(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 254 457 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.10.2023 Bulletin 2023/40

(21) Application number: **22165811.5**

(22) Date of filing: **31.03.2022**

(51) International Patent Classification (IPC):
H01H 33/02 *(2006.01)* *H01H 9/54* *(2006.01)*
H01H 3/26 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01H 33/02; H01H 9/54; H01H 2003/266; H01H 2033/028

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Hitachi Energy Switzerland AG**
5400 Baden (CH)

(72) Inventor: **ALFREDSSON, Anders**
771 35 Ludvika (SE)

(74) Representative: **Valea AB**
Box 7086
103 87 Stockholm (SE)

(54) **A SWITCH AND AN OVERVOLTAGE PROTECTION SYSTEM FOR A SERIES CAPACITOR BANK**

(57) A switch (1) comprising an interruption chamber (2), a first contact (3) electrically connected to a first circuit terminal (4) and a second contact (5) electrically connected to a second circuit terminal (6). Each electrical contact (3, 5) is movable by a respective drive means (9, 10) and the drive means (9, 10) are configured to simultaneously move the electrical contacts (3, 5) from respective first positions (po1, po2) in which the electrical contacts (3, 5) are physically separated, towards respective second positions (pc1, pc2) in which the electrical contacts (3, 5) physically contact each other.

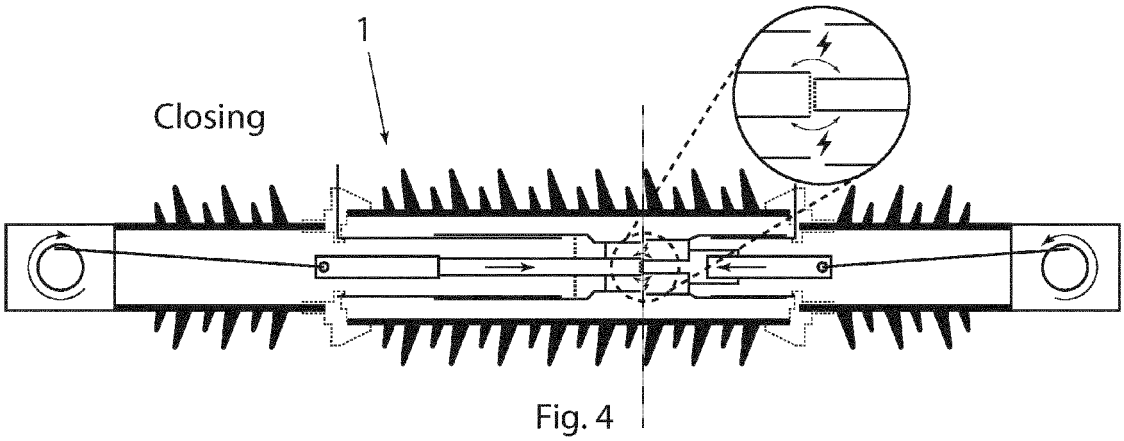

Fig. 4

EP 4 254 457 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to overvoltage protection in installations of power transmission systems.

BACKGROUND

[0002] When capacitors are inserted into a transmission system, series capacitance banks compensate for inherent line inductance to lower total impedance. In effect, this allows the circuit to transfer more energy. Such series banks may be located in the middle of (along) a transmission line or at an installation at either end of the transmission line section. The installation may be a substation.

[0003] Series capacitor banks are typically mounted on a platform energized at system voltage. An overvoltage protection system is mounted on the platform to protect the series capacitor bank from overvoltage. The overvoltage protection system typically comprises a metal oxide varistor connected in parallel with the series capacitor bank, and a switch connected in parallel with the metal oxide varistor and with the series capacitor bank. The switch is normally open, such that no electric current can flow through the switch. To prevent unacceptable overvoltage over the series capacitor bank, or unacceptable thermal stress on the metal oxide varistor, the switch is closed. The switch takes some time to close and meanwhile the metal oxide varistor protects the series capacitor bank. However, the metal oxide varistor can only operate for a limited time, depending on the thermal capacity of the metal oxide varistor of choice. Shorter closing times of the switch allows lower thermal capacity of the metal oxide varistor, thus reducing cost and size of the metal oxide varistor.

[0004] Accordingly, there is a need of a switch with shorter closing time.

[0005] Normally, switches comprise an interruption chamber provided on a support insulator fixed on ground, and with the switch electrically connected by cables to the other components. Such switches comprise a fixed first contact and a movable second contact. The second contact is movable from its open position to its closed position by means of a drive means, for example a spring-loaded mechanism. The switch is normally open, i.e. has the second contact separated a predetermined distance from the first contact such that they are physically separated and cannot conduct electric current. Once overvoltage is detected, the drive means is released such that the spring-loaded mechanism propels the second contact towards the first contact until the first and second contacts physically contact each other, allowing them to conduct electric current to bypass the metal oxide varistor and the series capacitor bank. The prior art switch has an electronic control unit positioned on ground level along with its drive means for moving the second contact at least from its open position to its closed position, but typically also back from the closed position to the open position. The high voltage levels involved require the drive means to be connected to the second contact via an electrically insulating control rod extending through the support insulator, which is often about five meters long due to the high voltage levels involved.

[0006] The accelerations and impacts of movable parts of the switch, including the control rod, are substantial and the parts involved need to be designed tough enough to withstand the forces and stresses involved. Heavier parts need more power/force to be accelerated or they will accelerate slower, and heavier parts result in higher forces and stress during impact when the first and second contacts physically contact each other at closing of the switch.

