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(54) **Switch assembly for a medium or high voltage switchgear, comprising a three-position switch**

(57) The invention relates to a switch assembly (1) for a medium or high voltage switchgear, comprising a three-position switch (2) with a movable contact piece (3) which can be brought by an electrical motor (4) into three different positions, namely:

- a switched-on position (5), which connects the movable contact piece (3) to an isolator contact (6),
- an earthing position (7), which connects the movable contact piece (3) to an earth contact (8), and
- a disconnected position (9), which is arranged between switched-on position (5) and the earthing position (7), wherein two types of means for generating electrical signals for position indication are arranged at the three-position switch (2), whereof one type is a precise linear operating micro switch (10) generating a discontinuous electrical signal and the other type is a less precise aux-

iliary switch (11) generating a continuous electrical signal, wherein the electrical signals are transmitted to a control unit (12) for controlling the electrical motor (4), comprising an electrical indication unit (13) for indicating the actual position of the movable contact piece (3), wherein a first micro switch (10a) is coupled to the moving drive of the movable contact piece for detecting the switched-on position (5) and a second micro switch (10b) is coupled to the moving drive of the movable contact piece for detecting the earthing position (7), and two pairs of micro switches (10c, 10d) and auxiliary switches (11a, 11b) are coupled to the moving drive of the movable contact piece for detecting the disconnected position (9), wherein each auxiliary switch (11a, 11b) is both in parallel and/or in series connected to each micro switch (10c, 10d).

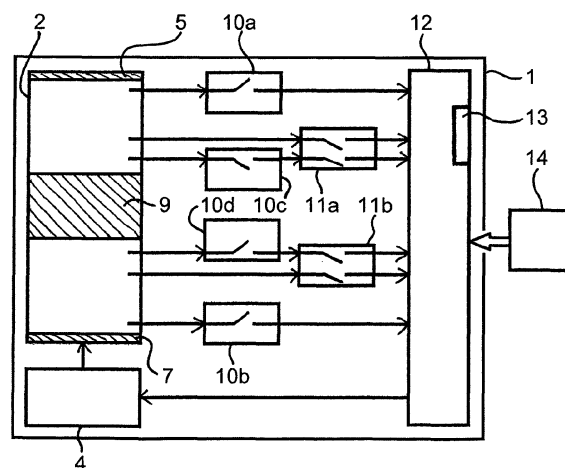


Fig. 2

DescriptionField of the invention

5 **[0001]** The invention relates to a switch assembly for a medium or high voltage switchgear, comprising a three-position switch with a movable contact piece which can be brought by an electrical or hydraulical motor or drive into three different positions, namely a switched-on position, which connects the movable contact piece to an isolator contact, an earthing position, which connects the movable contact piece to an earth contact, and a disconnected position, which is arranged between switched-on position and the earthing position, wherein two types of means for generating electrical signals for position indication are arranged at the three-position switch, whereof one type is a precise linear operating micro switch generating a discontinuous electrical signal and the other type is a less precise auxiliary switch generating a continuous electrical signal, wherein the electrical signals are transmitted to a control unit for controlling the electrical motor, comprising an electrical indication unit for indicating the actual position of the movable contact piece.

15 Background of the invention

[0002] In the control of high voltage multi-position switches such like three-position switches, it is state of the art to use a set of individual switches for the electrical position indication. The electrical position indication can be realized by means of auxiliary switches, inductive position indicators or similar.

20 **[0003]** A three-position switch is regarded as two individual switches: an isolator and an earthing switch. These two switches provide the position indication open and close each. The electrical open and close position indications are provided by two kinds of switches: A micro switch which provides an accurate position indication and another auxiliary switch which provides a less accurate position indication.

In order to control the operation of the motor drive of a three-position switch, it has to be used the accurate position indications by the micro switches for the control circuit. The auxiliary switches can be used for visualization and interlockings. For control purposes, the direct and the inverted signal of the micro switches has to be used.

25 **[0004]** A current and well known technical solution is the operation of the micro switches and auxiliary switches by a cam disk that makes sure that the desired signals are generated. Furthermore, a new linear mechanical operation of the micro switches was introduced, which allows an easier mechanical layout. The operation of the auxiliary switches was modified. The micro switches, which indicate the isolator off and earthing switch off position are only operated when they are in or near the middle position of the three-position switch, whereas the respective auxiliary switches provide a constant signal throughout the whole path of operation.

