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(54) PROTECTION DEVICE FOR DISCHARGE CURRENT WITH A TRANSVERSE EXHAUST DIRECTION

(57) Protection device (1) configured to allow the circulation of a discharge current comprising: a spark gap (15) provided with a first connection assembly and a second connection assembly, an insulating casing provided with a plurality of walls forming a housing wherein are located the first electrode and the second electrode, said plurality of walls also forming an exhaust channel (51) presenting an exit section oriented toward an exhaust direction (63), the protection device (1) extending between a rear area (11) of the protection device (1) configured to cooperate with a receiving station (5) and/or a receiving bracket of a base and a front area (7) of the protection device (1), the rear area (11) being opposed to the front area (7) according to a height direction (13), the exhaust direction (63) being transverse to the height direction (13).

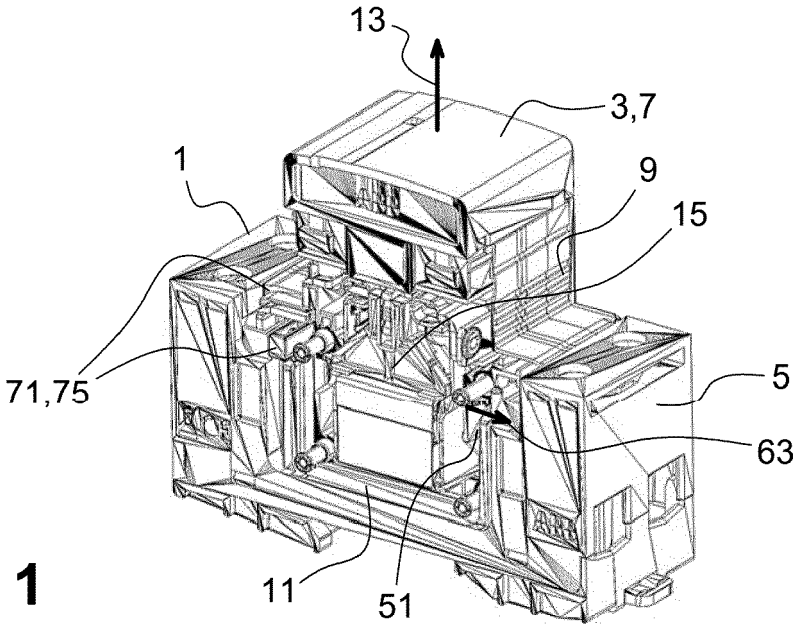

Fig. 1

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Description

Field of the invention

[0001] The present invention concerns a protection device for discharge current with a transverse exhaust direction.

Prior art

[0002] It is known to use a protection device with a spark gap intended to be disposed between a phase of an installation to be protected and the earth, the neutral and the earth, a phase and the neutral, or between two phases in the case differential protection.

[0003] Such a spark gap comprises two connection assemblies. Each connection assembly comprises an electrode and a conductive terminal cooperating with the corresponding electrode.

[0004] The two electrodes are arranged in proximity so that an overvoltage beyond a certain threshold applied to the conductive terminals generates an electric spark.

[0005] To limit an overpressure due to the electric arc, it is known to have one or several openings in an insulating casing of the protection device. This arrangement gives satisfaction in that the excess of air is easily removed from the protective device and the inside pressure drops.

[0006] However, it may be difficult to disconnect the protection device to perform insulation tests on the electrical network of the installation. It may also be necessary to replace the protection device following an accumulation of lightning strikes or a default on the network.

[0007] In addition, the ignition of the spark gap engenders very fast exhausting gas, which should be taken into account.

[0008] The present invention aims to solve all or some of the disadvantages mentioned above.

Summary of the invention

[0009] For this purpose, the present invention relates to a protection device configured to allow the circulation of a discharge current, the protection device comprising:

- a spark gap provided with a first connection assembly and a second connection assembly, the first connection assembly comprising a first electrode and a first conductive terminal cooperating with said first electrode, the second connection assembly comprising a second electrode and a second conductive terminal cooperating with said second electrode, the first electrode and the second electrode being located remotely in such a way to allow an electric spark to be formed in-between,
- an insulating casing provided with a plurality of walls forming a housing wherein are located the first electrode and the second electrode, said plurality of walls also forming an exhaust channel starting from an opening formed in the housing, the exhaust channel presenting an exit section oriented toward an exhaust direction opposed to the housing and opening outside the insulating casing,
the protection device extending between a rear area of the protection device and a front area of the protection device according to a height direction, the exhaust direction being transverse to the height direction, the rear area being configured to cooperate with a receiving station and/or a receiving bracket of a base.