[0007] Accordingly, there is a need of a switch which is durable, inexpensive and enables shorter closing time.

SUMMARY

[0008] An object of the invention is to provide a switch with shorter closing times, wherein the switch should be suitable for high voltage use.

[0009] According to a first aspect of the present disclosure, this and other objects are achieved by a switch as defined in independent claim 1, with various optional embodiments defined in the dependent claims. The switch comprises an interruption chamber, a first contact connected to a first circuit terminal, and a second contact connected to a second circuit terminal. The first and second contacts are arranged to conduct an electric current from the first circuit terminal to the second circuit terminal when the first and second contacts are in physical contact, ie. abutting each other. The switch further comprises a first drive means that is configured to move the first contact from a first position, in which the first contact is not able to physically contact the second contact, to a second position, in which the first electrical contact is in physical contact with the second contact when the second contact is in a second position.

[0010] The switch comprises a second drive means that is configured to move the second contact from a first position, in which the second contact is not able to physically contact the first contact, to said second position of the second contact.

[0011] Hence, if the first contact is not in its second position, for example when it is in its first position, the second contact will not be able to be moved such that the second contact physically contacts the first contact; In other words, the first contact is out of reach of the second contact when the first contact is not in its second position. Similarly, the

second contact is out of reach of the first contact when the second contact is not in its second position.

[0012] Accordingly, when both the first contact and the second contact are in their second positions, they will physically contact each other, but if either one of the first contact and the second contact is not in its respective second position, the first and second contacts will not be able to physically contact each other.

[0013] The first and second drive means are configured to simultaneously move the first and second contacts from their respective first positions towards their respective second position.

[0014] Hence, when the first and second contacts are in their respective first position the switch is open and cannot conduct electrical current between its first and second circuit terminals. When the switch is to be closed, the gap between the first and second contacts is reduced until they physically contact each other. By simultaneously moving both the first contact and the second contact towards their respective second position, i.e. towards the closed position of the switch, the time needed to close the switch is decreased as compared to prior art solutions in which only one electrical contact is moved, the other electrical contact being static.

[0015] The first drive means may comprise a first actuator and the second drive means may comprise a second actuator. The use of one actuator for each drive means enable a less simple and light mechanism for transmission of forces from each actuator to each respective electrical contact, whilst allowing independent control of the movement of each electrical contact. Fewer and lighter moving parts promote greater acceleration of the respective electrical contact, thereby enabling a shorter closing time of the switch.

[0016] The first and second actuators may be servo motors. Servo motors allow for precise control in terms of angular position, acceleration, and velocity, thus enabling improved control of the movement of each electrical contact. The use of servo motors instead of conventional spring-operated mechanisms with latches mitigate dead time caused by the mechanical latches.

[0017] The servo motors may be digitally controllable. Digitally controllable servo motors use a microprocessor to receive and direct action at high-frequency voltage pulses. The faster pulses provide consistent torque for quicker and smoother response times.

[0018] The switch may further comprise an electronic control unit configured to control movement of the first drive means and the second drive means, to perform the simultaneous movement of the first and second contacts towards their respective second position.

[0019] The switch may further comprise a support structure for supporting the interruption chamber such that the interruption chamber is elevated from an underlying surface, such as ground.

[0020] The switch may comprise one or more insulators attaching the interruption chamber to the support structure.

[0021] The switch may be a live tank switch. Alternatively, the switch may be a dead tank switch.

[0022] According to a second aspect of the present disclosure, this and other objects are achieved by an installation, such as a substation, for an electric power transmission system. The installation comprises a platform that is electrically isolated from ground, and at least one switch, such as the switch according to the first aspect described above. The switch comprises an interruption chamber, a first contact connected to a first circuit terminal, and a second contact connected to a second circuit terminal. The first and second contacts are arranged to conduct an electric current from the first circuit terminal to the second circuit terminal when the first and second contacts are in physical contact.

[0023] The switch further comprises a first drive means that is configured to move the first contact from a first position, in which the first contact is not able to physically contact the second contact, to a second position, in which the first electrical contact is in physical contact with the second contact when the second contact is in a second position.

[0024] Also, the switch comprises a second drive means that is configured to move the second contact from a first position, in which the second contact is not able to physically contact the first contact, to said second position of the second contact.

[0025] The switch is mounted on the platform, and the first and second drive means of the switch are configured to simultaneously move the first and second contacts from their respective first positions towards their respective second position.

[0026] The installation may further comprise an overvoltage protector, such as a metal oxide varistor MOV bank, wherein said overvoltage protector is mounted on said platform and connected in parallel with said switch.

[0027] The installation may further comprise a series capacitor bank connected in parallel with the overvoltage protector.

[0028] According to a third aspect of the present disclosure, this and other objects are achieved by a method of closing a switch, such as a switch according to the first aspect described above.

[0029] The switch comprises an interruption chamber, a first contact connected to a first circuit terminal, and a second contact connected to a second circuit terminal. The first and second contacts are arranged to conduct an electric current from the first circuit terminal to the second circuit terminal when the first and second contacts are in physical contact.

[0030] The switch further comprises a first drive means that is configured to move the first contact from a first position, in which the first contact is not able to physically contact the second contact, to a second position, in which the first electrical contact is in physical contact with the second contact when the second contact is in a second position.

[0031] Also, the switch comprises a second drive means that is configured to move the second contact from a first

position, in which the second contact is not able to physically contact the first contact, to said second position of the second contact. The method comprises controlling the first and second drive means to simultaneously move the first and second contacts towards their respective second positions.

