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(54) **INTERLOCK MECHANISM FOR AN EARTHING SWITCH OF A GAS INSULATED SUBSTATION**

(57) The invention relates to an interlock system (1) to block or free a cogwheel of an actuation mechanism of an earth switch for gas insulated substation, this interlock system (1) comprising a housing (4) enclosing :
- a swivel lever having an end moveable between a blocking position pressed against the cogwheel, and a free position at a distance from the cogwheel ;
- a rotating axle movable between a blocking position and a free position, this axle having an inner extremity

carrying a cam disc to move the swivel lever, and an outer extremity protruding out of the housing (4) to actuate this axle ;
- a spring having an extremity secured to the swivel lever and another extremity secured to the housing (4) to press the swivel lever against the cam disk ;
- a key lock (8, 9) secured to the housing (4) and cooperating with the axle (21) to lock it in its blocking or free position.

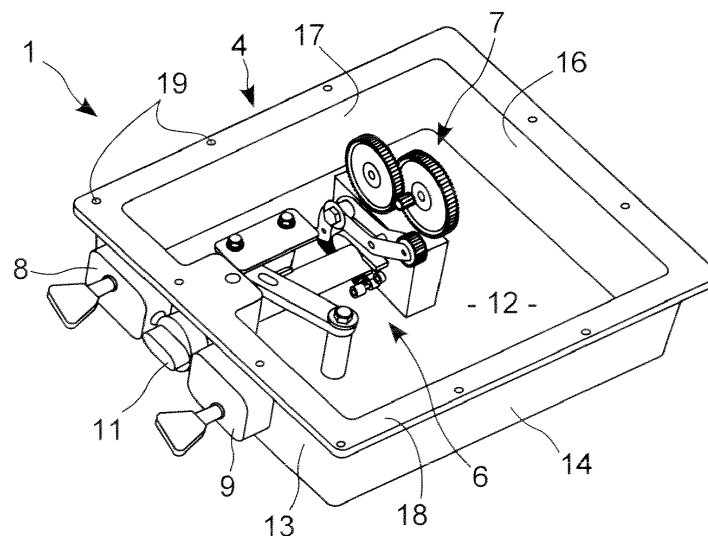


FIG. 2

Description

TECHNICAL FILED

[0001] The invention relates to securing from unintended or unauthorized operation an electric earthing switch of a gas insulated substation, such as an earthing switch allowing to electrically connect electric lines to the earth.

STATE OF PRIOR ART

[0002] In a gas insulated substation, an electric line to be connected to the earth comprises typically one or three bus bars mounted in a leak-proof casing filled with dielectric gas such as SF₆.

[0003] The earthing switch of such a substation comprises a housing secured to the casing surrounding the bus bars, and connections to these bus bars and to an earth connector of the substation. It encloses an actuating mechanism including cogwheel reductor, and a drive motor, allowing to operate the switch from its open status where it disconnects the bus bars from the earth to its closed status where it connects the bus bars to the earth, by means of its drive motor.

[0004] Most of the time there is also a possibility to operate the switch manually by means of an additional hand crank in order to allow operation in cases where the drive motor cannot be used.

[0005] The goal of the invention is to provide an interlock mechanism to ensure that such an earthing switch be secured against unauthorized or unintended operation.

PRESENTATION OF THE INVENTION

[0006] The invention relates to an interlock system to block or free a cogwheel of an actuation mechanism of an earth switch for gas insulated substation, this interlock system comprising a housing enclosing :

- a swivel lever having an end moveable between a blocking position pressed against the cogwheel, and a free position at a distance from the cogwheel ;
- a rotating axle movable between a blocking position and a free position, having an inner extremity cooperating with the swivel lever to move it from its blocking position to its free position and conversely upon rotation of this axle, and an outer extremity protruding at an outer face of the housing to allow actuation of this axle by an operator;
- a key lock secured to the housing and cooperating with the axle to lock this axle in its blocking position or in its free position.

[0007] With this arrangement, the interlock mechanism can easily be mounted to an existing earthing switch without requiring expansive adaptation of this earthing switch.

[0008] The invention also relates to an interlock system such as designed above, wherein the inner extremity of the rotating axle carries a cam disc cooperating with the swivel lever to move it from its blocking position to its free position and conversely upon rotation of this axle, and comprising a spring having an extremity secured to the swivel lever and another extremity secured to the housing to continuously press the swivel lever against the cam disk.

10 [0009] The invention also relates to an interlock system such as defined above, wherein the spring continuously pulls a part of the swivel lever to its blocking position.

