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(54) **MULTIFUNCTIONAL SWITCH MODULE FOR HIGH VOLTAGE COMPACT SWITCHGEAR**

MULTIFUNKTIONELLES SCHALTMODUL FÜR KOMPAKTE
HOCHSPANNUNGS-SCHALTANLAGE

MODULE DE COMMUTATION MULTIFONCTIONNEL POUR COMMUTATEUR COMPACT HAUTE
TENSION

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Description

[0001] The invention relates to the technical field of arrangements for insulated switchgears usable in high-voltage substations. A classic high-voltage switchgear might be described as a stacking or series of interconnected modules (or components) having each a specific function. An example is given by means of Figure 1A describing a switchgear known in the art. Said switchgear typically comprises the following components:

- a bushing 1 connected to
- a disconnecting and earthing switch 2 connected to
- a circuit-breaker 3 connected to
- another disconnecting and earthing switch 4 connected to
- a current transformer 5 connected to
- another bushing 6.

[0002] Among the disadvantages of prior art switchgears one finds notably their size, their high number of enclosures and insulated supports. For instance, the substation space available for such switchgear is sometimes confined, and therefore compact solutions are required, while full functionality is still needed. Relevant prior art switchgears are for instance described in DE 196 15 912 A1, according to the preamble of claim 1, and WO2011/015367 A1.

[0003] It is an objective of the present invention to overcome the previously mentioned disadvantages. This objective is solved by the measures taken in accordance with the independent claim. Further advantageous embodiments are proposed by the dependent claims.

[0004] According to an aspect of the invention, a multifunctional module (see component 234 in Figure 1B) having both the function of the circuit-breaker and the disconnecting and earthing switch is proposed. The advantage of using a multifunctional module in a switchgear is to decrease the number of modules required for accomplishing the same functionalities, and by the same way, the number of sealings and basically the costs for producing the switchgear.

[0005] The present invention concerns therefore a multifunctional module for a high voltage switchgear assembly, said multifunctional module being configured for connecting a first equipment to a second equipment, one of said equipment being typically an upstream equipment and the other one a downstream equipment, and comprising:

- a housing for enclosing insulating space, said housing comprising for instance connecting parts for connecting said housing to another module housing, for instance a current transformer module housing;
- a circuit-breaker (hereafter CB) arranged in said insulating space, for instance encapsulated in said housing, and configured for being connected to the second equipment, wherein the CB comprises a mo-

bile rod CBR, a first contact and a second contact, wherein the mobile rod CBR is configured for moving the first contact along a longitudinal axis X between a first position at which it is in contact with the second contact and a second position at which it is distant from said second contact in order to interrupt a current flow between the first equipment and the second equipment in order to protect the first or second equipment (depending on the direction of the flow of current between the first equipment and the second equipment) from an overcurrent or overload

- a switch arranged in said insulating space, for instance encapsulated in said housing, wherein the switch comprises at least one mobile connector that is mobile in translation along a longitudinal axis Y between a disconnecting position configured for disconnecting the first equipment from the CB, and a connecting position configured for connecting the first equipment to the CB. Preferentially, the switch is a disconnecter and earthing switch (hereafter DSES), wherein the disconnecter switch is configured for isolating the downstream equipment from the upstream equipment and the earthing switch is configured for earthing de-energized parts of the module (or of the switchgear) and/or for short-circuiting said parts at the same time;

characterized in that the switch comprises at least one mobile rod SR for moving said connector from the disconnecting position to the connecting position and vice versa, wherein the mobile rod SR and the mobile rod CBR cross each other in said insulating space. According to the present invention, the motion of the mobile rod SR and the motion of the mobile rod CBR are independent.

[0006] The present invention proposes that the mobile rod CBR involved in the displacement in translation of the first contact crosses at some point the mobile rod SR that is involved in the displacement in translation of the connector in order to gain compactness of the module by crossing the kinematics involved in respectively the displacement of the connector and the displacement of the first contact. By this way, a compact module including two functionalities might be obtained: a CB functionality and a switch functionality in a compact housing.

[0007] In particular, at least one rod among the mobile rod CBR and the mobile rod SR is mobile according to a translational movement along its longitudinal axis. Preferentially, at least one rod among the mobile rod CBR and mobile rod SR is mobile according to a rotational movement around its longitudinal axis. For instance, the mobile rod CBR is mobile according to a translational movement, notably along the longitudinal axis X, and the mobile rod SR is a shaft mobile according to a rotational movement around its longitudinal axis R, and a system of cranks transforms said rotational movement in a translation along the longitudinal axis Y for the mobile connector.

[0008] Preferentially, at least one rod among the mo-

mobile rod CBR and the mobile rod SR extends along its longitudinal axis and comprises one part, located at the crossing with the other rod among the mobile rod CBR or the mobile rod SR, that is radially distant from its longitudinal axis in order to make or form an opening and clear a free path for said other rod at said crossing. For instance, the mobile rod CBR is a rod extending along the longitudinal axis X and said part comprises an opening in the form of a hole in the body of the mobile rod CBR so that the mobile rod SR can extend through the mobile rod CBR, i.e. through said hole from one side of the mobile rod CBR to the other side of the mobile rod CBR. In this case, the opening is a cavity in one of the rods among the mobile rod CBR and the mobile rod SR, and said part is a wall of the cavity, wherein the cavity is open so that the other rod goes through said cavity and extends from one side of the rod to the other side of said rod through said cavity. In other embodiments, said part of one of the rods among the mobile rod CBR and mobile rod SR may form a bridge that spans the other rod. In particular, according to the present invention, at least one of the rods among the mobile rod CBR and the mobile rod SR deviates from its main axis of extension, for instance from its longitudinal axis, in order to partially surround the other rod at their crossing location.

[0009] The present invention also concerns a switchgear assembly suitable for high voltage, said switchgear assembly comprising:

- at least one bushing;
- at least one DSES;
- a CB;
- a current transformer (hereafter CT);

characterized in that the DSES and the CB are comprised in a multifunctional module as described above.

[0010] Further description and details of the invention will be described now on the basis of embodiments illustrated by the following figures:

Figure 1. A) schematic illustration of a switchgear known in the art; B) schematic illustration of a switchgear according to the invention.

Figure 2 side view of schematic illustration of a multifunctional module according to the invention.

Figure 3 schematic illustrations of different embodiments A-D of rod crossings according to the present invention, showing for each rod crossing A-D a side view on the left and a top view on the right.

Figure 4 schematic illustrations of a preferred embodiment of the invention.

Figure 5 schematic illustration of a crossing accord-

ing to the invention.