[0032] According to a fourth aspect of the present disclosure, this and other objects are achieved by a method of controlling an installation. The installation comprises a platform that is electrically isolated from ground, and comprises at least one switch, such as a switch according to the first aspect described above. The switch comprises an interruption chamber, a first contact connected to a first circuit terminal, and a second contact connected to a second circuit terminal. The first and second contacts are arranged to conduct an electric current from the first circuit terminal to the second circuit terminal when the first and second contacts are in physical contact.

[0033] The switch further comprises a first drive means that is configured to move the first contact from a first position, in which the first contact is not able to physically contact the second contact, to a second position, in which the first electrical contact is in physical contact with the second contact when the second contact is in a second position.

[0034] Also, the switch comprises a second drive means that is configured to move the second contact from a first position, in which the second contact is not able to physically contact the first contact, to said second position of the second contact. The method comprises closing the switch by operating said first and second drive means to simultaneously move the first and second contacts towards their respective second positions.

[0035] The installation may further comprise an overvoltage protector, such as a metal oxide varistor MOV bank, and wherein said overvoltage protector is mounted on said platform and connected in parallel with said switch, wherein the method comprises detecting an overvoltage and triggering said closing of the switch upon detection of overvoltage.

[0036] According to a fifth aspect of the present disclosure, this and other objects are achieved by using a switch, an installation, or any one of the methods described above in a high voltage circuit, such as in an electric power transmission line or system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] All figures are schematic and not drawn to scale.

Fig. 1 shows a schematic side view of an installation comprising an overvoltage protector and a switch.

Fig. 2 shows a schematic view from above of the installation shown in fig. 1.

Figs. 3-5 show a cross-sectional view of a switch according to a first embodiment.

Fig. 3 shows an open state of the switch.

Fig. 5 shows a closed state of the switch.

Fig. 4 shows the switch in a state between the open state and the closed state as a spark is formed, before a first contact physically contacts a second contact of the switch.

Fig. 6 shows an exploded view of parts of the switch.

DETAILED DESCRIPTION

[0038] A switch 1 according to a first embodiment of the invention will hereinafter be described with reference to the appended drawings.

[0039] As shown in the exploded view of fig. 6, the switch 1 comprises an interruption chamber 2, a first contact 3 connected to a first circuit terminal 4, and a second contact 5 connected to a second circuit terminal 6. The first 3 and second 5 electrical contacts are arranged to conduct an electric current from the first circuit terminal 4 to the second circuit terminal 6 when the first 3 and second 5 electrical contacts are in physical contact. The switch 1 comprises a first drive means 7 that is configured to move the first contact 3 from a first position po1, in which the first contact 3 is not able to physically contact the second contact 5, to a second position pc1, in which the first electrical contact 3 is in physical contact with the second contact 5 when the second contact 5 is in a second position pc2. Also, the switch 1 comprises a second drive means 8 that is configured to move the second contact 5 from a first position po2, in which the second contact 5 is not able to physically contact the first contact 3, to said second position pc2 of the second contact 5.

[0040] The first 7 and second 8 drive means are configured to simultaneously move the first 3 and second 5 electrical contacts from their respective first positions po1, po2 towards their respective second position pc1, pc2. Since both electrical contacts 3, 5 are moved towards each other simultaneously, the time it takes for the switch 1 to close is reduced as compared to switches in which one of the electrical contacts 3, 5 is fixed, or at least not simultaneously moved towards the other electrical contact 5, 3.

[0041] In other words, the switch 1 comprises an interruption chamber 2, a first contact 3 electrically connected to a first circuit terminal 4 and a second contact 5 electrically connected to a second circuit terminal 6. Each electrical contact 3, 5 is movable by a first drive means 7 and a second drive means 8 respectively, and the drive means 7, 8 are configured to simultaneously move the electrical contacts 3, 5 from respective first positions po1, po2 in which the electrical contacts

3, 5 are physically separated, towards respective second positions pc1, pc2 in which the electrical contacts 3, 5 physically contact each other.

[0042] Movement of the switch 1 from an open position to a closed position is shown in figs. 3-5. In fig. 4, the movement of the electrical contacts 3, 5 is illustrated by arrows and a spark formed before the electrical contacts 3, 5 physically contact each other.

[0043] The first drive means 7 comprises a first actuator 9 and the second drive means 8 comprises a second actuator 10, both in the form of servo motors, preferably digitally controllable servo motors.

[0044] As shown in fig. 3-6, each servo motor is connected to the respective electrical contact 3, 5 via a suitable mechanical transmission/linkage. The mechanical transmission/linkage transforms movement of each respective actuator 9, 10 to a movement of each respective electrical contact 3, 5. In the illustrated embodiment, the mechanical transmission comprises an arm/wheel 19 (represented by a circle in the figures) attached to an outgoing shaft of the servo motor, which shaft is rotatable by the servo motor. The arm 19 is connected to the respective electrical contact 3, 5 by a respective control rod 20.

[0045] The control rod/mechanical transmission is preferably electrically insulating such that current cannot flow from the respective electrical contact 3, 5 to the respective servo motor 9, 10 through the control rod/mechanical transmission. Typically both drive means are electrically isolated from the respective electrical contact 3, 5. This enables both drive means 7, 8 to be mounted at the same electric potential as the platform whilst still being able to break the circuit through the switch 1. The platform has the same electric potential as the transmission line.