30 **[0005]** This causes a problem when it comes to the usage of these signals for the control of the motor which operates the three-position switch. In order to overcome this problem, it is possible to install two individual circuits for the motor operation, wherein one is responsible for the control of the isolator and the other is responsible for the control of the earthing switch. These two circuits are connected in parallel to the motor. For safety reasons it is necessary to interlock the circuits against each other. The disadvantages are that the solution is mechanically complex and requires more equipment for the operation of the electrical motor.

35 **[0006]** Another option would be to use an electronic or electromechanical memory in order to store the current position of the three-position switch. The disadvantage of this solution is, that the information can either be lost through a power supply outage, or through manual alternation of the memory device.

40 **[0007]** The document WO 2011/023205 A1 discloses a drive device, in particular for a multi-position switching apparatus, for example for a disconnecting and earthing switch, the movable contact piece of which can be brought into three different positions: switched-on position, disconnected position, earthing position, and back, comprising a carrier which can be moved linearly by means of a linear motion drive, wherein an electromagnetically controllable link motion is provided, which retains and locks the carrier in the three positions.

Summary of the invention

50 **[0008]** It is an object of the present invention to provide a switch assembly for a low, medium or high voltage switchgear, which generates continuous and reliable electrical position indication signals for the motor control of medium or high voltage switches. This object is achieved by the subject-matter of the independent Claim 1. Further exemplary embodiments are evident from the dependent Claims and the following description.

55 **[0009]** According to the invention at least a first signal generating element is provided in mechanically corresponding way to the three-position switch for detecting the switched-on position, and furthermore at least a second signal generating element for detecting the earthing position and at least a third signal generating element for detecting the disconnecting position, and that additionally auxiliary signal generating elements are signalwise coupled with the first and/or second and/or third signal generating elements in that way, that the signal of the first, second and third signal generating element

corresponds with the position of the moving contact piece in a bijective detectable way. As signal generating elements micro switches can be used as the easiest form of signal generating elements.

The disadvantage of the discontinuous signal of the micro switches can be compensated if contacts of the auxiliary switches are wired in series respectively in parallel to the micro switch contacts. This solution allows to use the linear operation of the switches for the position indication and to apply a circuit for the motor control with less equipment. The flank of the open and close position indication signal is always generated through the micro switches. This is necessary due to the fact that only the micro switches can provide the exact position indication for the control of the electrical motor. The commutation of the current flow from the micro switch to the auxiliary switch cannot be recognized through an external circuit which is connected to the internal circuit.

[0010] Preferably, the micro switches and the auxiliary switches are electrical, mechanical or optical switches. An example for the electrical switch is a proximity switch. Furthermore inductive position indicators can be used.

[0011] Moreover, the control unit can be controlled by a microprocessor. This enables a fast and easy way to control the control unit. Furthermore, the electrical motor is a direct current motor.

[0012] According to a preferred embodiment, the auxiliary switches are positively driven. For security reasons, the control unit should be actuated through the positively driven auxiliary switches, which make sure that the electrical motor is stopped when the respective position is reached.

[0013] Furthermore is realized via a preferred embodiment, that for detecting the actuation area around the middle position of the three position switch, the microswitches 10c and 10d each are logically coupled with auxiliary switches 11 a and 11 b in that way, that a normally open contact of the auxiliary switches 11 a and 11 b are in parallel to the normally closed contacts of the microswitches 10c and 10d, and that a further normally closed contact of the auxiliary switches 11b and 11a is in series with the normally closed contact of the micro switches 10c and 10d.

Brief description of the drawings

[0014] The foregoing and other aspects of the invention will become apparent following the detailed description of the invention, when considered in conjunction with the enclosed drawings.

Figure 1 shows a simplified depiction of a three-position switch, and

Figure 2 is a block diagram of a switch assembly for a medium or high voltage switchgear, comprising the three-position switch shown in Figure 1.

Figure 3 switching scheme of the microswitches

Figure 4 Wiring of the switches for position indication

Figure 5 Path signal diagramm

[0015] The reference symbols used in the drawings, and their meanings, are listed in summary form in the list of reference symbols. All drawings are schematic.

Detailed description of the drawings

[0016] Figure 1 shows a three-position switch 2 with a movable contact piece 3 which can be brought by an electrical motor 4 into three different positions. The actual shown position is a disconnected position 9, which is arranged between a switched-on position 5, in this case the vertical one and an earthing position 7, in this case the horizontal one. If the movable contact piece 3 is in switched-on position 5, it is connected to an isolator contact 6. However, the earthing position 7 connects the movable contact piece 3 to an earth contact 8.