[0011] Figure 1A shows a schematic view of a switchgear assembly known in the art and as previously described. Said switchgear is formed by a series of modules or components having each a specific functionality, like a CT, or a DSES, or a CB. The present invention proposes to merge at least two modules having each a different functionality, typically a switch and a CB module, into a single module comprising both functionalities, i.e. the switch and CB functionalities. Such a merging of functionalities inside a single module or component is illustrated in Figure 1B that allows a comparison between the prior art technique and the present invention. Figure 1B schematically illustrates a switchgear according to the invention. Said switchgear comprises for instance a bushing 6 connected to a current transformer 5 connected to a multifunctional module 234 according to the invention, itself connected to another bushing 1. The multifunctional module 234 includes notably a CB and a switch functionality, for instance the DSES functionalities of the components 2 and 4, and replaces thus the components DSES 2, DSES 4 and CB 3 of Figure 1A. Due to the replacement of three components (2, 3, 4) of the switchgear according to Fig. 1A by a single component (234) for the switchgear according to Fig. 1B, one advantageously obtains a more compact switchgear compared to switchgears known in the art where said functionalities are separated in dedicated modules.

[0012] Figure 2 presents a side view cut scheme of a multifunctional module 4 according to the invention. Said multifunctional module 4 is configured for connecting a first equipment 1 to a second equipment 2. For instance, the first equipment 1 might comprise a bushing connected to a CT, itself connected to straight connector configured for interacting with a mobile connector 61 of a switch 6 of the multifunctional module 4. Said multifunctional module 4 comprises for instance a housing 41 enclosing an insulating space for the switch 6 and a CB 5. The mobile connector 61 is mobile in translation along a longitudinal axis Y between a disconnecting position at which it is disconnected from the first equipment 1, for instance from the straight connector, and a connecting position at which it is connected to the first equipment 1, for instance to the straight connector. A mobile rod SR 62 of the switch is preferentially mechanically connected to said mobile connector 61 for translating the latter between a connecting position at which it connects the CB 5 to the first equipment 1 and a disconnecting position at which it disconnects the CB 5 from the first equipment 1, the CB 5 being notably configured for preventing an overcurrent flowing between the first equipment 1 and a second equipment 2 that is connected to the CB 5. Said second equipment 2 may comprise for instance a bushing connected to another CT, itself connected to a second contact 53 of the CB 5. Typically, the CB 5 comprises a mobile rod CBR 51, a first contact 52 and said second contact 53, wherein the mobile rod CBR 51 is mechani-

cally connected to the first contact 52 for moving the latter along a longitudinal axis X between a first position at which it is in contact with the second contact 53 and a second position at which it is distant from said second contact 53 in order to interrupt said overcurrent flowing between the first equipment 1 and the second equipment 2.

[0013] According to the present invention and as shown in Fig. 2, the mobile rod SR 62 that is configured for moving said connector 61 from the disconnecting position to the connecting position and vice versa crosses the mobile rod CBR 51, said crossing of the rods involved in the displacement of the mobile first contact 52 and the mobile connector 63 allowing to merge the switch and CB functionality in a single compact module. The crossing of the rods according to the invention is schematically illustrated by Figure 5 for a better comprehension. In particular, by crossing, it has to be understood that the projection of one of the rods (i.e. the mobile rod SR 62, or respectively the mobile rod CBR 51) on a plan comprising the longitudinal axis of the other rod (i.e. comprising the longitudinal axis of the mobile rod CBR 51, or respectively the longitudinal axis of the mobile rod SR 62), wherein said plan is parallel to the longitudinal axis of said one of the rod (i.e. to the mobile rod SR 62, or respectively to the mobile rod CBR 51) forms a cross with the projection of said other rod (i.e. with said mobile rod CBR 51, or respectively with the mobile rod SR 62) on said same plan, wherein the projections of said rods intersect at the center of a cross. Taking the concrete case of Figure 5, the plan X'Y' is a plan comprising the longitudinal axis LY of the mobile rod SR 62. It is possible to rotate said plan X'Y' around said longitudinal axis LY so that it becomes parallel to the longitudinal axis LX of the mobile rod CBR 51. According to the present invention, a longitudinal axis of the mobile rod SR or CBR is an axis extending from one extremity of the rod to the other extremity of the rod according to a length of the rod, and that is preferentially an axis of rotation and/or of translation of the rod when said rod is moving for displacing the contact it is connected to (i.e. the mobile connector 61 for the mobile rod SR, wherein said mobile connector 61 is for instance movable along the axis Y, and the first contact 52 for the mobile rod CBR, wherein said first contact 52 is for instance movable along the axis X). According to the present invention, the plan X'Y' comprises thus the longitudinal axis LY of the mobile rod SR 62 and is parallel to the longitudinal axis LX of mobile rod CBR 51. By projecting according to an axis Z' perpendicular to the plan X'Y' the mobile rod CBR 51 on said plan X'Y' (said projection being illustrated by the arrows P) and by projecting also the mobile rod SR 62 on said plane X'Y', one obtains, according to the present invention, a crossing C of the projections. In particular, the mobile rod CBR 51 and the mobile rod SR cross each other according to an angle comprised between 60-120°, with 70-90° as preferred values, when projected on said plan.

[0014] Figure 3 shows different embodiments A-D for

the crossing of the mobile rod CBR 51 and the mobile rod SR 62 according to a side view (on the left) and top view (on the right) that might be implemented in the multifunctional module according to Fig. 2. According to the schemes of Fig. 3, the rods cross each other perpendicularly, but this is not an essential feature. Indeed, as explained above, the crossing angle might be different from 90°.

[0015] According to Fig. 3A - 3C, the mobile rod CBR 51 extends along its longitudinal axis that is, according to the preferred embodiment of Figure 3 the longitudinal axis X, and comprises a part, located at the crossing with the mobile rod SR 62, that is radially distant from its longitudinal axis represented by the axis X in order to form an aperture or opening 511 and clear a free path for the mobile rod SR 62 at said crossing. Preferentially, said opening 511 extends along part of the length of the mobile rod CBR 51, wherein the length L of this opening 511 is greater than the width SR_W of mobile rod SR 62 measured along the length of the mobile rod CBR 51 so as to let the mobile rod SR 62 pass through said aperture while allowing a motion of the mobile rod CBR 51 for moving the first contact 52 along the longitudinal axis X between the first position at which it is in contact with the second contact 53 and the second position at which it is distant from said second contact 53. Thanks to this opening 511, the rods cross each other and may each move independently from the other for moving respectively the mobile connector 61 for the mobile rod SR 61 and the first contact 52 for the mobile rod CBR 51. According to Fig. 3A, said opening 511 completely surrounds the mobile rod SR 62 so that the latter is enclosed in said opening 511 in a projection of the crossing. For instance a projection of the mobile rod SR 62 on a plan perpendicular to the longitudinal axis of the mobile rod SR 62 and that cuts the mobile rod CBR 51 along its length is enclosed in said opening (see the top view of Fig. 3A). Fig. 3B shows another embodiment of said opening 511, wherein the mobile rod CBR 62 comprises a first part 512 and a last part 514 extending along the longitudinal axis of the mobile rod CBR 51, and a middle part 513 located between the first part 512 and the last part 513 that extends from the first part 512 to the last part 513 while being distant from the longitudinal axis of the mobile rod CBR 51, in order to create said opening 511, said opening 511 forming for instance an aperture centralized around the longitudinal axis of the mobile rod. According to Fig. 3C, the opening 511 is formed by the space comprised around the longitudinal axis between two arms 515 and 516 of the mobile rod CBR 51 that connect each a first part 512 to a last part 514 of the mobile rod CBR 51 so as to create between said first part 512 and said last part 514 a free space along said longitudinal axis of the mobile rod CBR 51 for the mobile rod SR 62, said free space being the opening 511, said first and last parts extending along the longitudinal axis of the mobile rod CBR 51.