[0010] The invention also relates to an interlock system such as defined above, where the end of the swivel lever comprises a pinion to be meshed with two meshed cogwheels of the actuation mechanism when the swivel lever is in the blocking position, and at a distance from these two meshed cogwheels when the swivel lever is in the free position.

20 [0011] The invention also relates to an interlock system such as defined above, comprising a pivoting lever movable along the rotating axle by the actuation mechanism between an open and a closed position corresponding to electrically open and closed statuses of the earthing switch, a feather key carried by the rotating axle and located between the open end closed positions of the pivoting lever when the rotating axle is in the blocking position, to ensure that the rotating axle cannot be moved from its free position to its blocking position if the pivoting lever is at an intermediate position between its open and closed positions.

25 [0012] The invention also relates to an earthing switch equipped with an interlock system such as defined above.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

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Figure 1 is a perspective view of an earthing switch equipped with an interlock module according to the invention ;

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Figure 2 is a perspective view showing the inner face of the housing of the interlock system according to the invention with its components in the free position when the earthing switch is in its open status ;

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Figure 3 is a perspective view of the components of the interlock system according to the invention in the blocked position when the earthing switch is in the open status ;

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Figure 4 is a front view of the components of the interlock system according to the invention in the blocked position ;

Figure 5 is a front view of the components of the interlock system according to the invention in the free position ;

Figure 6 is a perspective view of the components of the interlock system according to the invention in the

free position when the earthing switch is in its open status ;

Figure 7 is a perspective view of the components of the interlock system according to the invention in the free position when the earthing switch is being operated from its open status to its closed status;

Figure 8 is a perspective view of the components of the interlock system according to the invention in the free position when the earthing switch is in its closed status ;

Figure 9 is a perspective view of the components of the interlock system according to the invention in the blocked position when the earthing switch is in its closed status.

DETAILED PRESENTATION OF PARTICULAR EMBODIMENTS

[0014] In figure 1, an interlock system 1 according to the invention is fixed to the housing 2 of an earthing switch 3 of an insulated gas station, this earthing switch further comprising in the enclosure of its housing an actuation mechanism which is not visible in figure 1.

[0015] As seen in figure 2, the interlock system 1 comprises a cast housing 4 enclosing an interlock mechanism 6 which cooperates with the actuation mechanism 7 of the earthing switch 3, two keylocks 8 and 9 and a rotating knob 11 both carried at the outer face of the housing 4.

[0016] The housing 4 has the general shape of a parallelepiped having one of its faces open, i.e. comprising a main or bottom flat wall 12 continued by four walls 13, 14, 16, 17 surrounding this bottom wall 12 and extending each almost perpendicular to this bottom wall 12. The four surrounding walls 13, 14, 16, 17 are terminated by a common peripheral edge forming a flange 18 comprising holes 19 by means of which this housing 4 is bolted on the housing of the earthing switch.

[0017] With this housing, the interlock system can easily be fitted to an existing earthing switch by replacing the cover plate of this earthing switch, without any further modification.

[0018] The interlock system which can be seen in more details in figure 3 and 4 comprises an axle 21 extending along an axis AX parallel to the main wall 12 and perpendicular to the front surrounding wall 13. This axle 21 has a first extremity supported by a central support 22 protruding from the center of the main wall 12 and comprising a bearing. The second extremity of this axle 21 protrudes through the front wall 13 which forms the other bearing supporting this axle 21.

[0019] The knob 11 is secured to the second extremity of the axle 21 which protrudes out of the front wall 13, allowing an operator to rotate the axle 21 by turning its knob 11.

[0020] The actuation mechanism of the earthing switch comprises two cogwheels 23, 24 and a free pinion 26 meshed in cogwheel 23, which are located closed to the central support 22 and rotate around corresponding axes

which are parallel to axis AX. This actuation mechanism comprises other components which are not shown on the figures.

[0021] The cogwheel 23 can be blocked in rotation by the free end of a swivel lever 27 which is carried by the central support 22, and which can rotate relatively to an axis of rotation parallel to axis AX and at a distance from this axis. This lever 27 carries a pinion 28 at its free end.

[0022] When this swivel lever 27 is in a free position where it is retracted as in figures 2, 5, 6, 7 and 8, its free end is at a distance from cogwheel 23 and pinion 26, allowing the actuation mechanism of the earthing switch to be operated. When this swivel lever 27 is in its blocking position where it is deployed, as in figures 3, 4 and 9, the pinion 28 of its free end is meshed with cogwheel 23 and with pinion 26 to block their rotation, rendering operation of the actuation mechanism impossible.