[0010] In other words, oriented toward an exhaust direction opposed to the housing means that an airflow passing through the exit section is moving away from the housing.

[0011] The direction defined according to the alignment of the rear area and the front area and called height direction is not to be understood as limitative with reference to the geometry of the protection device. It simply defines a geometric direction that is equivalent to an extension direction defined according to the rear area and front area alignment.

[0012] The exit section is opening outside the insulating casing, which means that there is no wall of the insulating casing in front of the exit section in the exhaust direction. An airflow is then able to exit the exhaust channel directly outside the insulating casing.

[0013] According to an aspect of the invention, the exhaust channel is configured to exhaust air from the housing in case of an overpressure in the housing.

[0014] The fact that the protection device is configured to cooperate with a receiving station and/or a receiving bracket of a base facilitates the insulation measurements on an installation and the replacement of the protection device at the end of its life. Indeed, no cable needs to be disconnected.

[0015] This arrangement allows limiting the effects of the pressure peak due to the formed electric spark. Indeed, the pressure peak implies that an airflow tries to exit the housing. The exhaust channel is therefore useful to guide this airflow out and avoid mechanical constraints on the protection device and/or on the receiving station.

[0016] According to one aspect of the invention, the protection device can comprise a two of spark gaps mounted in series. This enables to protect several phases of an installation with a single protection device.

[0017] The fact that the exhaust direction is transverse to the height direction allows exhausting air in a direction that does not disturb a user that is located in front of the front area. In addition, the cooperation between the protection device and the receiving station is maintained, as there are no constraints according to the height direction on these parts.

[0018] According to an aspect of the invention, the front area includes a grip portion. This allows an easy handling of the protection device.

[0019] According to an aspect of the invention, the two spark gap are aligned according to a direction transverse to the height direction and to the exhaust direction. Preferably, to each spark gap corresponds an insulating casing as described in this text.

[0020] According to one possibility, the spark gap is a gas-filled spark gap.

[0021] According to an aspect of the invention, the plurality of walls are forming two exhaust channels. Preferably, the two exhaust directions of the two exhaust channels are opposed so as to define two exhaust airflows flowing in an opposed way. In particular, the two exhaust directions are aligned or parallel or inclined with an angle of less than 5 degrees.

[0022] This arrangement enables to stabilize the protection device as the constraints engendered by the two airflows are canceling each other.

[0023] According to one aspect of the invention, the exhaust channel presents an entrance elbow starting from the opening, a straight portion connected to the entrance elbow and extending along the housing, and, an exit elbow including the exit section.

[0024] The exhaust channel that is provided with an entrance elbow and an exit elbow enables to orient the airflow in a direction that will not disturb the cooperation between the protection device and the receiving station and/or the receiving bracket of a base.

[0025] The particular arrangement of the exhaust channel makes it possible to prevent the overpressure from causing the ejection of the protective device of the reception station. Indeed, the orientation in the exhaust direction suppresses the strength that might remove the protection device from the base and/or receiving station.

[0026] According to one aspect of the invention, the entrance elbow and the exit elbow are portions of the exhaust channel wherein an airflow passing through is diverted from an initial airflow direction to a final airflow direction that is transverse to the initial airflow direction.

[0027] According to one aspect of the invention, the straight portion is extending according to a direction parallel to or inclined at an angle of less than 5 degrees to the height direction and/or the opening formed in the housing is oriented in a direction transverse to the height direction.

[0028] In other words, oriented in a direction means that an airflow passing through the opening is mainly oriented according to said direction.

[0029] This arrangement allows reducing the constraints on the protection device and/or the receiving station when an overpressure appears in the housing. Indeed, the generated airflow is diverted and is not directly aimed at the receiving station.

[0030] According to one aspect of the invention, the straight portion and the housing are delimited by a separating wall of the plurality of walls, the separating wall being contiguous to the opening.

[0031] This arrangement is a simple and efficient way to create the straight portion of the exhaust channel. The separating wall has a dual purpose of defining the limit of the housing and a side of the straight portion.