[0017] According to Figure 2 the switch assembly 1 comprises the electrical motor 4, the three-position switch 2, with a linear movement of a drive system, four micro switches 10a, 10b, 10c, 10d and two auxiliary switches 11 a, 11 b being arranged at the three-position switch 2 for detecting indirectly the position of the movable piece 3 and generating electrical signals. The electrical signals are transmitted to a control unit 12, comprising an electrical indication unit 13, wherein the control unit 12 controls the electrical motor 4 and the electrical indication unit 13 indicates the actual position of the movable contact piece 3. The control unit 12 can be operated by a user 14 for bringing the movable piece 3 to earthing position 7 or disconnected position 9 or switched-on position 5.

[0018] The micro switches 10a, 10b, 10c, 10d generate more precise electrical signals than the auxiliary switches 11 a, 11 b do. However, the auxiliary switches 11 a, 11 b generate continuous electrical signals, because they are constantly actuated through the linear movement of the drive system in the respective position. The micro switches 10a, 10b, 10c,

10d are only actuated by the drive system when detecting means are near the respective position of the micro switches 10a, 10b, 10c, 10d.

[0019] There is a first micro switch 10a arranged at the three-position switch 2 for detecting the switched-on position 5 and a second micro switch 10d is arranged at the three-position switch 2 for detecting the earthing position 7. Two pairs of micro switches 10c, 10d and auxiliary switches 11 a, 11 b are arranged at the three-position switch 2 for detecting the disconnected position, wherein each auxiliary switch 11a, 11b is both in parallel and in series connected to each micro switch 10c, 10d.

[0020] For position indication "isolator closed", which means that the movable piece 3 is in switched-on position 5 or position indication "earthing switch closed", which means that the movable piece 3 is in earthing position 7, there is no need for auxiliary switches 11, because micro switches 10 generate more precise electrical signals. The electrical signals in this case are continuous, because of the small range of the detecting position.

[0021] For position indication "isolator open", which means that the movable piece 3 switched from the switched-on position 5 to disconnected position 9, the auxiliary switch 11a is in parallel connected to the micro switch 10c. The micro switch 10c generates the electrical signal "isolator open" and the auxiliary switch 11 a generates the electrical signal "earthing switch not open".

[0022] For position indication "earthing switch open", which means that the movable piece 3 switched from the earthing position 7 to disconnected position 9, the auxiliary switch 11 b is in parallel connected to the micro switch 10d. The micro switch 10d generates the electrical signal "earthing switch open" and the auxiliary switch 11 b generates the electrical signal "isolator not open".

[0023] By connecting the auxiliary switch 11 in parallel to the micro switch 10 a disjunction is created. The combination of the continuous but less precise electrical signal of the auxiliary switch 11 with the precise but discontinuous electrical signal of the micro switch 10 results to a continuous and precise electrical signal, which is transmitted to the control unit 12. The electrical indication unit 13 indicates the actual position of the movable contact piece 3.

[0024] For position indication "isolator not open", which means that the movable piece 3 switched from the switched-on position 5 to disconnected position 9, but did not reach the disconnected position 9 yet, the auxiliary switch 11a is in series connected to the micro switch 10c. The micro switch 10c generates the electrical signal "isolator not open" and the auxiliary switch 11 a generates the electrical signal "earthing switch open".

[0025] For position indication "earthing switch not open", which means that the movable piece 3 switched from the earthing position 7 to disconnected position 9, but did not reach the disconnected position 9 yet, the auxiliary switch 11 b is in series connected to the micro switch 10d. The micro switch 10d generates the electrical signal "earthing switch not open" and the auxiliary switch 11 b generates the electrical signal "isolator open".

[0026] The signal propagates or exist furthermore in that case if the drive is in opposite position.

[0027] By connecting the auxiliary switch 11 in series to the micro switch 10 a conjunction is created. The combination of the continuous but less precise electrical signal of the auxiliary switch 11 with the precise but discontinuous electrical signal of the micro switch 10 results to a continuous and precise electrical signal, which is transmitted to the control unit 12. The electrical indication unit 13 indicates the actual position of the movable contact piece 3.

[0028] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art and practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In particular, the switch assembly 1 may comprise a multi-position switch instead of a three-position switch 2. The multi-position switch should have at least three different positions, namely switched-on position 5, earthing position 7 and disconnected position 9. Thus the switch assembly 1 may comprise a four-position switch.