[0023] The swivel lever 27 is moved from its blocking position to its free position and conversely by the rotation of axis 21. More particularly, this axis 21 carries a cam disk 29 at its first extremity, which is applied against a corresponding part of swivel lever 27. Additionally, a return spring 31 has a first extremity fixed to the central support 22 and a second extremity fixed to the extremity of lever 27 which is opposite to its free extremity which carries pinion 28. Thanks to this spring 31, the swivel lever 27 is continuously pulled to its blocking position, and it is continuously pressed against cam disk 29.

[0024] When the axle 21 is in its blocking position as in figure 4, the cam disk is pressed to a central portion of swivel lever 27, this central portion being closed to its axis of rotation, allowing the action of spring 31 to expand swivel lever 27 at its blocking position.

[0025] When the axle 21 is in its free position as in figure 5, i.e. one eighth of turn counterclockwise from its blocking position, cam disk 29 is pressed against a portion of swivel lever 27 opposite to its free end and distant from its rotation axis, counteracting the action of spring 31, to retract swivel lever 27 at its free position.

[0026] As it can be seen on figures 4 and 5, the central support 22 comprises two stopping pins 32, 33 protruding from its face oriented towards the front wall 13 and which limit rotation of the cam disk 29, and as a result from axle 21, between its free position and its blocking position.

[0027] Practically, the two keylocks 8 and 9 carried at the outer face of front wall 13 at either sides of knob 11, allow to lock axle 21 in its blocking position and in its free position. The knob has two pairs of holes each lying diametrically opposed and each shifted by an angle. Turning the keys drives the bolts of the keylocks into the holes of the knob and locks so any further rotation of the rational axle.

[0028] Accordingly, an operator wanting to operate the earthing switch from its electrically open status as in figure 3 to its electrically closed status has to firstly use the keys 34 and 36 to open keylocks 8 and 9 to allow operation of knob 11. Once the keylocks 8 and 9 are unlocked, the operator has to rotate knob 11 counterclockwise of

one eighth turn to retract the swivel lever 27 to its free position, which corresponds to the situation of figure 6. At this stage, the earthing switch can be operated from its open status to its closed status, for example manually or by commanding its integrated motor drive, which leads to the situation seen in figure 8.

[0029] At that stage, the operator can turn the knob of one eighth turn clockwise to deploy swivel lever 27 to its blocking position in order to block further operation of the earthing switch, and lock the keylocks 8 and 9 with keys 34 and 36, which corresponds to situation of figure 9.

[0030] The interlock system according to the invention further comprises means to ensure that it cannot be locked when the earthing switch is at an intermediate status between its open and closed status, such as in figure 7.

[0031] The interlock mechanism comprises a pivoting lever 37 which is rotatable around an axis AY perpendicular to the bottom wall 12 of the housing, and which is movable along the rotating axis 21. This pivoting lever 37 is coupled to a corresponding tappet of the actuation mechanism of the earthing switch, which moves between an open and a closed position corresponding to the open status and to the closed status of the earthing switch.

[0032] More particularly, the tappet of the actuation mechanism comprises a stud or finger protruding from its extremity and which is inserted into a corresponding oblong hole 40 of the pivoting lever 37. This hole extending along the length of the pivoting lever 37 in the vicinity of the rotating axis 21.

[0033] When the mechanism is switched from its open to its closed status, the tappet rotates in a plane perpendicular to the bottom wall 12 and comprising the AX axis, with the stud staying inserted in hole 40. This results in the stud moving according to a circular path of large radius which extends mainly along the axis 21, to move the pivoting lever 37 from its open to its closed position. Converse movement is obtained when switching the mechanism from closed to open status.

[0034] Accordingly, when the earthing switch is in its electrically open status as in figure 2, 3 and 6, the pivoting lever 37 is in its open position, with its free end closed to the front wall 13. When the earthing switch is in its electrically closed status as in figure 8 and 9, the pivoting lever 37 is at its closed position with its free end distant from the front wall 13 and closer to the central support 22.

[0035] The free end of the pivoting lever 37 extends beneath a retaining plate 38 which extends parallel to the bottom wall 12 and which is above the level of the rotating axis 21 relatively to the bottom wall 12 to which it is fixedly secured.

[0036] The rotating axis 21 comprises a feather key 39 protruding out of its outer cylindrical surface in a region located between the open position and the closed position of the pivoting lever 37.