[0032] According to an aspect of the invention, the exit elbow comprises an exit wall contiguous to the exit section and linked to the separating wall.

[0033] This construction is a simple way of creating the exhaust channel and in particular the exit elbow with an easy and efficient design.

[0034] According to one aspect of the invention, the entrance elbow and the straight portion comprise a diverting wall of the plurality of walls located at least in part in front of the opening in a parallel way to the exhaust direction.

[0035] The construction of the entrance elbow is also simple and effective. Preferably, the diverting wall constitutes a turning wall that realizes the rotation of the airflow in the entrance elbow.

[0036] According to one aspect of the invention, the diverting wall is partly facing the separating wall. This allows defining the straight portion of the exhaust channel with a simple construction.

[0037] According to one aspect of the invention, the protection device comprises a recess configured to cooperate with a receiving bracket of a base, the recess being formed in the rear area.

[0038] According to one aspect of the invention, the recess is configured to cooperate with a rail.

[0039] According to one aspect of the invention, the protection device comprises an interlock mechanism configured to releasably secure the protection device on a receiving station in a mounted position, the first conductive terminal and the second conductive terminal being configured to respectively cooperate with a first complementary terminal and a second complementary terminal of the receiving station in the mounted position.

[0040] The presence of the interlock mechanism facilitates the insulation measurements on an installation and the replacement of the protection device at the end of its life. Indeed, no cable needs to be disconnected.

[0041] According to one aspect of the invention, the interlock mechanism is configured to cooperate with the receiving station according to an insertion direction until the mounted position is reached, the straight portion extending parallel to or at an angle of less than 5 degrees to the insertion direction in the mounted position.

[0042] Preferably, the exhaust direction is transverse to the insertion direction. In particular, the opening and/or the exit section are oriented transverse to the insertion direction.

[0043] In other words, oriented in a direction means that an airflow passing through the opening and/or the exit section is mainly oriented according to said direction.

[0044] This arrangement allows maintaining the protection device in the mounted position, as in case of an overpressure in the housing there are not constraints on the protection device according to the insertion direction unmounting the protection device.

[0045] According to one aspect of the invention, the

interlock mechanism comprises two latch elements, each latch element being arranged to cooperate with a corresponding complementary latch element of the receiving station in the mounted position, the two latch elements being symmetric according to a central plane of the protection device.

[0046] This arrangement enables an easy insertion in the mounted position and a good position keeping as two symmetrical latch elements are used.

[0047] Preferably, the two latch elements are formed on two extremities of the insulating casing, the extremities being aligned in a direction transverse to the height direction. This arrangement participates to the good position keeping.

[0048] In particular, the two latch elements comprise each a captive screw, a quarter-turn system screw or snap-in system part. In that case, the complementary latch elements are screw thread or complementary snap-in system parts.

[0049] According to one aspect of the invention, the spark gap is provided with a deionization chamber, the first connection assembly comprises a first guiding member and the second connection assembly comprises a second guiding member, the first guiding member and the second guiding member being configured so as to allow the formed electric spark to be guided toward the deionization chamber, and, the first guiding member, the second guiding member and the deionization chamber are located in the housing.

[0050] This arrangement allows limiting the effects of the pressure peak due to the formed electric spark. Indeed, the pressure peak implies that an airflow tries to exit the housing. The exhaust channel is therefore useful to guide this airflow out and avoid mechanical constraints on the protection device and/or on the receiving station.

[0051] According to one aspect of the invention, the deionization chamber is at least partially aligned with the opening in a parallel way to the exhaust direction.

[0052] This arrangement allows the airflow generated by an electrical spark to leave the housing rapidly as the exhaust channel is near. The duration of the overpressure in the housing is then reduced.

[0053] According to one aspect of the invention, the deionization chamber includes a plurality of aligned plates configured to form small electric sparks between adjacent plates.

[0054] Preferably, the plates of the plurality of plates extend parallel to or at an angle of less than 5° to the height direction. In particular, the plates of the plurality of plates are aligned according to a direction transverse to the height direction.

[0055] This arrangement enables a compact construction of the housing as the opening is near the deionization chamber.

[0056] According to one aspect of the invention, the plurality of walls are forming two exhaust channels configured in a symmetric way compared to a central symmetry plane of the deionization chamber.