[0029] In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

[0030] According to figure 3, the electrical open and close position indications are provided by two kinds of switches: A micro switch which provides an accurate position indication and another auxiliary switch which provides a less accurate position indication. In order to control the operation of the motor drive of a three-position switch, one has to use the accurate position indications by the micro switches for the control circuit.

[0031] The auxiliary switches can be used for visualization and interlockings. For control purposes, the direct and the inverted signal of the micro switches has to be used.

[0032] The figure 3 indicates the signals generated by micro switches and auxiliary switches according to the path of motion from one position of the switch to the other.

[0033] It is visible that the micro switches which indicate the isolator off and earthing switch off position are only operated when they are in or near the middle position of the three-position switch, whereas the respective auxiliary switches provide a constant signal throughout the whole path of operation.

[0034] This causes a problem when it comes to the usage of these signals for the control of the motor which operates the three-position switch. In fact it is not possible to apply the scheme as it was designed for the old system.

[0035] In order to overcome this problem, it is possible install two individual circuits for the motor operation - one for the control of the isolator and one for the control of the earthing switch. These two circuits are connected in parallel to the motor. For safety reasons it is necessary to interlock the circuits against each other.

[0036] According to that, figure 4 shows the wiring of the micro switches and the auxiliary switches as described in the invention.

The wiring of the micro switches for the position indication of the outer positions does not have to be changed due to the fact that the micro switches are correctly operated by the mechanism.

[0037] It is important to recognize that the flank of the respective open and close position indication signal is always generated through the micro switch. This is necessary due to the fact that only the micro switch can provide the exact position indication for the control of the motor. The commutation of the current flow from the micro switch to the auxiliary switch cannot be recognized through an external circuit which is connected to the internal circuit.

[0038] For security reasons, the motor control must be actuated through positively driven contacts which make sure that the motor is stopped when the respective position is reached. Special focus must be laid on the normally closed contacts which are used to de-energize the motor contactor. Through the application of the above described scheme, it is possible to replace micro-switches which provide a positively driven normally closed contact by cheaper ordinary ones. This applies to the position "Earthing switch open" and "Isolator open". The required function is realized by the auxiliary contacts which provide this feature through their design.

[0039] The result of the corresponding of the switches according to the middle position of the drive is shown in Figure 5, in accordance to the schematic diagram of figure 4.

ESW is standing for earthing switch.

ISO is standing for isolator

The black bars are displaying the "high"-signal and the white bars are displaying the low signal.

[0040] The upper signal ESW open in figure 5 displays, that the drive has not reached the dielectrical isolated area of the earthing contact. The black bar represents the position area of the moving contact, along which the switches 10d and 11 b causes a high signal. The second signal line above with the status "Earthing switch (ESW) not open" shows the inverted signal.

[0041] The third signal line from above with status "Isolator (ISO) open" shows the black bar which represents the status, that the drive has not reached the dielectrical isolated area of the disconnecting position. The black bar represents the position area of the moving contact, along which the switches 10c and 11a causes a high signal.

[0042] The fourth signal line shows the status "isolator not open" and shows the inverted signal of the above Isolator (ISO)-open signal.

[0043] All this results in the fact, that the dielectrical isolating areas of the earth position and the disconnecting position overlap in the middle position.

[0044] It has to be considered, that the middle position is not a discrete sharp position, but an extended area along the switching path, for example realized in that the dimensions of the contact corresponding to the middle position are larger, than the size of the moving contact.

Reference signs

[0045]

1	switch assembly
2	three-position switch
3	movable contact piece
4	electrical motor
5	switched-on position
6	isolator contact
7	earthing position
8	earth contact
9	disconnected position
10a, 10b, 10c, 10d	micro switch
11a, 11b	auxiliary switch
12	control unit
13	indication unit

14

user

Claims

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1. A switch assembly (1) for a medium or high voltage switchgear, comprising a three-position switch (2) with a movable contact piece (3) which can be brought by an electrical motor (4) into three different positions, namely:

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- a switched-on position (5), which connects the movable contact piece (3) to an isolator contact (6),
- an earthing position (7), which connects the movable contact piece (3) to an earth contact (8), and
- a disconnected position (9), which is arranged between switched-on position (5) and the earthing position (7),

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wherein two types of means for generating electrical signals for position indication are arranged at the three-position switch (2), whereof one type is a precise linear operating micro switch (10) generating a discontinuous electrical signal and the other type is a less precise auxiliary switch (11) generating a continuous electrical signal, wherein the electrical signals are transmitted to a control unit (12) for controlling the electrical motor (4), comprising an electrical indication unit (13) for indicating the actual position of the movable contact piece (3),

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characterized in that a first micro switch (10a) is coupled to the moving drive of the movable contact piece for detecting the switched-on position (5) and a second micro switch (10b) is coupled to the moving drive of the movable contact piece for detecting the earthing position (7), and two pairs of micro switches (10c, 10d) and auxiliary switches (11 a, 11 b) are coupled to the moving drive of the movable contact piece for detecting the disconnected position (9), wherein each auxiliary switch (11a, 11 b) is both in parallel and/or in series connected to each micro switch (10c, 10d).