[0046] In this embodiment, each electrical contact 3, 5 is movably supported in/on a respective support member 21 attached to the interruption chamber 2. The support members 21 are electrically conductive, but in other embodiments, each circuit terminal 4, 6 may instead be electrically connected to the respective electrical contact 3, 5 using one or more flexible contacts. In this embodiment, a cylindrical portion of each electrical contact 3, 5 comprises a cylindrical portion fitting slidably with a corresponding cylindrical portion of the respective support member 21. In other embodiments, any other suitable way of movably guiding the electrical contacts 3, 5 may be used instead.

[0047] The switch 1 comprises a support structure 12 for supporting the interruption chamber 3 such that the interruption chamber 2 is elevated from an underlying surface, such as ground 16 or a platform 15 of an installation.

[0048] As shown in fig. 1, the switch 1 comprises insulators 13 attaching the interruption chamber 2 to the support structure 12. The actuators 9, 10 are mounted on the support structure 12 and connected to the electrical contacts 3, 5 through the insulators 13. In other embodiments, the actuators 9, 10 may alternatively be mounted in any other suitable way.

[0049] The switch 1 is a live tank switch but may in other embodiments alternatively be a dead tank switch.

[0050] As shown in figures 1 and 2, the switch 1 may advantageously be used in an installation 14 of a high voltage circuit, mounted on a platform 15 of the installation 14 that is electrically isolated from ground 16.

[0051] An overvoltage protector 17, such as a metal oxide varistor (MOV) bank, is mounted on the platform 15 and connected in parallel with the switch 1. The overvoltage protector 17 is used to protect a series capacitor bank 18 mounted on the platform 15. The switch 1 is normally in an open position, i.e. not conducting any current in parallel with the MOV bank 17. Upon detection of overvoltage the switch 1 is closed such that electric current can be transferred through the switch 1 to bypass the MOV bank 17, thereby preventing the MOV bank 17 from reaching its thermal capacity. Shorter closing time of the switch 1 allows use of a MOV bank 17 with lower thermal capacity and hence lower production cost.

[0052] The system voltage for the high voltage circuit is typically between 360 kV and 800 kV, but the switch 1 can be resized/redesigned for use with other system voltages.

[0053] A specific advantage is achieved by mounting the switch 1 on the platform 15, since the voltage drop the switch 1 needs to handle when mounted on the platform 15 is considerably lower than what it would be if the switch 1 was mounted off the platform on its own insulating support structure on ground 16. For a 550 kV system voltage, the voltage over the switch 1 is typically 30-90 kV.

[0054] This enables downsizing of the electrically insulating components of the switch 1, and hence of movable parts of the switch 1, such as the arms 19 and the control rods 20. By providing smaller and lighter movable parts, the actuators 9, 10 can quicker accelerate the parts and thus achieve a shorter closing time of the switch 1.

[0055] An electronic control unit 11 may be provided as part of the switch 1 or as a separate unit provided as part of the installation. The electronic control unit 11 is configured to control movement of the first drive means 7 and the second drive means 8 to perform the simultaneous movement of the first 3 and second 5 electrical contacts towards their respective second position (pc1, pc2). The electronic control unit detects an overvoltage and controls the simultaneous movement towards the second positions

[0056] (pc1, pc2) in response to detected overvoltage, to thereby quickly close the switch 1 when overvoltage occurs.

[0057] The first and second drive means 7, 8 may be powered by any suitable power source, such as a battery or power from an electrical transmission line.

[0058] The present switch 1 could alternatively be employed in other applications than in installations for electrical

transmission lines.

1	switch	13	insulators
2	interruption chamber	14	installation
3	first contact	15	platform
4	first circuit terminal	16	ground
5	second contact	17	overvoltage protector
6	second circuit terminal	18	series capacitor bank
7	first drive means	19	arm
8	second drive means	20	control rod
9	first actuator	21	support member
10	second actuator	po1	first position of first contact
11	electronic control unit	po2	first position of second contact
12	support structure	pc1	second position of first contact
		pc2	second position of second contact

Claims

1. A switch (1) comprising:

- an interruption chamber (2),
- a first contact (3) connected to a first circuit terminal (4), and
- a second contact (5) connected to a second circuit terminal (6),
- wherein the first (3) and second (5) electrical contacts are arranged to conduct an electric current from the first circuit terminal (4) to the second circuit terminal (6) when the first (3) and second (5) electrical contacts are in physical contact,
- wherein the switch (1) comprises a first drive means (7) that is configured to move the first contact (3) from a first position (po1), in which the first contact (3) is not able to physically contact the second contact (5), to a second position (pc1), in which the first electrical contact (3) is in physical contact with the second contact (5) when the second contact (5) is in a second position (pc2),
- wherein the switch (1) comprises a second drive means (8) that is configured to move the second contact (5) from a first position (po2), in which the second contact (5) is not able to physically contact the first contact (3), to said second position (pc2) of the second contact (5),

characterized in that

- the first (7) and second (8) drive means are configured to simultaneously move the first (3) and second (5) electrical contacts from their respective first positions (po1, po2) towards their respective second position (pc1, pc2).

2. The switch (1) according to claim 1, wherein the first drive means (7) comprises a first actuator (9) and wherein the second drive means (8) comprises a second actuator (10).

3. The switch (1) according to claim 2, wherein the first (9) and second (10) actuators are servo motors.

4. The switch (1) according to claim 3, wherein the servo motors are digitally controllable.

5. The switch (1) according to any one of claims 1-4, further comprising an electronic control unit (11) configured to control movement of the first drive means (7) and the second drive means (8) to perform the simultaneous movement of the first (3) and second (5) electrical contacts towards their respective second position (pc1, pc2).