[0037] When the rotating axis 21 is in its free position, the feather key 39 extends laterally, i.e. away from the path of the pivoting lever 37, allowing the pivoting lever

37 to move freely between its extreme positions. But when the rotating axis 21 is at its blocking position, the feather key 39 extends opposite to the bottom wall 12, i.e. into the path of pivoting lever 37.

[0038] The result is that if the pivoting lever 37 is at an intermediate position as in figure 7, between an open and a closed status of the earthing switch, the rotating axis 21 cannot be operated from its free position to its blocking position. Practically, in such a movement the feather key 39 encounters the pivoting lever 37, forbidding the rotating axis 21 to reach the blocking position.

[0039] To improve efficiency of the arrangement, the pivoting lever 37 comprises two stop pins protruding from its bottom face and which stop firmly the feather key 39 in case of rotation of axis 21 to the blocking position when this pivoting lever 37 is at an intermediate position as in figure 7. The feather key and the stop pins have each a height which is superior to the distance between the axle 21 and the pivoting lever 37.

[0040] Thanks to this feather key 39 which can interfere with the pivoting lever 37 at an intermediate position, it is not possible to lock the interlock system when the earthing switch is at an intermediate status between open and closed.

Claims

1. Interlock system (1) to block or free a cogwheel (23) of an actuation mechanism (7) of an earth switch (3) for gas insulated substation, this interlock system (1) comprising a housing (4) enclosing :

- a swivel lever (27) having an end moveable between a blocking position pressed against the cogwheel, and a free position at a distance from the cogwheel ;
- a rotating axle (21) movable between a blocking position and a free position, having an inner extremity cooperating with the swivel lever (27) to move it from its blocking position to its free position and conversely upon rotation of this axle (21), and an outer extremity protruding at an outer face of the housing (4) to allow actuation of this axle (21) by an operator;
- a key lock (8, 9) secured to the housing (4) and cooperating with the axle (21) to lock this axle in its blocking position or in its free position.

2. Interlock system according to claim 1, wherein the inner extremity of the rotating axle (21) carries a cam disc (29) cooperating with the swivel lever (27) to move it from its blocking position to its free position and conversely upon rotation of this axle (21), and comprising a spring (31) having an extremity secured to the swivel lever (27) and another extremity secured to the housing (4) to continuously press the swivel lever (27) against the cam disk (29).

3. Interlock system according to claim 2, wherein the spring (31) continuously pulls a part of the swivel lever (27) to its blocking position.
4. Interlock system according to claim 3, where the end of the swivel lever (27) comprises a pinion (26) to be meshed with two meshed cogwheels (23, 26) of the actuation mechanism (7) when the swivel lever (27) is in the blocking position, and at a distance from these two meshed cogwheels (23, 26) when the swivel lever (27) is in the free position.
5. Interlock system according to any of claims 1 or 4, comprising a pivoting lever (37) movable along the rotating axle (21) by the actuation mechanism (7) between an open and a closed position corresponding to electrically open and closed statuses of the earthing switch (3), a feather key (39) carried by the rotating axle (21) and located between the open end closed positions of the pivoting lever (37) when the rotating axle (21) is in the blocking position, to ensure that the rotating axle (21) cannot be moved from its free position to its blocking position if the pivoting lever (37) is at an intermediate position between its open and closed positions.
6. Earthing switch equipped with an interlock system according to any of the previous claims.

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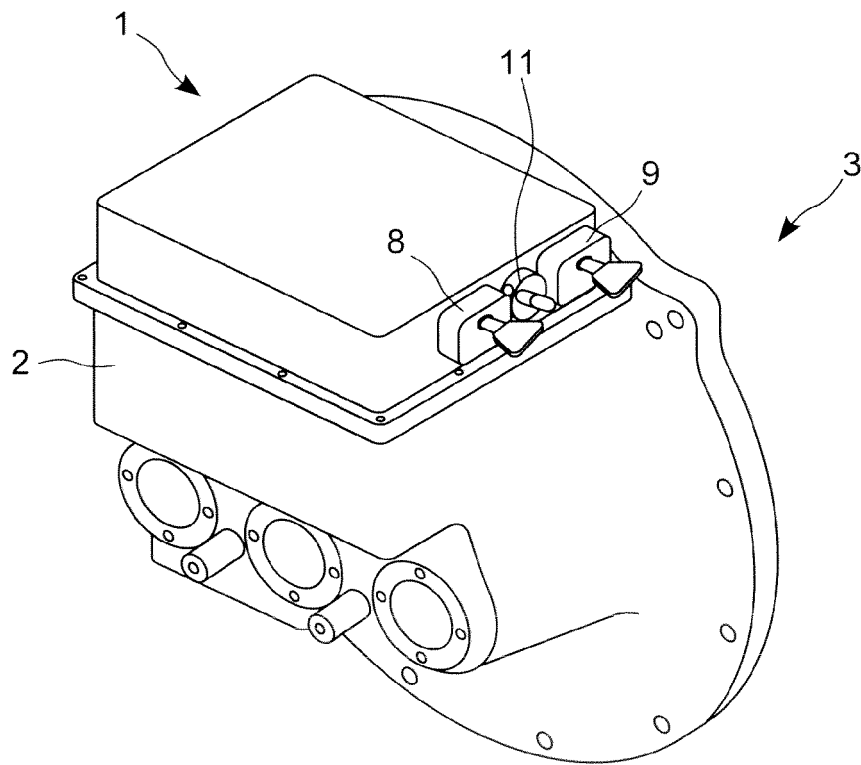