[0016] The preferred embodiments according to Fig. 3A-3C comprise a mobile rod CBR and a mobile rod SR

moving preferentially according to a translational displacement along their long axis for displacing the mobile connector 61 or the first contact 62. Typically, the mobile rod SR is arranged substantially vertically compared to the mobile rod CBR which is arranged substantially horizontally. Figure 3D proposes another preferred embodiment, wherein both the mobile rod CBR 51 and the mobile rod SR 62 are arranged substantially horizontally, wherein for instance, the mobile rod CBR 51 is mobile according to a translational movement along its longitudinal axis, and the mobile rod SR 62 is a shaft mobile according to a rotational movement around its longitudinal axis Z. Preferentially, the longitudinal axis of the mobile rod CBR and of the mobile rod SR are in a same plane, for instance in a horizontal plane.

[0017] According to the embodiment of Fig. 3D, which is also shown in Fig. 4A and 4B, the mobile rod CBR 51 comprises an opening 511 in the form of a cavity arranged around the longitudinal axis of the mobile rod CBR 51 and extending along part of the length of the mobile rod CBR 51, in the body of the mobile rod CBR 51 (i.e. inside said mobile rod CBR), said cavity comprising at least two, preferentially three or four apertures or windows to the outside, each extending along a part of the length of the mobile rod CBR 51 for allowing on one hand the crossing of the mobile rod CBR 51 with the mobile rod SR 62 and on the other hand a motion of an articulated arm mechanically connecting the mobile rod SR 62 to the mobile connector 61 so as to authorize an independent motion of the first contact 52 and the mobile connector 61.

[0018] In particular, the cavity of the mobile rod CBR comprises one or two windows or apertures, for instance a first window, and optionally a second window, wherein the mobile rod SR 62 extends from the outside of said cavity, through the first window to the inside of said cavity, and optionally further extends from the inside of said cavity through the second window facing the first window to an opposite outside of said cavity. Preferentially, the multifunctional module comprises a SR drive connected to one of the extremities of the mobile rod SR 62 and configured for driving said mobile rod SR into rotation around its longitudinal axis, wherein the other one of said extremities of the mobile rod SR 62 might be for instance supported into rotation by the housing of the multifunctional module, typically by a bearing.

[0019] The cavity might also comprise a third or optionally a fourth window or aperture through which said articulated arm extends from inside the cavity to the outside of the cavity in direction of the mobile connector 61, said articulated arm being configured for transforming the rotational motion of the mobile rod SR in a translational motion of the mobile connector 61. For instance, said articulated arm comprises a crank 63 comprising a first extremity and a second extremity, wherein the first extremity is fixed to the mobile rod SR 62 inside said cavity and said second extremity is connected to a crank rod 64, wherein said crank 63 is configured for being driven into rotation by the mobile rod SR around the lon-

gitudinal axis of said mobile rod SR 61, the driving into rotation of said crank 63 according to a first direction of rotation resulting in a rotational motion of its second extremity from the inside of the cavity to the outside of the cavity through said third window in direction of the mobile connector 61, said second extremity putting itself into motion the crank rod 64 that is fixed at one extremity and by means of a rotational joint to the crank 63 and at its other extremity and by means of another rotational joint to the mobile connector 61, so that the rotational movement of the mobile rod SR 62 according to said first direction of rotation is transformed into a translational movement of the mobile connector 61 by means of the kinematics of the articulated arm formed by the crank 63 and the crank rod 64, said translational movement moving the mobile connector 61 from the disconnecting position to the connecting position, i.e. away from the cavity, when the mobile rod SR 62 rotates according to said first direction of rotation (see Fig. 4B) so as to establish an electric contact with the first equipment by means of the mobile connector 61, and inversely, said translational movement moving the mobile connector 61 from its connecting position to its disconnecting position, i.e. closer to the cavity (see Fig. 4A), when the mobile rod SR 62 rotates according to a second direction of rotation opposite to the first direction of rotation so as to break the electric contact with the first equipment and bring the mobile connector to its disconnecting position. According to the embodiment of Fig. 3D, the crank 63 and the mobile rod SR 62 are joined together so that the crank 63 rotates together with the mobile rod SR 62, while the crank rod 64 is rotatably connected to the crank 63 and to the mobile connector 61 for instance by means of bearings.

[0020] Optionally, and as illustrated in Fig. 4, the articulated arm comprises another crank rod 65, rotatably connected to the crank 63 and to an earthing connector 66. For instance, said another crank rod 65 has one of its extremities connected to the second extremity of the crank 63, notably by means of a rotational joint, and has its other extremity connected to the earthing connector 66, notably also by means of a rotational joint. According to the embodiment of Fig. 4, the rotation of the crank 63 is further configured for putting into motion at the same time not only the crank rod 64 moving at least partially from the inside of the cavity to the outside of the cavity through said third window, but also said other crank rod 65 that may move at least partially from the inside of the cavity to the outside of the cavity through a fourth window facing the third window. Said other crank rod 65 is configured for driving the earthing connector into a translational motion from a connecting position to a disconnecting position and vice versa, wherein the rotation of the mobile rod SR 62 according to the first direction of rotation is configured for disconnecting the earthing connector from the earth while establishing the electrical contact between the mobile connector 61 and the first equipment, and the rotation of the mobile rod SR 62 according to the second direction of rotation is configured for connecting

said earthing connector to the earth while breaking the above-mentioned electric contact of the mobile connector 61 with the first equipment.