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2. A switch according to claim 1,
characterized in that the signal generating elements are provided without the use of an electronical or electromechanical memory element.

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3. A switch according to claim 1 or 2,
characterized in that the auxiliary signal generating element is an electromechanical switch or switch arrangement with a physical switching part, which hold an electrical contact closed along a mechanically extended moving path.

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4. A switch according to claim 1 or 2,
characterized in that the signal generating elements (10a, 10b, 10c) are microswitches, and the auxiliary switches (11) are electronic, electromechanical or optical switches.

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5. A switch according to one of the aforesaid claims,
characterized in that the signal generating elements are coupled or interconnected with a control unit, controlled by a microprocessor.

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6. A switch according to one of the aforesaid claims,
characterized in that the electrical drive is a direct current motor.

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7. A switch according to one of the aforesaid claims,
characterized in that spindle drive with shaft joint.

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8. A switch according to one of the aforesaid claims,
characterized in that for detecting the actuation area around the middle position of the three position switch, the microswitches (10c) and (10d) each are logically coupled with auxiliary switches (11a) and (11b) **in that way**, that a normally open contact of the auxiliary switches (11a) and (11b) are in parallel to the normally closed contacts of the microswitches (10c) and (10d), and that a further normally closed contact of the auxiliary switches (11 b) and (11a) is in series with the normally closed contact of the micro switches (10c) and (10d).