FIG. 1

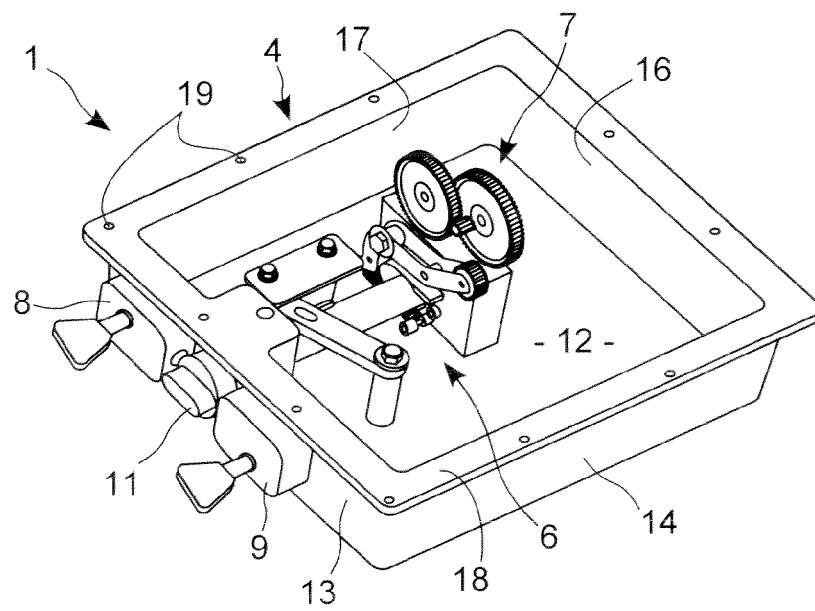


FIG. 2

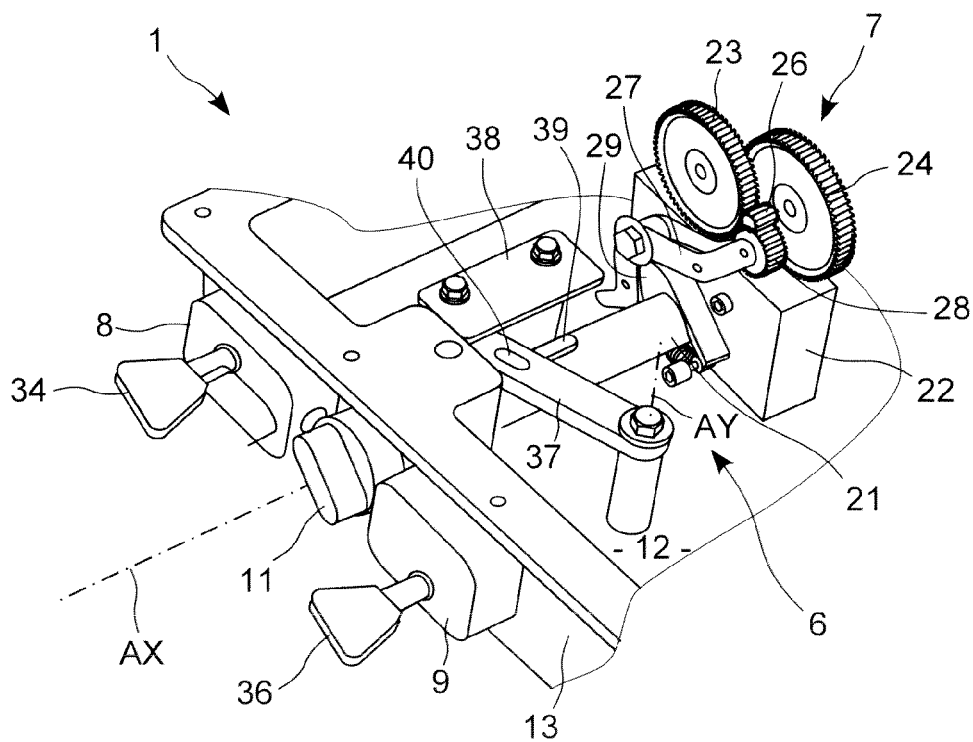