[0021] In particular, the rotation of the crank 63 takes place between a first extreme position and a second extreme position, wherein at the first extreme position, the second extremity of the crank 63 is located closer to the mobile connector 61 than to the earthing connector 66, and at the second extreme position, said second extremity is located closer to the earthing connector than to the mobile connector 61. Between the first extreme position and the second extreme position, the crank 63 may have a rest position, wherein the second extremity is preferentially located inside said cavity. Typically, for joining the first extreme position, the second extremity of the crank 63 leaves the inside of the cavity for the outside of the cavity through the third window, pushing according to a rotational movement in said first direction the crank rod 64 upward and at the same time pulling the crank rod 65 upward, said motion upward of the crank rods 64 and 65 driving into motion respectively the mobile connector 61 that is pushed upward by the crank rod 64 according to a translational movement in direction of the connecting position and the earthing connector that is pulled upward by the crank rod 65 according to a translational movement that moves it away from its connecting position. Typically, for joining the second extreme position, the second extremity of the crank 63 leaves the inside of the cavity for the outside of the cavity through the fourth window opposite to the third window, pulling according to a rotational movement in said second direction the crank rod 64 downward and at the same time pushing the crank rod 65 downward, said motion downward of the crank rods 64 and 65 driving into motion respectively the mobile connector 61 that is pulled downward by the crank rod 64 according to a translational movement that moves it away from its connecting position and the earthing connector that is pushed downward by the crank rod 65 according to a translational movement in direction of its connecting position. Preferentially, at the rest position of the crank 63, and as shown in Fig. 4A, both the mobile connector 61 and the earthing connector 66 are disconnected respectively from the first equipment and from the earth. The motion of the second extremity of the crank 63 from its position wherein the crank 63 is at the rest position to its position wherein the crank 63 is at its first extreme position is notably configured for connecting the mobile connector 61 to the first equipment, while maintaining the earthing connector disconnected from the earth (see Fig. 4B). The motion of the second extremity of the crank 63 from its position wherein the crank 63 is at the rest position to its position wherein the crank 63 is at its second extreme position is configured for connecting the earthing connector 66 to the earth, while maintaining the mobile connector 61 disconnected from the first equipment. The crank 63 can move from its rest position to the first or the second extreme position and inversely for establishing or breaking an electrical contact

with the first equipment or the earth. Preferentially, the longitudinal axis of the crank 63 that goes from the first extremity to the second extremity of the crank 63 is substantially parallel to or aligned with the longitudinal axis of the mobile rod CBR 51 and located inside the cavity when the crank 63 is at said rest position. The motion of the crank 63 then may take place upward (i.e. according to said first direction of rotation) through the third window or respectively downward (i.e. according to said second direction of rotation) through the fourth window in order to push the mobile connector 61 and pull the earthing switch or respectively to pull the mobile connector 61 and push the earthing switch.

[0022] As shown in Fig. 4A and 4B, the driving mechanism 7 controlling the motion of the mobile rod CBR for moving the first contact 52 along the longitudinal axis X from its second position to its first position in contact with the second contact 53 is independent from the SR drive that controls the rotation according to said first direction of rotation or said second direction of rotation of the mobile rod SR 62. The length of the cavity of the mobile rod CBR 51 allows a complete motion of the crank 63 from its first extreme position to its second extreme position and vice versa when the first contact 62 is connected to the second contact 53 and also when it is disconnected from the second contact 53.

[0023] The multifunctional module 4 shown in Fig. 4 might be typically used for a gas insulated switchgear wherein the housing 41 of the multifunctional module 4 is configured for hermetically enclosing the insulated gas, said gas surrounding notably the articulated arm and the mobile rod SR 62. According to Fig. 4, the switch is preferentially a DSES, wherein the mobile rod SR 62 is a shaft with rotation axis Z (see Fig. 3D), wherein the rotation of said shaft around its rotation axis Z is configured for moving the mobile connector 61 and the earthing connector 66 of the DSES between connecting and disconnecting positions, wherein when the mobile connector 61 is in the connecting position, it is configured for connecting the upstream equipment to the downstream equipment and the earthing connector is not connected to the earth, and wherein when the earthing connector 66 is in the connecting position, it is configured for connecting the multifunctional module to the earth and the mobile connector is disconnected from the upstream equipment. According to the particular embodiment of Fig. 4, the mobile rod CBR 51 preferentially surrounds at least partially the mobile rod SR 62, so that the rotation axis Z of the mobile rod 62 (which is actually the same as the longitudinal axis of the mobile rod SR 62) and the longitudinal axis of the mobile rod CBR 51 are crossing when considering a top view of the multifunctional module (see right figure 3D) and so that the mobile rod SR 62 goes through the mobile rod CBR when considering a side view of the module (see right figure 3D or Fig. 4).

[0024] In conclusion, the present invention proposes a crossed path kinematics for the CB and a switch, wherein said switch is in particular a DSES, wherein the mobile

rod SR 62, whose motion (rotation and/or translation) allows to connect/disconnect an upstream equipment to/from a downstream equipment by moving the mobile connector 61, and the mobile rod CBR 51, whose translation allows to connect/disconnect the first contact 52 to/from the second contact 53, are crossing each other when projecting the mobile rod SR 62 on a plan comprising the mobile rod CBR 51, wherein said plan is parallel to the mobile rod SR 62. Finally, according to the detailed description in relation with the drawings, the mobile rod CBR 51 comprises an opening for allowing the crossing with the mobile rod SR 62. Nevertheless, the role of the rods might be inverted so that the mobile rod SR 62 comprises said opening so as to allow the crossing with the mobile rod CBR 51. In this case, the role and features of the mobile rod CBR 51 and the mobile rod SR 62 would be inverted in the detailed description of the figures.

Claims

1. Multifunctional module (4) for a high voltage switch-gear assembly, said multifunctional module (4) being configured for connecting a first equipment (1) to a second equipment (2), and comprising:

- a housing (41) for enclosing an insulating space;
- a circuit-breaker (hereafter CB) (5) arranged in said insulating space and configured for being connected to the second equipment (2), wherein the CB (5) comprises a mobile rod CBR (51), a first contact (52) and a second contact (53), wherein the mobile rod CBR (51) is configured for moving the first contact (52) along a longitudinal axis X between a first position at which it is in contact with the second contact (53) and a second position at which it is distant from said second contact (53) in order to interrupt a current flow between the first equipment (1) and the second equipment (2) in order to protect the first or second equipment from an overcurrent or overload;
- a switch (6) arranged in said insulating space, wherein the switch (6) comprises at least one mobile connector (61) that is mobile in translation along a longitudinal axis Y between a disconnecting position configured for disconnecting the first equipment (1) from the CB (5), and a connecting position configured for connecting the first equipment (1) to the CB (5);

characterized in that

the switch (6) comprises at least one mobile rod SR (62) for moving said mobile connector (61) from the disconnecting position to the connecting position and vice versa, wherein the mobile rod SR (62) and the mobile rod CBR (51) cross each other and where-

in the motion of the mobile rod SR (62) and the motion of the mobile rod CBR (51) are independent.