[0057] This arrangement allows a better evacuation of the airflow generated by an electric spark as a higher flow rate is enabled. In addition, the symmetry between the two exhaust channels enables the creation of two identical flow outing the two exit sections, which cancels the constraints on the protection device transversally to the height direction.

[0058] The present invention also concerns an electrical system comprising a protection device as described above and a receiving station configured to cooperate with the protection device in mounted position, the electrical system also presenting an extension channel or two extension channels when applicable, the or each extension channel realizing, in mounted position, a fluidic connection between the corresponding exhaust channel and an exterior area, the exterior area being contiguous to the electric system when the protection device and the receiving station are in mounted position.

[0059] This arrangement enables to reject the air generated by an electric spark in the exterior area and this in an effective way.

[0060] According to one aspect of the invention, the or each extension channel comprises a final portion extending in parallel way to or at an angle of less than 5° to the corresponding exhaust direction.

[0061] In other words, extending means that an airflow passing through the final portion is moving in a parallel way or inclined at an angle of less than 5° to an airflow passing through the exit section.

[0062] According to one aspect of the invention, the or each extension channel is formed in the protection device and/or in the receiving station.

[0063] This arrangement allows having a compact electrical system wherein the extension channel is easily integrated without necessitating additional space. This arrangement also enables to adapt to different protection device and receiving station designs.

[0064] According to an aspect of the invention, the electrical system comprises a support configured to cooperate with a complementary connecting element.

[0065] According to an aspect of the invention, the complementary connecting element comprises a rail. This arrangement enables to reject the airflow on the side of the rail and not on the other side that may be face by a user.

[0066] The different aspects defined above that are not incompatible can be combined.

Brief description of the figures

[0067] The invention will be better understood with the aid of the detailed description, which is set out below with reference to the appended drawing in which:

- figure 1 is a perspective view of an electrical system comprising a protection device and a receiving station;
- figure 2 is a perspective view of the receiving station ;

- figures 3 and 4 are perspective views of internal elements of the protection device;
- figures 5 and 6 are schematic cutting views of two alternatives constructions of the protection device.

Description with reference to figures

[0068] In the following detailed description of the figures defined above, the same elements or the elements that are fulfilling identical functions may retain the same references so as to simplify the understanding of the invention.

[0069] As illustrated in figures 1 and 2, an electric system 1 comprises a protection device 3 end a receiving station 5 in a mounted position. The protection device 3 is configured to allow the circulation of a discharge current.

[0070] The protection device 3 presents a front area 7 including a grip portion 9 so that a user can remove the protection device 3 from the receiving station 5. The protection device 3 also shows a rear area 11 opposed to the front area 7 according to a height direction 13.

[0071] As illustrated in figure 3, the protection device 3 comprises a spark gap 15 provided with a first connection assembly 17, a second connection assembly 19 and a deionization chamber 21. The protection device 3 comprise another spark gap mounted in series, the arrangements of both spark gaps being similar.

[0072] The first connection assembly 17 comprises a first electrode 23, a first guiding member 25 and a first conductive terminal 27 cooperating with said first electrode 23. In the same way, the second connection assembly 19 comprises a second electrode 29, a second guiding member 31 and a second conductive terminal 33 cooperating with said second electrode 29.

[0073] The first conductive terminal 27 and the second conductive terminal 33 are configured to respectively cooperate with a first complementary terminal 35 and a second complementary terminal 37 of the receiving station 5 in the mounted position.

[0074] The first connection assembly 17 and the second connection assembly 19 are symmetrical according to a central plane 39 of the protection device 3. The deionization chamber 21 also presents a central symmetry plane 41 that is merged to the central plane 39 of the protection device 3.

[0075] The first electrode 23 and the second electrode 29 are located remotely so that an electric spark can be formed in-between in case of an overvoltage. The first guiding member 25 and the second guiding member 31 are configured to allow the formed electric spark to be guided toward the deionization chamber 21.

[0076] The deionization chamber 21 comprises a plurality of aligned plates 43 configured to form small electric sparks between adjacent plates 43.

[0077] As illustrated in figures 3 and 4, the protection device 3 comprises an insulating casing 45 provided with a plurality of walls 47. Said plurality of walls 47 is forming a housing 49 wherein are located the first electrode 23, the second electrode 29, the first guiding member 25, the second guiding member 31 and the deionization chamber 21.