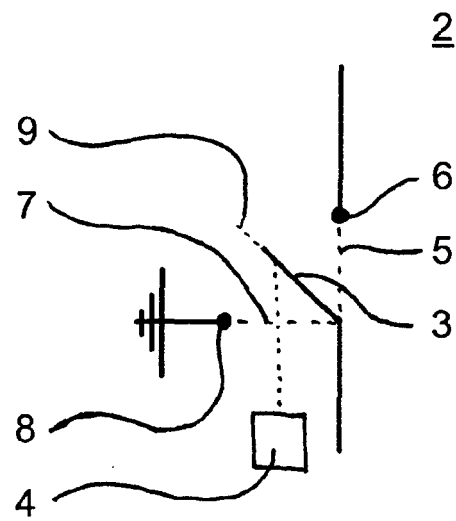


Fig. 1

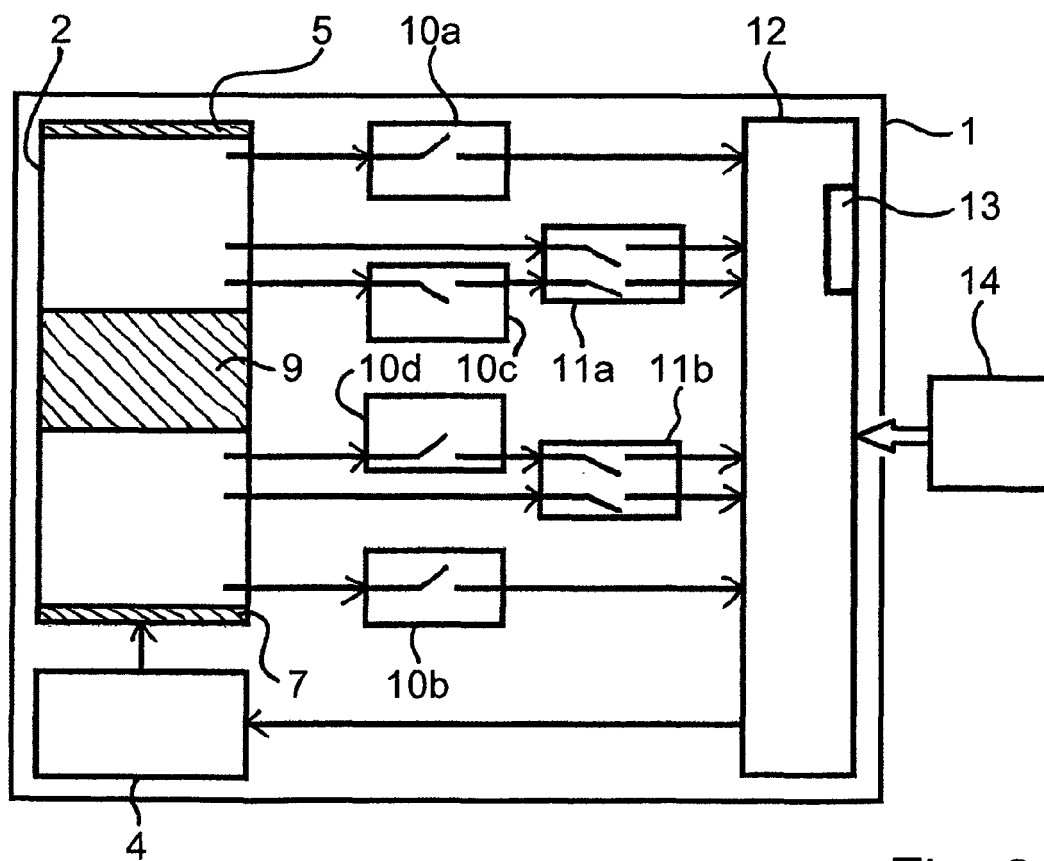


Fig. 2

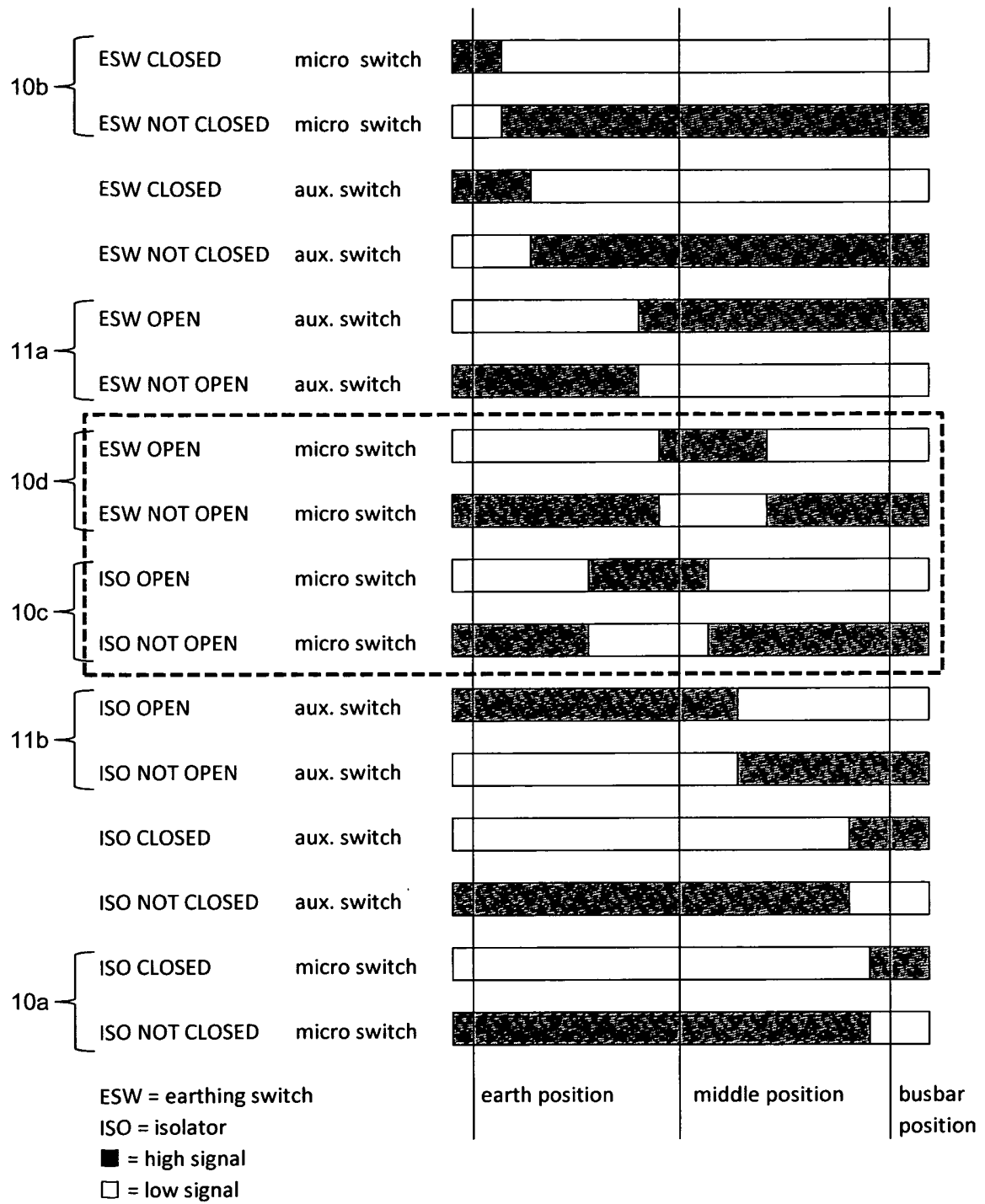