2. The multifunctional module (4) of claim 1, wherein the switch (6) is a disconnecter and earthing switch (hereafter DSES), wherein the disconnecter switch is configured for isolating one of the first or second equipment from the other one and the earthing switch is configured for earthing de-energized parts of the module.
3. The multifunctional module (4) of any one of the preceding claims, wherein at least one rod among the mobile rod CBR (51) and the mobile rod SR (62) is mobile according to a translational movement along its longitudinal axis.
4. The multifunctional module (4) of any one of the preceding claims, wherein at least one rod among the mobile rod CBR (51) and mobile rod SR (62) is mobile according to a rotational movement around its longitudinal axis.
5. The multifunctional module (4) of claim 4, wherein at least one rod among the mobile rod CBR (51) and the mobile rod SR (62) extends along its longitudinal axis and comprises one part, located at the crossing with the other rod among the mobile rod CBR (51) or the mobile rod SR (62), that is radially distant from its longitudinal axis in order to make an opening (511) and clear a free path for said other rod at said crossing.
6. The multifunctional module (4) of claim 5, wherein said other rod extends at least partially through said opening (511) .
7. The multifunctional module (4) of claim 5 or 6, wherein said part forms a bridge that spans said other rod.
8. The multifunctional module (4) of claim 5 or 6, wherein said opening (511) is a cavity in said rod and said part is a wall of the cavity, wherein the cavity is open so that the other rod goes through said cavity and extends at least partially through said cavity.
9. The multifunctional module (4) according to one of the claims 1 to 8, wherein at least one of the rod deviates from its longitudinal axis in order to partially surround the other rod.
10. Switchgear assembly comprising
 - at least one bushing;
 - at least one switch (6);
 - a CB (5) ;
 - a current transformer;

characterized in that the CB (5) and the switch (6) are comprised in a multifunctional module (4) according to one of the claims 1-9.

Patentansprüche

1. Multifunktionales Modul (4) für eine Hochspannungs-Schaltanlage, wobei das multifunktionale Modul (4) dafür konfiguriert ist, eine erste Einrichtung (1) mit einer zweiten Einrichtung (2) zu verbinden, und Folgendes umfasst:

- ein Gehäuse (41) zum Einschließen eines Isolierraums,
- einen Leistungsschalter (Circuit-Breaker, im Folgenden CB) (5), der in dem Isolierraum angeordnet und dafür konfiguriert ist, mit der zweiten Einrichtung (2) verbunden zu werden, wobei der CB (5) einen beweglichen Stab CBR (51), einen ersten Kontakt (52) und einen zweiten Kontakt (53) umfasst, wobei der bewegliche Stab CBR (51) dafür konfiguriert ist, den ersten Kontakt (52) entlang einer Längsachse X zwischen einer ersten Position, an der er mit dem zweiten Kontakt (53) in Kontakt ist, und einer zweiten Position, an der er von dem zweiten Kontakt (53) entfernt ist, zu bewegen, um einen Stromfluss zwischen der ersten Einrichtung (1) und der zweiten Einrichtung (2) zu unterbrechen, um die erste oder zweite Einrichtung vor einem Überstrom oder einer Überlast zu schützen,
- einen Schalter (6), der in dem Isolierraum angeordnet ist, wobei der Schalter (6) mindestens einen beweglichen Verbindungsstecker (61) umfasst, der entlang einer Längsachse Y zwischen einer Trennstellung, die dazu konfiguriert ist, die erste Einrichtung (1) von dem CB (5) zu trennen, und einer Verbindungsstellung, die dazu konfiguriert ist, die erste Einrichtung (1) mit dem CB (5) zu verbinden, translatorisch beweglich ist,

dadurch gekennzeichnet, dass

der Schalter (6) mindestens einen beweglichen Stab SR (62) zum Bewegen des beweglichen Verbindungssteckers (61) aus der Trennstellung in die Verbindungsstellung und umgekehrt umfasst, wobei der bewegliche Stab SR (62) und der bewegliche Stab CBR (51) sich kreuzen und wobei die Bewegung des beweglichen Stabs SR (62) und die Bewegung des beweglichen Stabs CBR (51) unabhängig sind.

2. Multifunktionales Modul (4) nach Anspruch 1, wobei der Schalter (6) ein Trenn- und Erdungsschalter (Disconnecter and Earthing Switch, im Folgenden DSES) ist, wobei der Trennschalter dafür konfigu-

riert ist, eine der ersten oder zweiten Einrichtung von der anderen zu isolieren, und der Erdungsschalter dafür konfiguriert ist, die stromlosen Teile des Moduls zu erden.

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3. Multifunktionales Modul (4) nach einem der vorhergehenden Ansprüche, wobei mindestens ein Stab unter dem beweglichen Stab CBR (51) und dem beweglichen Stab SR (62) gemäß einer translatorischen Bewegung entlang seiner Längsachse beweglich ist.

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4. Multifunktionales Modul (4) nach einem der vorhergehenden Ansprüche, wobei mindestens ein Stab unter dem beweglichen Stab CBR (51) und dem beweglichen Stab SR (62) gemäß einer Drehbewegung um seine Längsachse beweglich ist.

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5. Multifunktionales Modul (4) nach Anspruch 4, wobei mindestens ein Stab unter dem beweglichen Stab CBR (51) und dem beweglichen Stab SR (62) sich entlang seiner Längsachse erstreckt und einen Teil umfasst, der sich an der Kreuzung mit dem anderen Stab unter dem beweglichen Stab CBR (51) und dem beweglichen Stab SR (62) befindet, der radial entfernt von seiner Längsachse ist, um eine Öffnung (511) zu schaffen und einen freien Weg für den anderen Stab an der Kreuzung freizumachen.

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6. Multifunktionales Modul (4) nach Anspruch 5, wobei der andere Stab sich mindestens teilweise durch die Öffnung (511) erstreckt.

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7. Multifunktionales Modul (4) nach Anspruch 5 oder 6, wobei der Teil eine Brücke bildet, die den anderen Stab überspannt.

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8. Multifunktionales Modul (4) nach Anspruch 5 oder 6, wobei die Öffnung (511) ein Hohlraum in dem Stab ist und der Teil eine Wand des Hohlraums ist, wobei der Hohlraum offen ist, sodass der andere Stab durch den Hohlraum geht und sich mindestens teilweise durch den Hohlraum erstreckt.

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9. Multifunktionales Modul (4) nach einem der Ansprüche 1 bis 8, wobei mindestens einer der Stäbe von seiner Längsachse abweicht, um den anderen Stab mindestens teilweise zu umgeben.

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10. Schaltanlage, die Folgendes umfasst:

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- mindestens eine Durchführung,
- mindestens einen Schalter (6),
- einen CB (5),
- einen Stromwandler,

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dadurch gekennzeichnet, dass der CB (5) und der Schalter (6) in einem multifunktionalen Modul (4)

nach einem der Ansprüche 1 bis 9 enthalten sind.