6. The switch (1) according to any one of claims 1-5, further comprising a support structure (12) for supporting the interruption chamber (3) such that the interruption chamber (2) is elevated from an underlying surface, in particular

ground.

7. The switch (1) according to claim 6, wherein the switch (1) comprises one or more insulators (13) attaching the interruption chamber (2) to the support structure (12).

8. The switch (1) according to any one of the preceding claims, wherein the switch (1) is a live tank switch.

9. The switch (1) according to any one of the preceding claims, wherein the switch (1) is a dead tank switch.

10. An installation (14) for an electric power transmission system, wherein the installation (14) comprises:

a platform (15) that is electrically isolated from ground (16), and at least one switch (1),
wherein the switch (1) comprises:

- an interruption chamber (2),
- a first contact (3) connected to a first circuit terminal (4), and
- a second contact (5) connected to a second circuit terminal (6),
- wherein the first (3) and second (5) electrical contacts are arranged to conduct an electric current from the first circuit terminal (4) to the second circuit terminal (6) when the first (3) and second (5) electrical contacts are in physical contact,
- wherein the switch (1) comprises a first drive means (7) that is configured to move the first contact (3) from a first position (po1), in which the first contact (3) is not able to physically contact the second contact (5), to a second position (pc1), in which the first electrical contact (3) is in physical contact with the second contact (5) when the second contact (5) is in a second position (pc2), and
- wherein the switch (1) comprises a second drive means (8) that is configured to move the second contact (5) from a first position (po2) in which the second contact (5) is not able to physically contact the first contact (3), to said second position (pc2) of the second contact (5),

wherein the installation (14) is **characterized in that:**

- the switch (1) is mounted on the platform (15), and
- the first (7) and second (8) drive means of the switch (1) are configured to simultaneously move the first (3) and second (5) electrical contacts from their respective first positions (po1, po2) towards their respective second position (pc1, pc2).

11. The installation (14) according to 10, **characterized in that** the installation (14) further comprises an overvoltage protector (17), such as a metal oxide varistor (MOV) bank, wherein the overvoltage protector (17) is mounted on the platform (15) and connected in parallel with the switch (1).

12. The installation (14) according to claim 11, **characterized in that** the installation (14) further comprises a series capacitor bank (18) connected in parallel with the overvoltage protector (17).

13. A method of closing a switch (1),
wherein the switch (1) comprises:

- a first contact (3) connected to a first circuit terminal (4), and
- a second contact (5) connected to a second circuit terminal (6), wherein the first (3) and second (5) electrical contacts are arranged to conduct an electric current from the first circuit terminal (4) to the second circuit terminal (6) when the first (3) and second (5) electrical contacts are in physical contact,
- a first drive means (7) that is configured to move the first contact (3) from a first position (po1), in which the first contact (3) is not able to physically contact the second contact (5), to a second position (pc1), in which the first electrical contact (3) is in physical contact with the second contact (5) when the second contact (5) is in a second position (pc2), and
- a second drive means (8) that is configured to move the second contact (5) from a first position (po2), in which the second contact (5) is not able to physically contact the first contact (3), to said second position (pc2) of the second contact (5),

wherein the method is **characterized by** controlling said first (7) and second (8) drive means to simultaneously

move the first (3) and second (5) electrical contacts towards their respective second positions (pc1, pc2).

14. A method of controlling an installation (14), wherein the installation (14) comprises a platform (15) that is electrically isolated from ground (16), and comprises at least one switch (1),
wherein the switch (1) comprises:

- an interruption chamber (2),
- a first contact (3) connected to a first circuit terminal (4) and
- a second contact (5) connected to a second circuit terminal (6), wherein said first (3) and second (5) electrical contacts are arranged to conduct an electric current from said first circuit terminal (4) to said second circuit terminal (6) when said first (3) and second (5) electrical contacts are in physical contact,
- a first drive means (7) that is configured to move the first contact (3) from a first position (po1), in which the first contact (3) is not able to physically contact the second contact (5), to a second position (pc1), in which the first electrical contact (3) is in physical contact with the second contact (5) when the second contact (5) is in a second position (pc2), and
- a second drive means (8) that is configured to move the second contact (5) from a first position (po2), in which the second contact (5) is not able to physically contact the first contact (3), to said second position (pc2) of the second contact (5),

wherein the method is **characterized in that** the switch (1) is closed by operating said first (7) and second (8) drive means to simultaneously move the first (3) and second (5) electrical contacts towards their respective second positions (pc1, pc2).

15. The method according to claim 14, wherein the installation (14) further comprises an overvoltage protector (17), such as a metal oxide varistor (MOV) bank, and wherein the overvoltage protector (17) is mounted on the platform (15) and connected in parallel with the switch (1),
wherein the method is **characterized in that** it comprises detecting an overvoltage and triggering said closing of the switch (1) upon detection of overvoltage.

16. Use of a switch (1) according to any one of claims 1-9, or of a method according to any one of claims 10-15, in a high voltage circuit, such as in an electric power transmission line or system.