[0078] The plurality of walls 47 are also forming two exhaust channels 51 that are identical and symmetrical according to the central symmetry plane 41 of the deionization chamber 21. Only one exhaust channel 51 is described below for simplification purposes.

[0079] As also illustrated in figure 5 and 6, the exhaust channel 51 comprises an entrance elbow 53, a straight portion 55 and an exit elbow 57. The entrance elbow 53 is starting from an opening 59 formed in the housing 49, the opening 59 being extending according to a direction transverse to the height direction 13.

[0080] To said opening 59 corresponds a symmetrical opening 59 to which the description is also applicable.

[0081] The straight portion 55 is mounted in fluid connection with the entrance elbow 53 and the straight portion 55 is extending along the housing 49. The straight portion 55 is extending parallel to the height direction 13.

[0082] The exit elbow 57 is in fluidic connection with the straight portion 55 and presents an exit section 61 oriented toward an exhaust direction 63 opposed to the housing that is transverse to the height direction 13. The exit section 61 is opening outside the insulating casing 45.

[0083] Thus, the entrance elbow 53 and the exit elbow 57 are portions of the exhaust channel 51 wherein an airflow passing through from an initial airflow direction to a final airflow direction that is transverse to the initial airflow direction as shown on figures 3 to 6.

[0084] The plurality of walls 47 comprise a separating wall 65 contiguous to the opening 59. The separating wall 65 separates the straight portion 55 and the housing 49.

[0085] The plurality of wall 47 comprise a diverting wall 67 contiguous to the exit section 61 and partially located in front of the opening 59 in a parallel way to the exhaust direction 63. The plurality of walls 47 also comprise an exit wall 69 that is contiguous to the exit section 61 and linked to the separating wall 65.

[0086] Thus, the separating wall 65, the diverting wall 67 and the exit wall 69 are forming the exhaust channel 51. The deionization chamber 21 is aligned with the opening 59 in a parallel way to the exhaust direction 63.

[0087] As illustrated in figure 1, the protection device 3 comprise an interlock mechanism 71 configured to releasably secure the protection device 3 on the receiving station 5 in mounted position. The interlock mechanism 71 is optional as will be detailed in reference with figure 6.

[0088] The protection device 3 is configured to cooperate with the receiving station 5 according to an insertion direction 73 until the mounted position is reached. The insertion direction 73 corresponds to the height direction 13 as illustrated in figures 1 and 2.

[0089] The interlock mechanism 71 comprises two latch elements 75, each latch element 75 being arranged

to cooperate with a corresponding complementary latch element 77 of the receiving station 5 in the mounted position, the two latch elements 75 being symmetric according to the central plane 39 of the protection device 3.

[0090] The two latch elements 75 are formed on two extremities of the insulating casing 45, the extremities being aligned in a direction transverse to the height direction 13 and parallel to the exhaust direction 63.

[0091] The two latch elements 75 comprise each a snap-in system part configured to cooperate with a corresponding complementary snap-in system part of the receiving station 5.

[0092] As illustrated in figure 5, the electrical system 1 also comprises two extension channels 79. Only one will be described to simplify the description, the two extension channels 79 being symmetrical according to the central plane 39 of the protection device 3 in mounted position.

[0093] The extension channel 79 is realizing, in mounted position, a fluidic connection between the exhaust channel 51 and an exterior area 81. The exterior area 81 is contiguous to the electric system 1 when the protection device 3 and the receiving station 5 are in mounted position.

[0094] The extension channel 79 comprises a final portion 83 extending parallel to the exhaust direction 63. In other words, extending means that an airflow passing through the final portion 83 is moving in a parallel way to an airflow passing through the exit section 61.

[0095] The extension channel 83 can formed in the protection device 3 and/or in the receiving station 5.

[0096] The electrical system 1 also comprises a support 87 configured to cooperate with a rail 89, the final portion 83 in mounted position being opening on and formed in the support 87.

[0097] As illustrated in figure 6, the protection device 3 can be used a standalone without interlock mechanism 71 according to another embodiment. In this configuration, the insulating casing 45 presents a recess 91 configured to cooperate with a receiving bracket of a base 93.