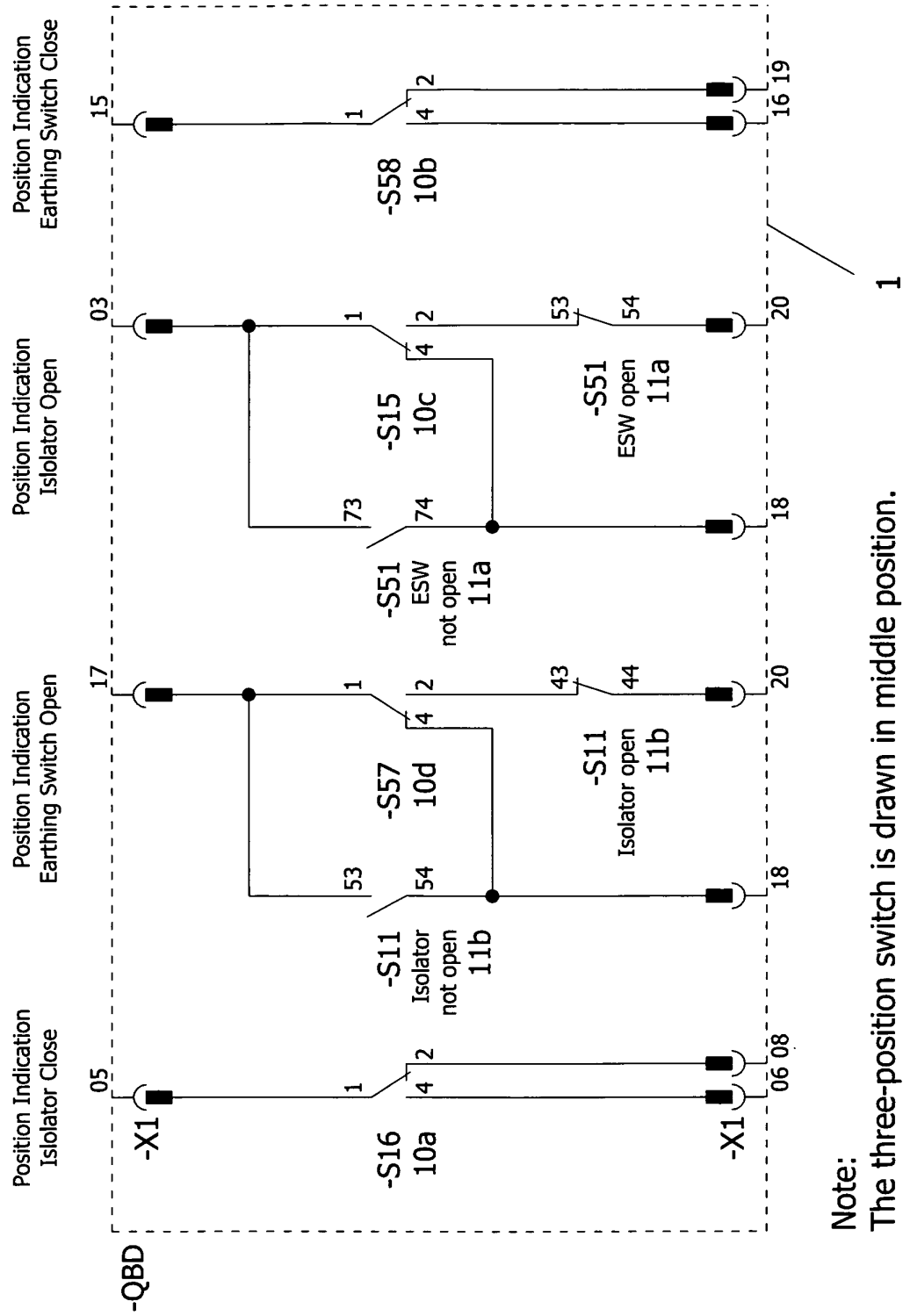


Figure 3



Note:
The three-position switch is drawn in middle position.
Therefore, contacts -S15 and -S57 are drawn operated.