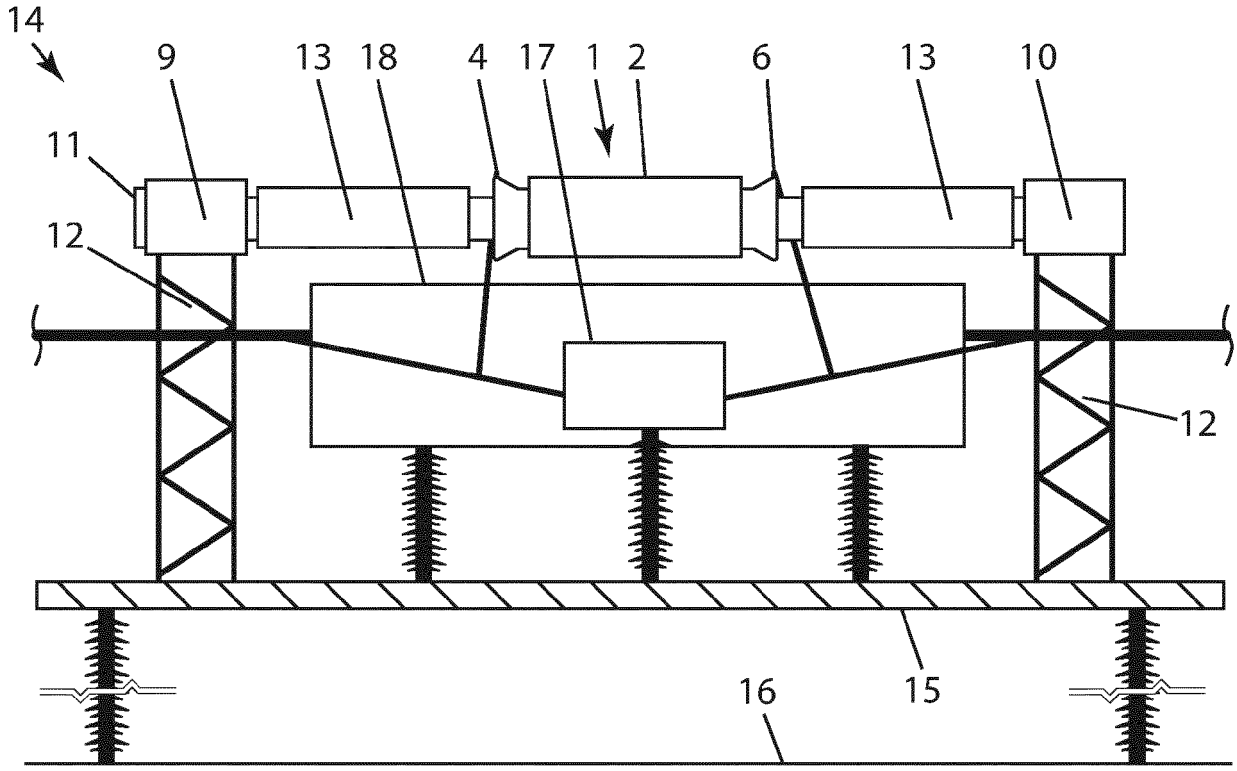

Fig. 1

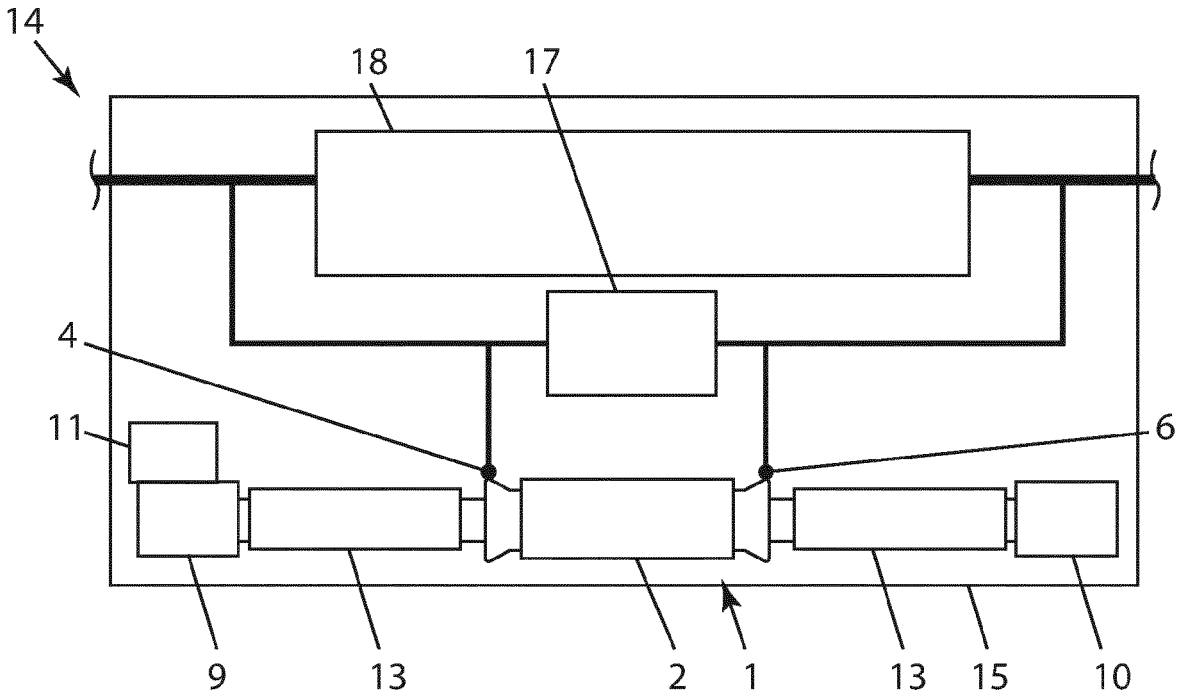

Fig. 2

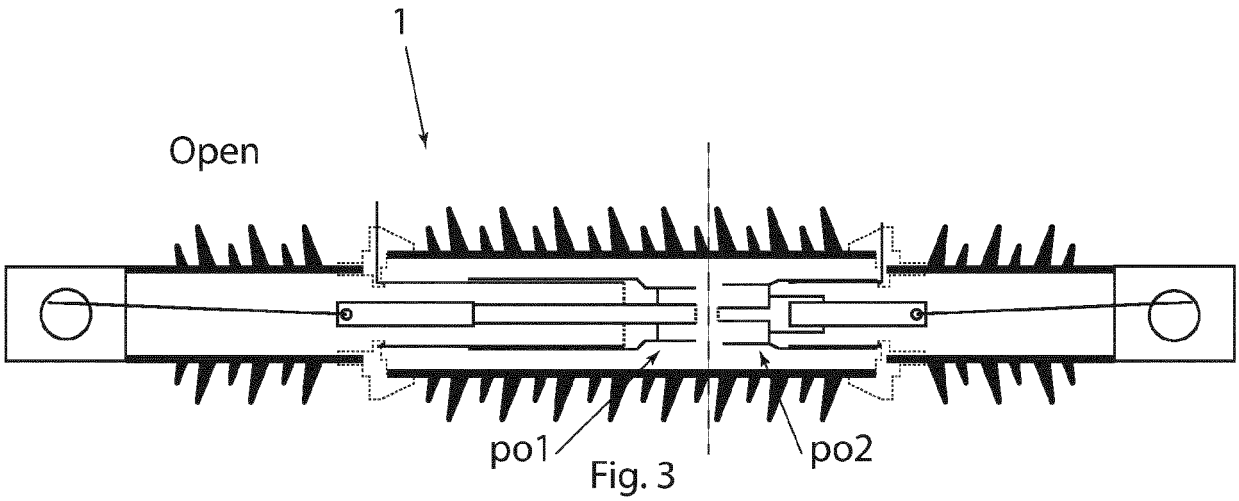

Fig. 3

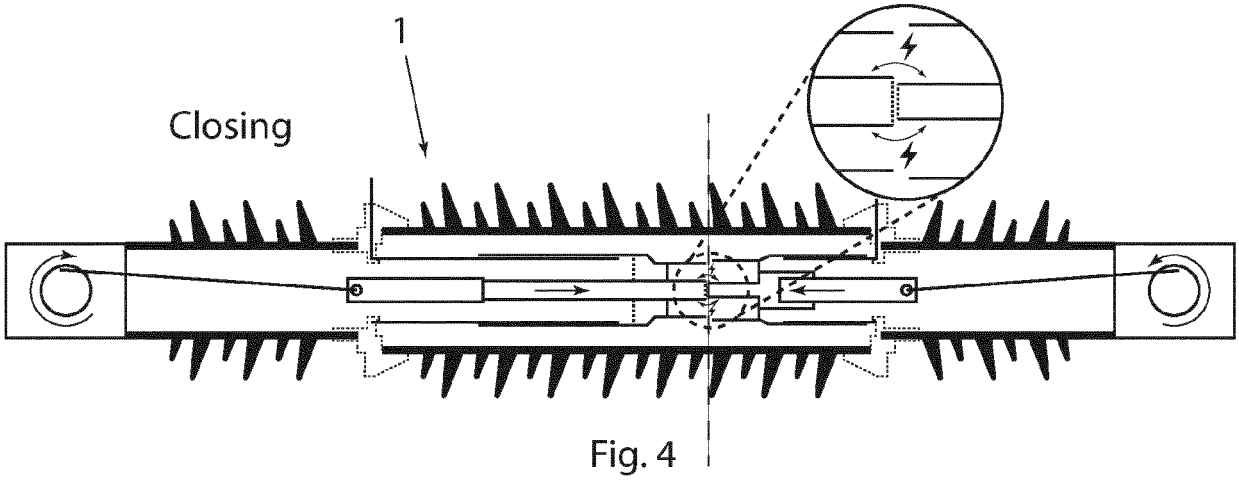

Fig. 4

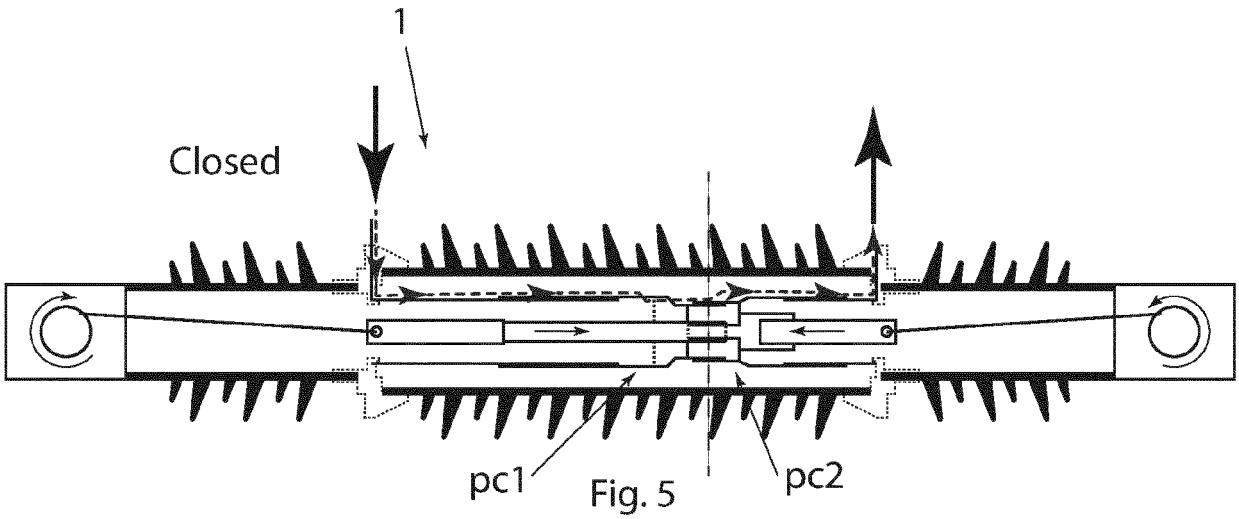

Fig. 5

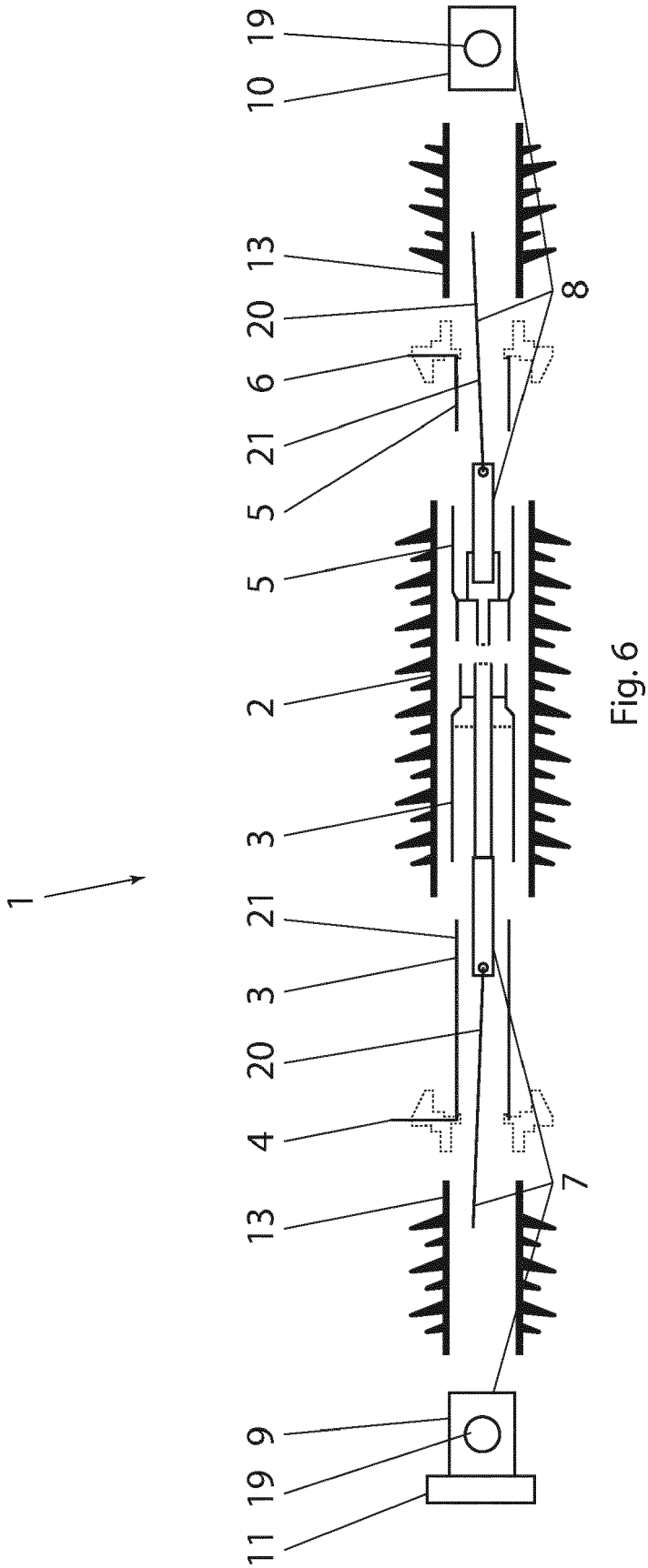

Fig. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 22 16 5811

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	FR 1 435 589 A (D APP ELECTR SPRECHER & SCHUH) 15 April 1966 (1966-04-15) * the whole document *	1,5-16	INV. H01H33/02 ADD. H01H9/54 H01H3/26