FIG. 3

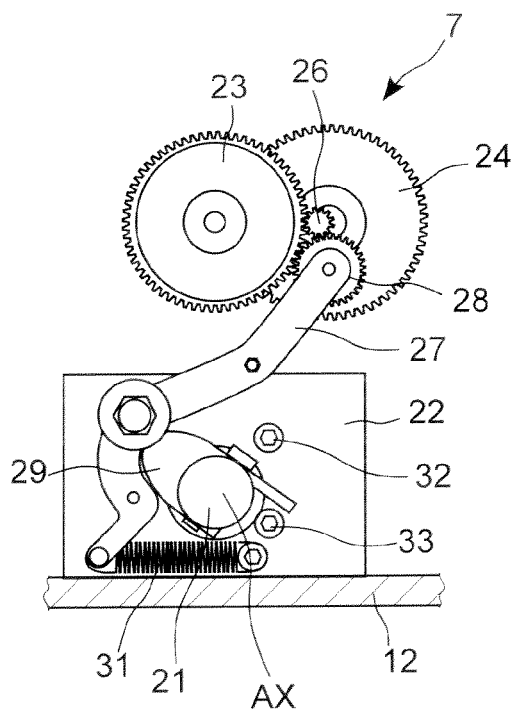


FIG. 4

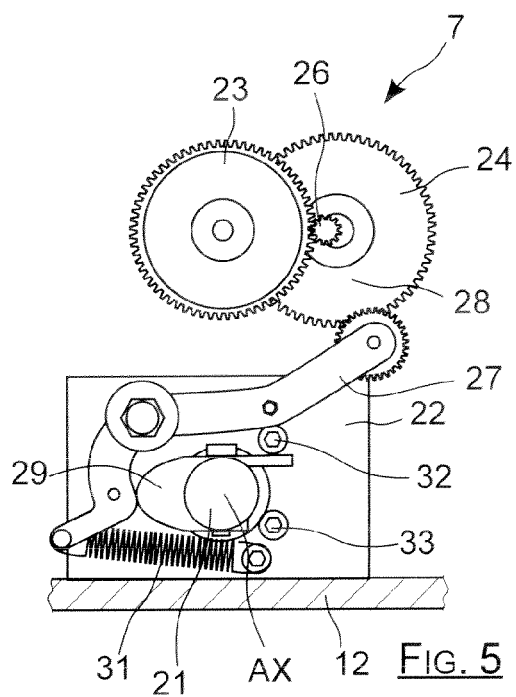