Figure 4

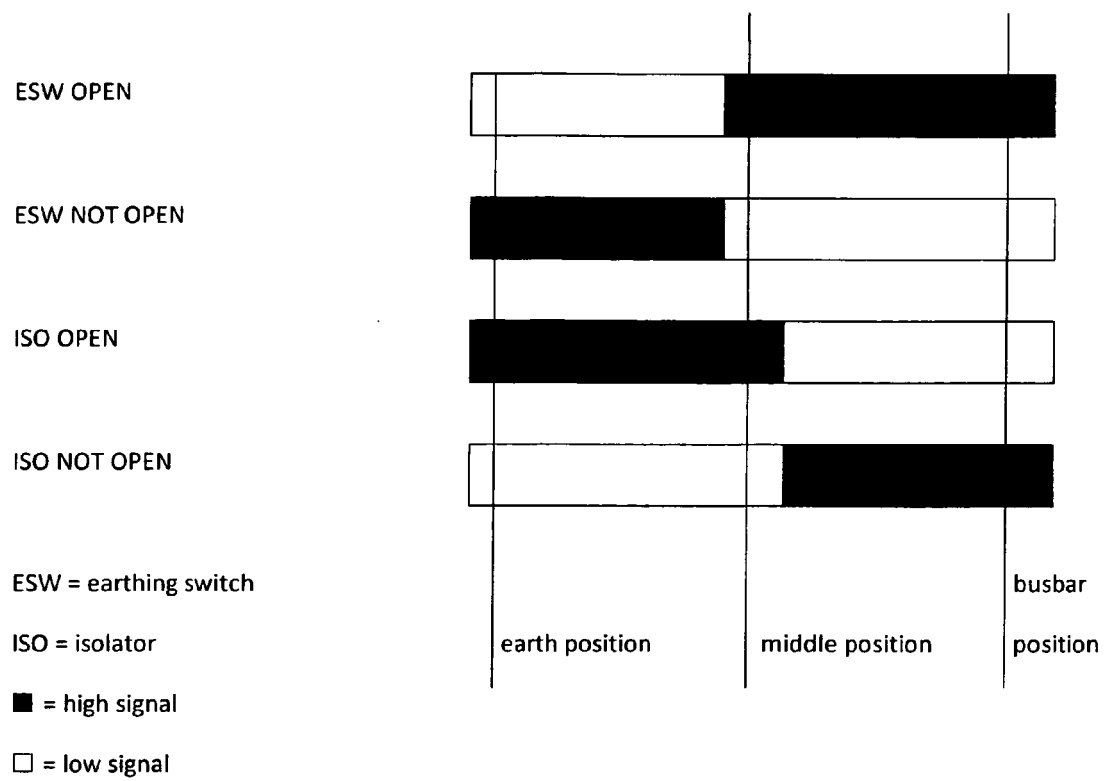


Figure 5



EUROPEAN SEARCH REPORT

Application Number
EP 12 00 7455

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2003 208837 A (TOSHIBA CORP) 25 July 2003 (2003-07-25) * paragraph [0003] - paragraph [0012]; figures 8,9 *	1-6	INV. H01H3/30 H01H9/16
A	----- EP 2 346 055 A1 (TOSHIBA KK [JP]) 20 July 2011 (2011-07-20) * paragraphs [0004] - [0008]; figure 8 *	1	
A	----- JP 2003 022735 A (TKD KK) 24 January 2003 (2003-01-24) * abstract; figures 1-7 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 April 2013	Examiner Mäki-Mantila, M
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 00 7455

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15-04-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2003208837 A	25-07-2003	JP 4146125 B2 JP 2003208837 A	03-09-2008 25-07-2003
EP 2346055 A1	20-07-2011	CN 102129922 A EP 2346055 A1 JP 2011146199 A	20-07-2011 20-07-2011 28-07-2011
JP 2003022735 A	24-01-2003	CN 1396612 A JP 4891495 B2 JP 2003022735 A KR 20030004983 A TW 518625 B	12-02-2003 07-03-2012 24-01-2003 15-01-2003 21-01-2003

EPO FORM P0459

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2011023205 A1 [0007]