[0098] The receiving bracket of the base 93 in the embodiment of figure 6 is a rail identical to the rail 89 used with the receiving station 5 of figure 5.

[0099] These arrangements enable to reject the airflow transverse to the height direction 13 and not on the side a user may face. The protection device 3 is then easy to remove for operating controls or to be replaced.

[0100] As goes without saying, the invention is not limited to the sole embodiment described above by way of example, it encompasses all the variants.

Claims

1. Protection device (1) configured to allow the circulation of a discharge current, the protection device (1) comprising:
   - a spark gap (15) provided with a first connection assembly (17) and a second connection assembly (19), the first connection assembly (17) comprising a first electrode (23) and a first conductive terminal (27) cooperating with said first electrode (23), the second connection assembly (19) comprising a second electrode (29) and a second conductive terminal (33) cooperating with said second electrode (29), the first electrode (23) and the second electrode (29) being located remotely in such a way to allow an electric spark to be formed in-between,
   - an insulating casing (45) provided with a plurality of walls (47) forming a housing (49) wherein are located the first electrode (23) and the second electrode (29), said plurality of walls (47) also forming an exhaust channel (51) starting from an opening (59) formed in the housing (49), the exhaust channel (51) presenting an exit section (61) oriented toward an exhaust direction (63) opposed to the housing and opening outside the insulating casing (45),
   the protection device (1) extending between a rear area (11) of the protection device (1) and a front area (7) of the protection device (1) according to a height direction (13), the exhaust direction (63) being transverse to the height direction (13), the rear area (11) being configured to cooperate with a receiving station (5) and/or a receiving bracket of a base (93).

2. Protection device (3) according to claim 1, wherein the exhaust channel (51) presents an entrance elbow (53) starting from the opening (59), a straight portion (55) connected to the entrance elbow (53) and extending along the housing (49), and, an exit elbow (57) including the exit section (61).

3. Protection device (3) according to claim 2, wherein the straight portion (55) is extending according to a direction parallel to or inclined at an angle of less than 5 degrees to the height direction (13) and/or wherein the opening (59) formed in the housing (49) is oriented in a direction transverse to the height direction (13).

4. Protection device (3) according to one of the claims 2 or 3, wherein the straight portion (55) and the housing (49) are delimited by a separating wall (65) of the plurality of walls (47), the separating wall (65) being contiguous to the opening (59).

5. Protection device (3) according to one of the claims 2 to 4, wherein the entrance elbow (53) and the straight portion (55) comprise a diverting wall (67) of the plurality of walls (47) located at least in part in front of the opening (59) in a parallel way to the exhaust direction (63).

6. Protection device (3) according to one of the claims 1 to 5, comprising a recess (91) configured to cooperate with a receiving bracket of a base (93), the recess (93) being formed in the rear area (11).

7. Protection device (3) according to one of the claims 1 to 6, comprising an interlock mechanism (71) configured to releasably secure the protection device (3) on a receiving station (5) in a mounted position, the first conductive terminal (27) and the second conductive terminal (33) being configured to respectively cooperate with a first complementary terminal (35) and a second complementary terminal (37) of the receiving station (3) in the mounted position.

8. Protection device (3) according to claim 7, wherein the interlock mechanism (71) is configured to cooperate with the receiving station (5) according to an insertion direction (73) until the mounted position is reached, the straight portion (55) extending parallel to or at an angle of less than 5 degrees to the insertion direction (73) in the mounted position.

9. Protection device (3) according to one of the claims 7 or 8, wherein the interlock mechanism (71) comprises two latch elements (75), each latch element (75) being arranged to cooperate with a corresponding complementary latch element (77) of the receiving station (5) in the mounted position, the two latch elements (75) being symmetric according to a central plane (39) of the protection device (3).

10. Protection device (3) according to one of the claims 1 to 9, wherein the spark gap (15) is provided with a deionization chamber (21), wherein the first connection assembly (17) comprises a first guiding member (25) and wherein the second connection assembly (19) comprises a second guiding member (31), the first guiding member (25) and the second guiding member (31) being configured so as to allow the formed electric spark to be guided toward the deionization chamber (21), and, the first guiding member (25), the second guiding member (31) and the deionization chamber (21) are located in the housing (49).

