the carrier.

9. Drive according to any of claims 1-8, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring (80).

10. Drive according to claim 9, wherein in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction, and wherein the movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction.

11. Drive according to any of claims 9-10, wherein a first end (84) of the second spring is connected to the pushrod.

12. Drive according to claim 11, wherein a second end (82) of the second spring is held in a fixed position.

13. Drive according to any of claims 10-12, wherein in the second switching action the drive is configured such that the at least one planetary cogwheel does not rotate about the axis of the sun cogwheel.

14. Drive according to claim 10 when dependent upon claim 7 or any of claims 11-13 when dependent upon claim 7, wherein in the second switching action the drive is configured such that the second end of the first spring is held in the fixed position.

15. Drive according to claim 10 when dependent upon 7 or any of claims 11-14 when dependent upon claim 7, wherein prior to the first switching action the drive is configured such that a rotation of the second end of the first spring in the first rotational direction is configured to store energy in the first spring.

16. A low, medium and high voltage switch comprising a drive according to any of claims 1-15.

17. A low, medium and high voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to any of claims 1-15;
- a second drive for a low, medium and high voltage switch according to any of claims 1-15;
- a third drive for a low, medium and high voltage switch according to any of claims 1-15; and

wherein, the first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each sun cogwheel in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

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

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40); and
- a cogwheel ring (60);

wherein, the pushrod comprises a threaded portion (20);
wherein, the sun cogwheel comprises an inner threaded portion located about an axis of the sun cogwheel;

wherein, the pushrod is connected to the sun cogwheel such that an axis of the pushrod is coaxial with the axis of the sun cogwheel;
wherein, the sun cogwheel comprises a plurality of outward facing teeth;
wherein, an axis of the cogwheel ring is coaxial with the axis of the sun cogwheel;
wherein, the cogwheel ring comprises a plurality of inward facing teeth;
wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring;
wherein, 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; and
wherein, in a first switching action:

a rotation of the cogwheel ring about the axis of the sun cogwheel in a first rotational direction is configured to rotate the sun cogwheel in a second rotational direction opposite to the first rotational direction; and
the rotation of the sun cogwheel in the second rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

19. Drive according to claim 18, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring (80).

20. Drive according to claim 19, wherein in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction, and wherein the movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction.

21. A low, medium and high voltage switch comprising a drive according to any of claims 18-20.

22. A low, medium and high voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to any of claims 18-20;
- a second drive for a low, medium and high voltage switch according to any of claims 18-20;
- a third drive for a low, medium and high voltage switch according to any of claims 18-20; and

wherein, the first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each sun cogwheel in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

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

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40); and
- a cogwheel ring (60);

wherein, the pushrod comprises a threaded portion (20);
wherein, the cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring;
wherein, the pushrod is connected to the cogwheel ring such that an axis of the pushrod is coaxial with the axis of the cogwheel ring;
wherein, the sun cogwheel comprises a plurality of outward facing teeth;
wherein, the axis of the cogwheel ring is coaxial with an axis of the sun cogwheel;
wherein, the cogwheel ring comprises a plurality of inward facing teeth;
wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring;
wherein, 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; and
wherein, in a first switching action:

a rotation of the at least one planetary cogwheel about the axis of the sun cogwheel in a first rotational direction is configured to rotate the cogwheel ring in a first rotational direction; and
the rotation of the cogwheel ring in the first rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

24. Drive according to claim 23, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring (80).

25. Drive according to claim 24, wherein in a second switching action energy release from the second spring is configured to move the pushrod along the

axis of the pushrod in a second direction opposite to the first direction, and wherein the movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in a second rotational direction opposite to the first rotational direction.

26. A low, medium and high voltage switch comprising a drive according to any of claims 23-25.

27. A low, medium and high voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to any of claims 23-25;
- a second drive for a low, medium and high voltage switch according to any of claims 23-25;
- a third drive for a low, medium and high voltage switch according to any of claims 23-25; and

wherein, the first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each cogwheel ring in the first rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

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

- a pushrod (10);
- a sun cogwheel (30);
- at least one planetary cogwheel (40); and
- a cogwheel ring (60);

wherein, the pushrod comprises a threaded portion (20);
wherein, the cogwheel ring comprises an inner threaded portion located about an axis of the cogwheel ring;
wherein, the pushrod is rotationally connected to the cogwheel ring such that an axis of the pushrod is coaxial with the axis of the cogwheel ring;
wherein, the sun cogwheel comprises a plurality of outward facing teeth;
wherein, the axis of the cogwheel ring is coaxial with an axis of the sun cogwheel;
wherein, the cogwheel ring comprises a plurality of inward facing teeth;
wherein, the at least one planetary cogwheel is located between the sun cogwheel and the cogwheel ring;
wherein, 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; and
wherein, in a first switching action:

a rotation of the sun cogwheel in a first rotational direction is configured to rotate the cogwheel ring in a second rotational direction counter to the first rotational direction; and
the rotation of the cogwheel ring in the second rotational direction is configured to move the pushrod along the axis of the pushrod in a first direction.