Revendications

1. Module multifonctionnel (4) pour un assemblage de dispositif de commutateur haute tension, ledit module multifonctionnel (4) étant configuré pour connecter un premier équipement (1) à un second équipement (2), et comprenant :

- un logement (41) pour renfermer un espace isolant ;
- un disjoncteur (ci-après CB) (5) qui est agencé dans ledit espace isolant et qui est configuré de sorte qu'il soit connecté au second équipement (2), dans lequel le CB (5) comprend une tige mobile CBR (51), un premier contact (52) et un second contact (53), dans lequel la tige mobile CBR (51) est configurée pour déplacer le premier contact (52) suivant un axe longitudinal X entre une première position à laquelle il est en contact avec le second contact (53) et une seconde position à laquelle il est à distance dudit second contact (53) de manière à interrompre une circulation de courant entre le premier équipement (1) et le second équipement (2) de manière à protéger le premier ou second équipement vis-à-vis d'une surintensité ou d'une surcharge ;
- un commutateur (6) qui est agencé dans ledit espace isolant, dans lequel le commutateur (6) comprend au moins un connecteur mobile (61) qui est mobile en translation suivant un axe longitudinal Y entre une position de déconnexion qui est configurée pour déconnecter le premier équipement (1) vis-à-vis du CB (5) et une position de connexion qui est configurée pour connecter le premier équipement (1) au CB (5) ;

caractérisé en ce que :

le commutateur (6) comprend au moins une tige mobile SR (62) pour déplacer ledit connecteur mobile (61) depuis la position de déconnexion jusqu'à la position de connexion et vice versa, dans lequel la tige mobile SR (62) et la tige mobile CBR (51) se croisent l'une l'autre et dans lequel le déplacement de la tige mobile SR (62) et le déplacement de la tige mobile CBR (51) sont indépendants.

2. Module multifonctionnel (4) selon la revendication 1, dans lequel le commutateur (6) est un commutateur de déconnexion et de mise à la masse (ci-après DSES), dans lequel le commutateur de déconnexion est configuré pour isoler un équipement pris parmi les premier et second équipements vis-à-vis de l'autre équipement et le commutateur de mise à la masse est configuré pour mettre à la masse des par-

ties désactivées du module.

3. Module multifonctionnel (4) selon l'une quelconque des revendications précédentes, dans lequel au moins une tige prise parmi la tige mobile CBR (51) et la tige mobile SR (62) est mobile selon un déplacement en translation suivant son axe longitudinal.
4. Module multifonctionnel (4) selon l'une quelconque des revendications précédentes, dans lequel au moins une tige prise parmi la tige mobile CBR (51) et la tige mobile SR (62) est mobile selon un déplacement en rotation autour de son axe longitudinal.
5. Module multifonctionnel (4) selon la revendication 4, dans lequel au moins une tige prise parmi la tige mobile CBR (51) et la tige mobile SR (62) s'étend suivant son axe longitudinal et comprend une partie, qui est localisée au niveau du croisement avec l'autre tige prise parmi la tige mobile CBR (51) et la tige mobile SR (62), qui est radialement à distance de son axe longitudinal de manière à constituer une ouverture (511) et à dégager un parcours libre pour ladite autre tige au niveau dudit croisement.
6. Module multifonctionnel (4) selon la revendication 5, dans lequel ladite autre tige s'étend au moins partiellement au travers de ladite ouverture (511).
7. Module multifonctionnel (4) selon la revendication 5 ou 6, dans lequel ladite partie forme un pont qui englobe ladite autre tige.
8. Module multifonctionnel (4) selon la revendication 5 ou 6, dans lequel ladite ouverture (511) est une cavité ménagée dans ladite tige et ladite partie est une paroi de la cavité, dans lequel la cavité est ouverte de telle sorte que l'autre tige pénètre au travers de ladite cavité et s'étende au moins partiellement au travers de ladite cavité.
9. Module multifonctionnel (4) selon l'une des revendications 1 à 8, dans lequel au moins l'une des tiges est déviée par rapport à son axe longitudinal de manière à ce qu'elle entoure partiellement l'autre tige.
10. Assemblage de module de commutateur comprenant :
 - au moins une douille ;
 - au moins un commutateur (6) ;
 - un CB (5) ;
 - un transformateur de courant ;

caractérisé en ce que le CB (5) et le commutateur (6) sont constitués selon un module multifonctionnel (4) selon l'une des revendications 1 à 9.