11. Protection device (3) according to claim 10, wherein the deionization chamber (21) is at least partially aligned with the opening (59) in a parallel way to the exhaust direction (63).

12. Protection device (3) according to one of the claims 10 or 11, wherein the plurality of walls (47) are forming two exhaust channels (51) configured in a symmetric way compared to a central symmetry plane (41) of the deionization chamber (21).

13. Electrical system (1) comprising a protection device (3) according to one of the claims 1 to 12 and a receiving station (5) configured to cooperate with the protection device (3) in mounted position, the electrical system (1) also presenting an extension channel (79) or two extension channels (79) when applicable, the or each extension channel (79) realizing, in mounted position, a fluidic connection between the corresponding exhaust channel (51) and an exterior area (81), the exterior area (81) being contiguous to the electric system (1) when the protection device (3) and the receiving station (5) are in mounted position.

14. Electrical system (1) according to claim 13, wherein the or each extension channel (79) comprises a final portion (83) extending in parallel way to or at an angle of less than 5° to the corresponding exhaust direction (63).

15. Electrical system (1) according to one of the claims 13 or 14, wherein the or each extension channel (79) is formed in the protection device (3) and/or in the receiving station (5).

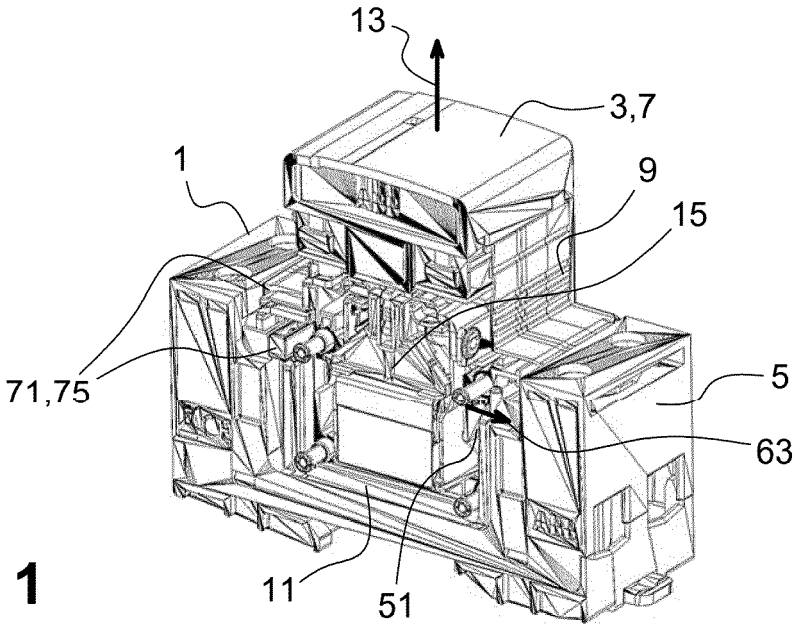

Fig. 1

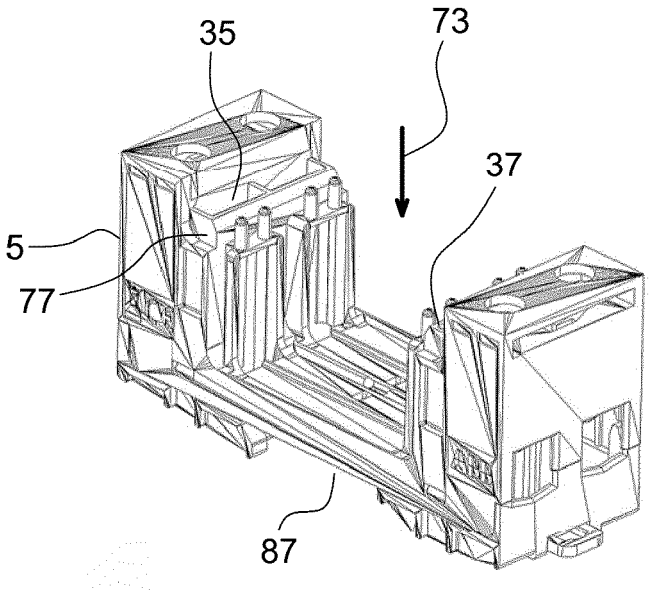

Fig. 2

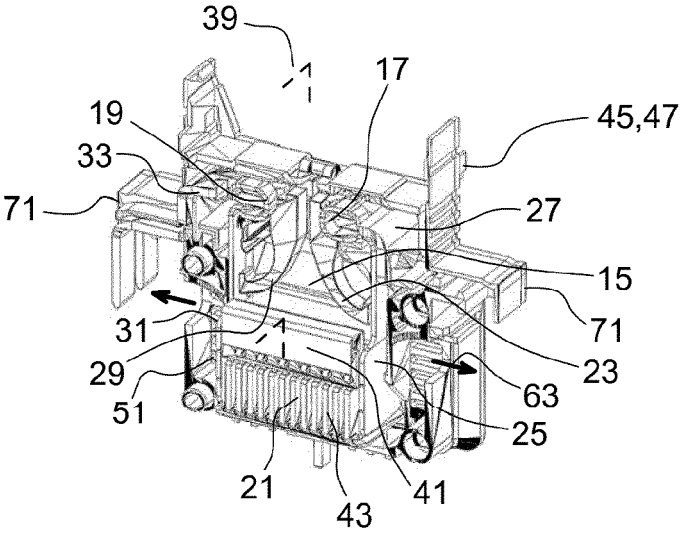

Fig. 3

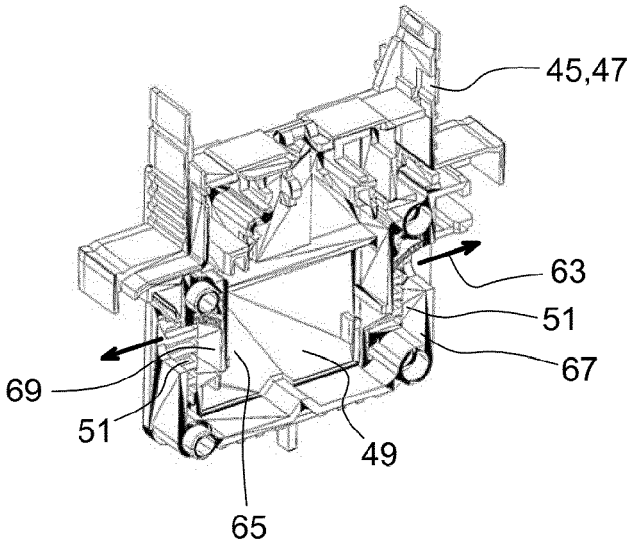

Fig. 4

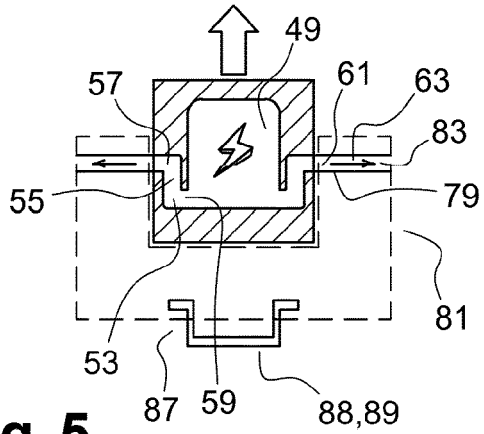

Fig. 5

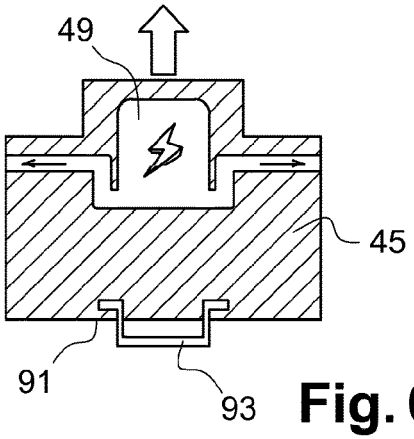

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 18 20 1743

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 Y	US 5 754 385 A (ALTMAIER HOLGER [DE] ET AL) 19 May 1998 (1998-05-19) * column 2, line 15 - line 18 * * column 6, line 45 - line 54; figure 7 * * column 8, line 13 - line 49; figures 15,16 *	1,2,6-8, 13-15 9-12	INV. H01T1/02 H01T1/15 H01T4/04 ADD. H01T4/14 H01T4/16
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 March 2019	Stichauer, Libor

CATEGORY OF CITED DOCUMENTS

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