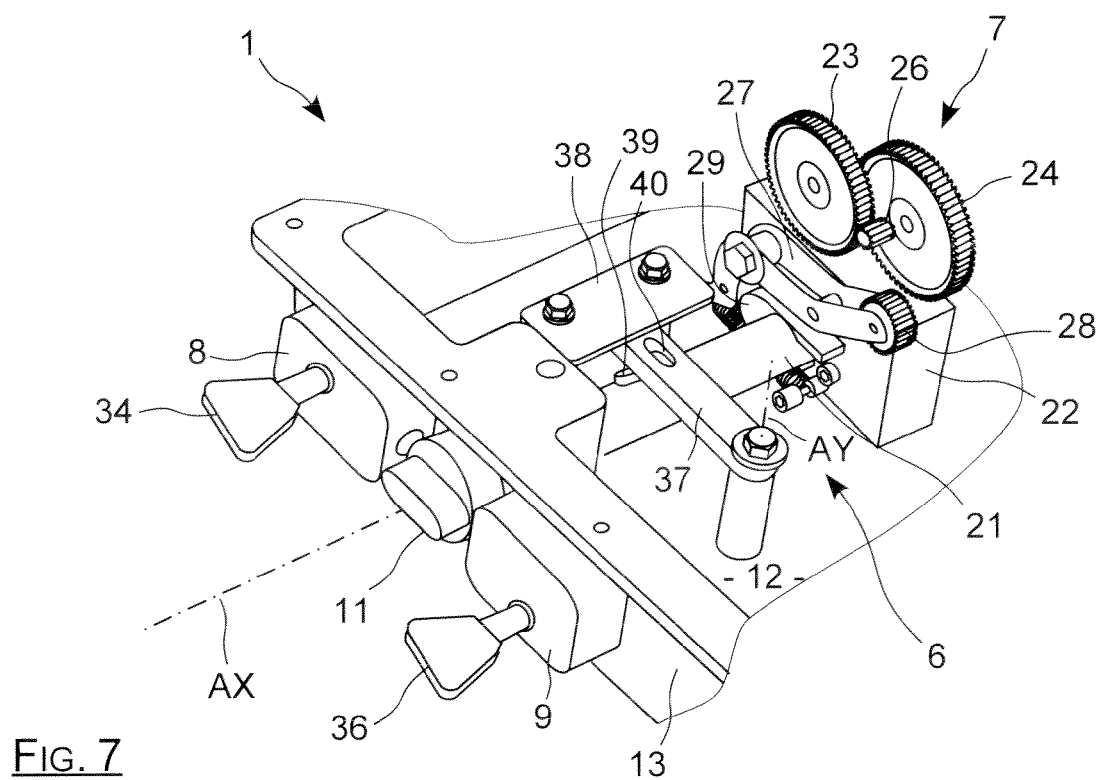
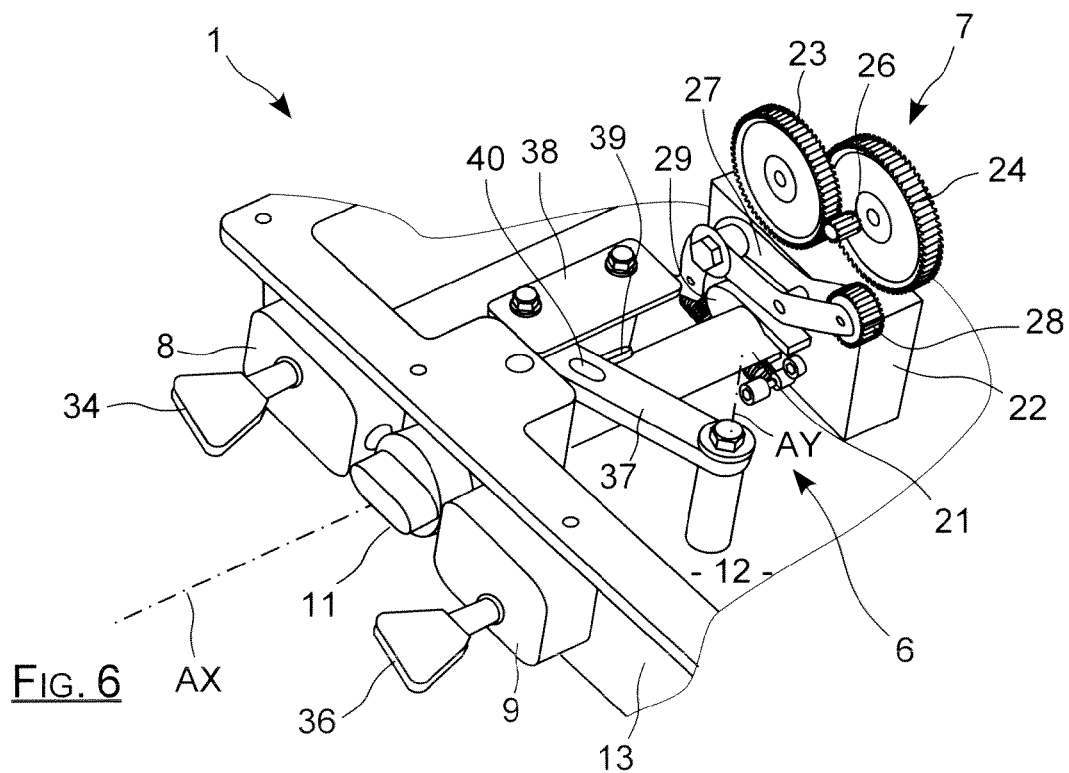