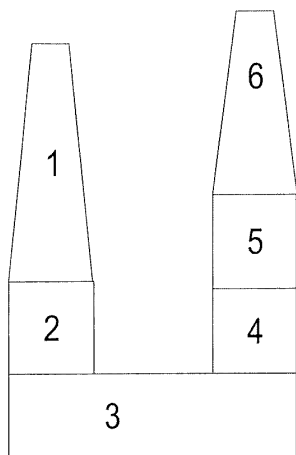


FIG 1A

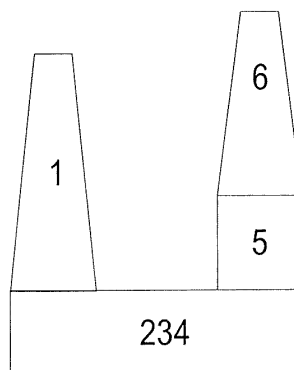


FIG 1B

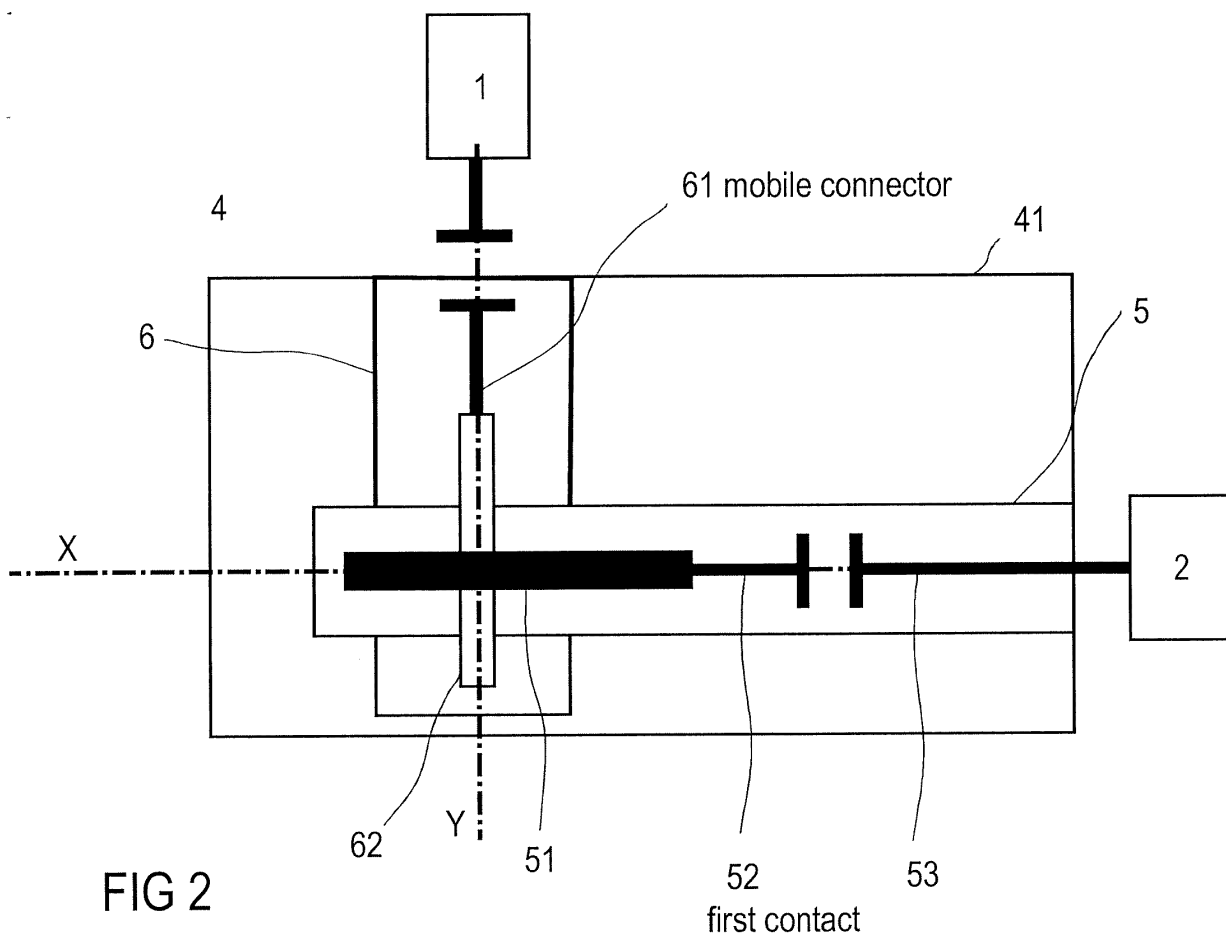


FIG 2

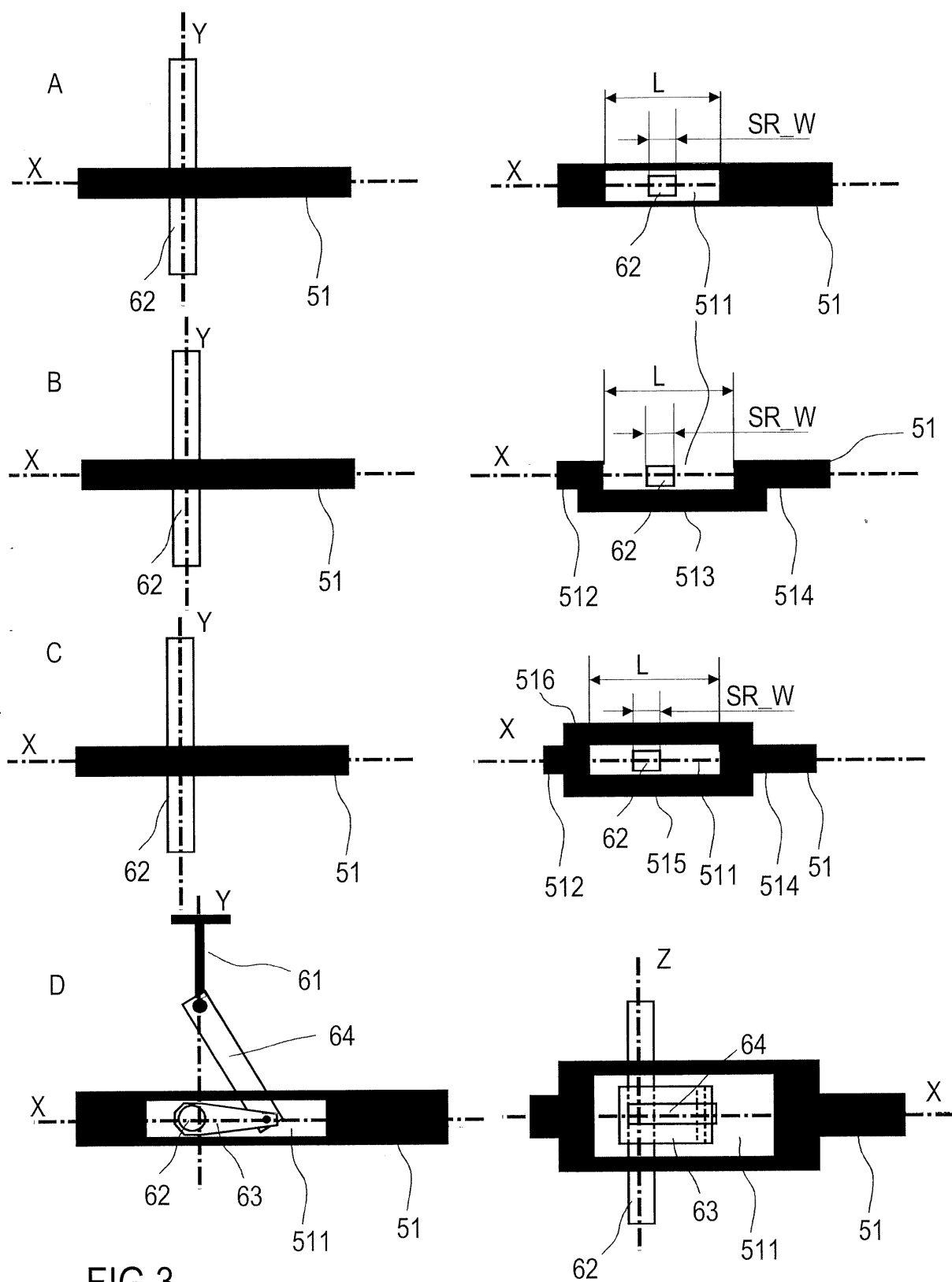