X	DE 199 63 256 C1 (SIEMENS AG [DE]) 23 May 2001 (2001-05-23) * column 3, line 17 - column 4, line 35 * * figure 1 *	1-5,8,9, 13,16	
X	US 10 923 298 B1 (CHEN STEVEN ZHENGHONG [US]) 16 February 2021 (2021-02-16) * column 3, line 17 - column 8, line 34 * * figures 1-6 *	1-5,8,9, 13,16	
X	US 2020/402752 A1 (LECCIA BRAD ROBERT [US] ET AL) 24 December 2020 (2020-12-24) * paragraphs [0016] - [0026] * * figures 1,2 *	1-5,8,9, 13,16	
			TECHNICAL FIELDS SEARCHED (IPC) H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 September 2022	Ledoux, Serge

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
.....
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 16 5811

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-09-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 1435589 A	15-04-1966	AT 258398 B	27-11-1967
		CH 409095 A	15-03-1966
		DE 1233046 B	26-01-1967
		FR 1435589 A	15-04-1966
DE 19963256 C1	23-05-2001	DE 19963256 C1	23-05-2001
		EP 1109185 A2	20-06-2001
US 10923298 B1	16-02-2021	US 10923298 B1	16-02-2021
		WO 2021197666 A1	07-10-2021
US 2020402752 A1	24-12-2020	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82