FIG. 5



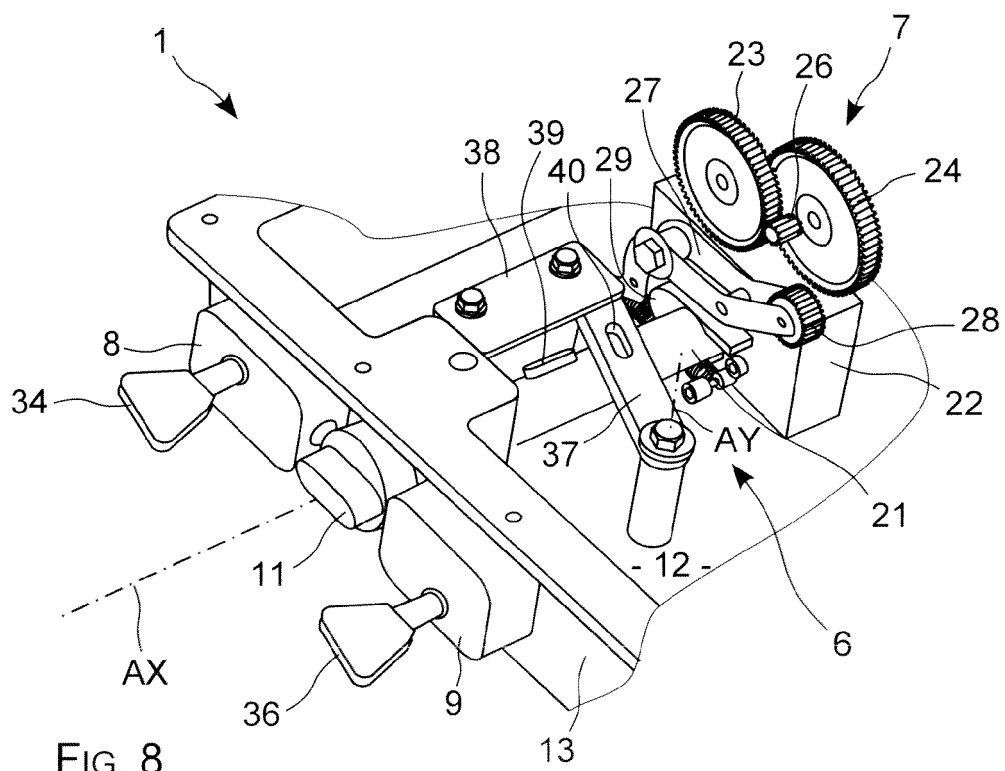


FIG. 8

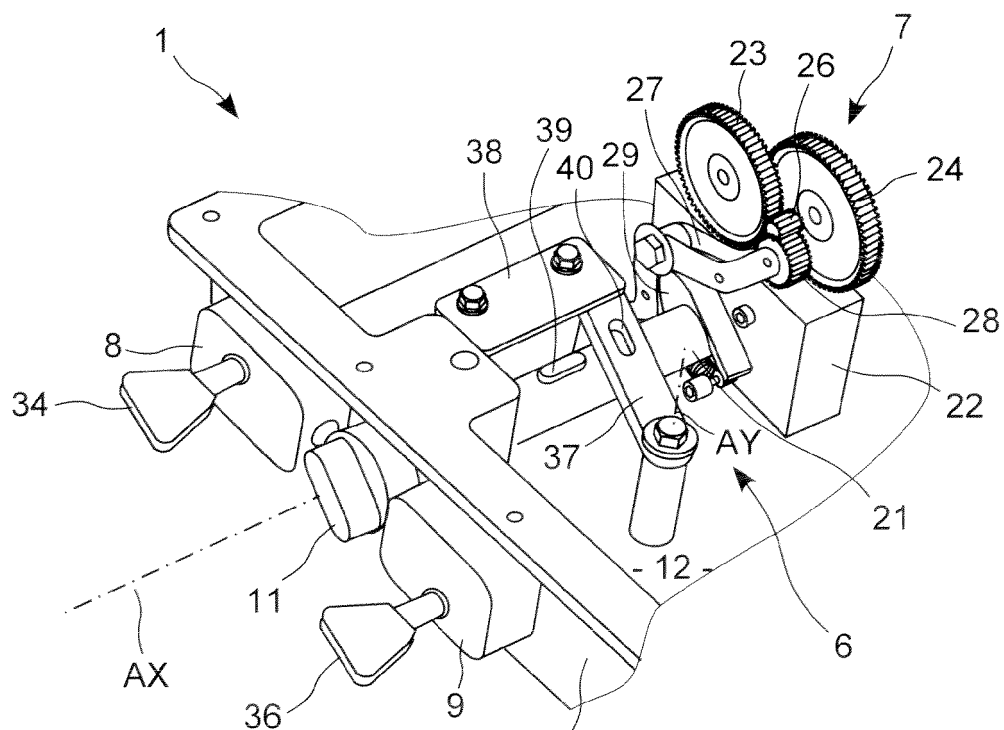


FIG. 9



EUROPEAN SEARCH REPORT

Application Number
EP 16 17 0388

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 September 2016	Examiner Bräckelmann, Gregor
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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