29. Drive according to claim 28, wherein in the first switching action movement of the pushrod along the axis of the pushrod is configured to store energy in a second spring (80).

30. Drive according to claim 29, wherein in a second switching action energy release from the second spring is configured to move the pushrod along the axis of the pushrod in a second direction opposite to the first direction. The movement of the pushrod along the axis of the pushrod in the second direction is configured to rotate the cogwheel ring in the first rotational direction opposite to the second rotational direction.

31. A low, medium and high voltage switch comprising a drive according to any of claims 28-30.

32. A low, medium and high voltage switching system, comprising:

- a first drive for a low, medium and high voltage switch according to any of claims 28-30;
- a second drive for a low, medium and high voltage switch according to any of claims 28-30;
- a third drive for a low, medium and high voltage switch according to any of claims 28-30; and

wherein, the first, second and third drives are configured to be driven by a single motor such that simultaneous rotation of each cogwheel ring in the second rotational direction is configured to move the pushrod of each drive along the axis of the pushrod in the first direction.

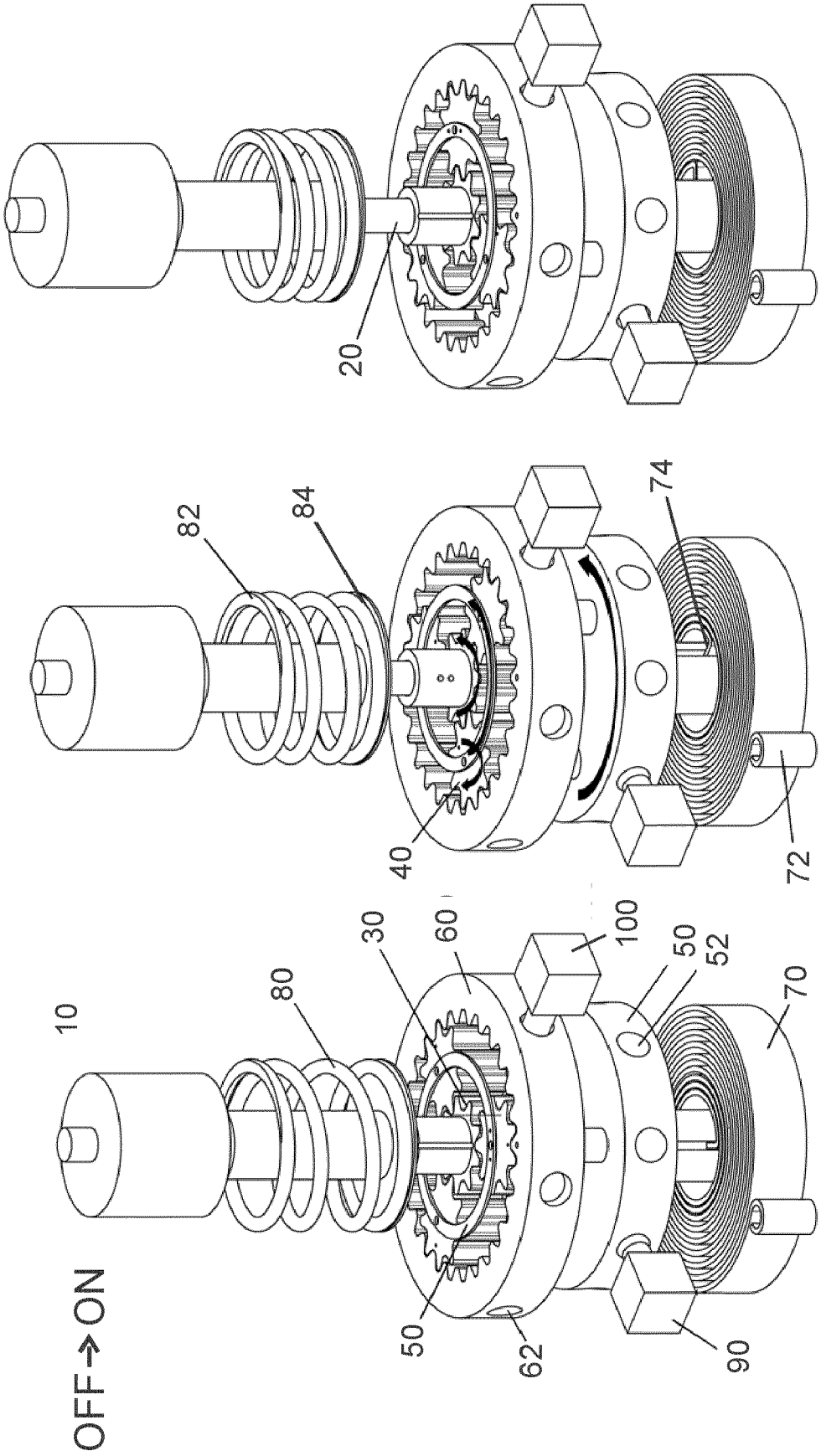

Fig. 1

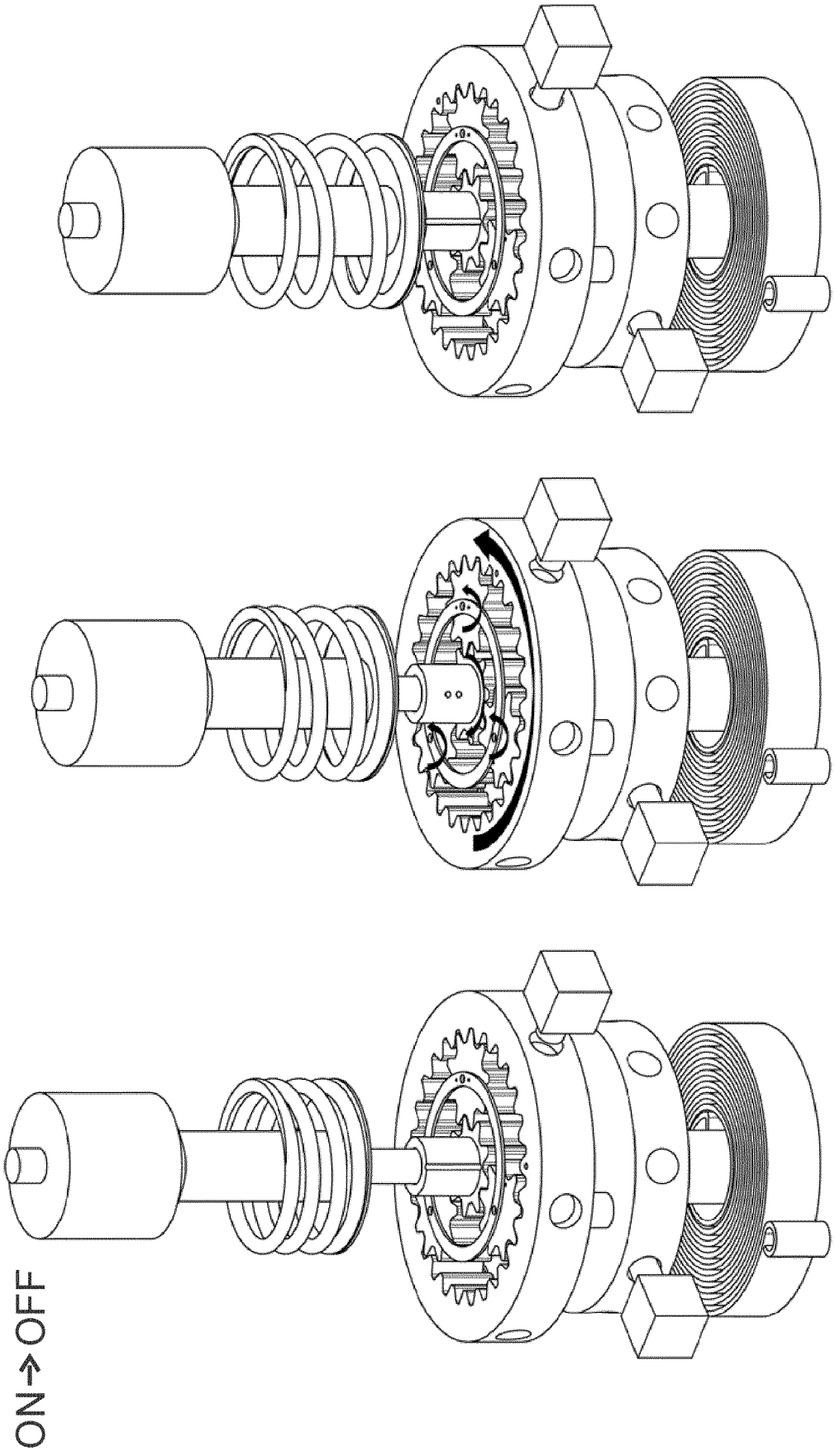

Fig. 2

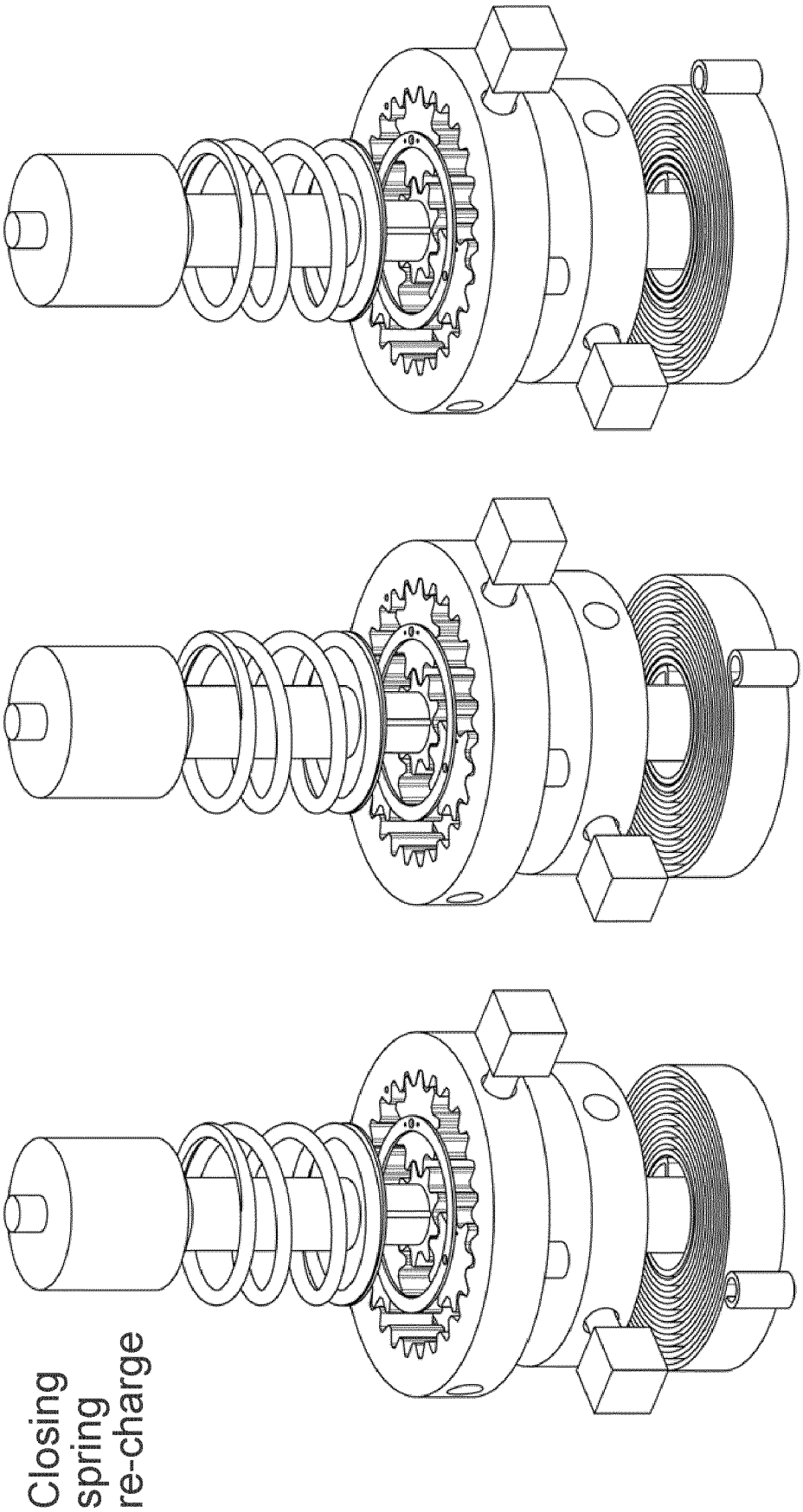

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 9654

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H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 January 2021	Meyer, Jan

CATEGORY OF CITED DOCUMENTS

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