FIG 3

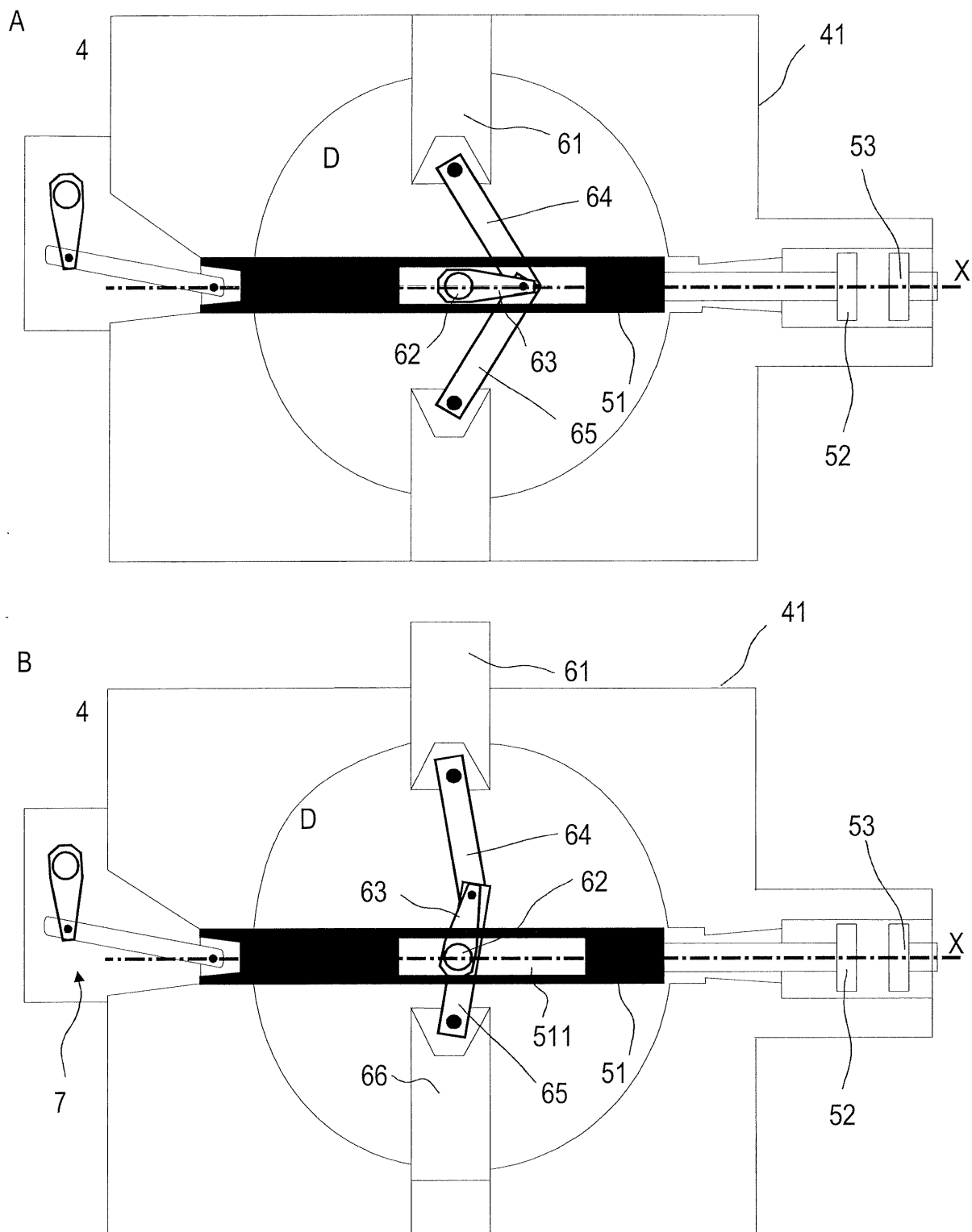


FIG 4

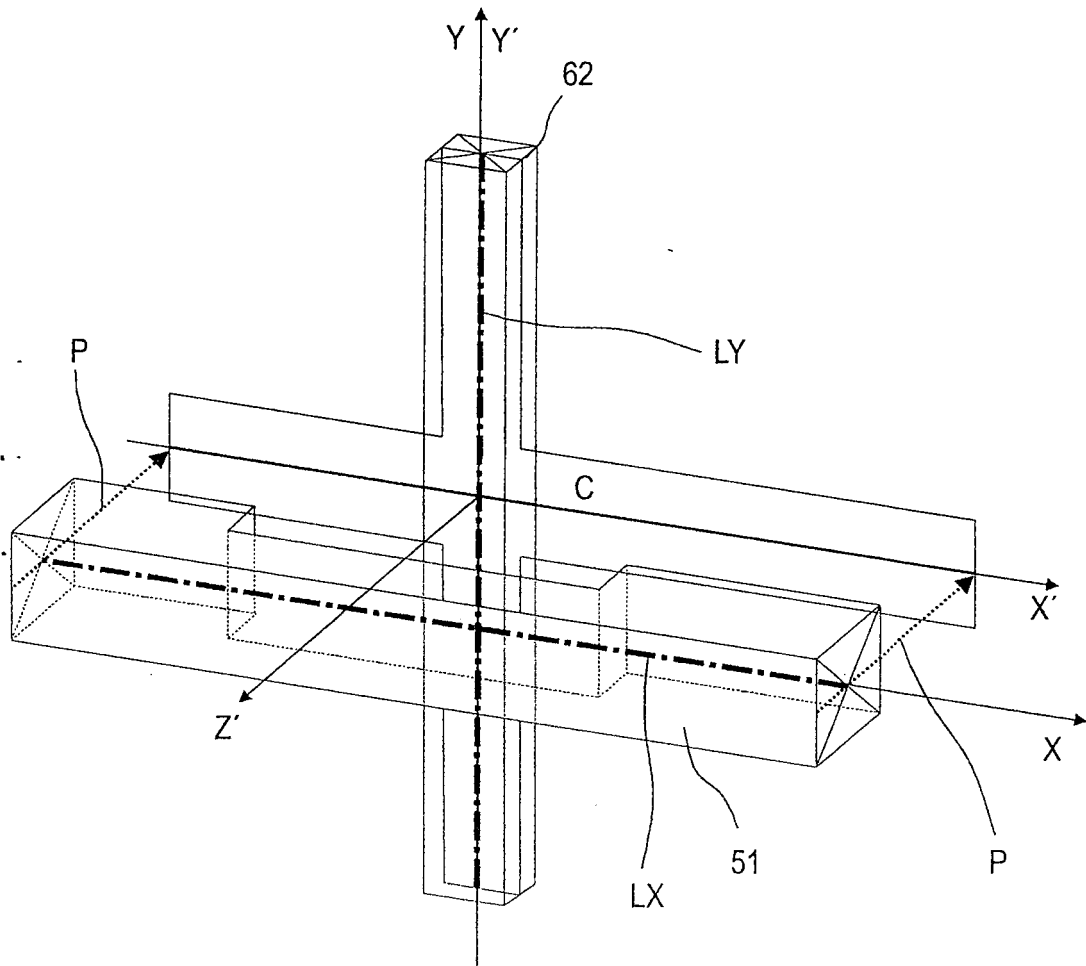


FIG 5

REFERENCES CITED IN THE DESCRIPTION

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