Device for ventilating electrical functional units

The present invention relates to a device (100, 100', 100'') for ventilating an electrical functional unit (110) of high and moderate voltage, the device (100, 100', 100'') implementing at least one outflow path (101, 101', 101'') located outside the electrical functional unit (110), which is impinged by exiting gases, and which has a pressure-reducing and/or cooling effect on the exiting gases of the electrical functional unit (110), and at least one of the at least one outflow paths (101, 101', 101'') having at least one inlet opening, which is connectable to at least one exit opening (115) located in an upper area of the electrical functional unit to receive exiting gases, and wherein at least one of the at least one outflow paths (101, 101', 101'') is guided downward along a back side (112) of the electrical functional unit (110) and comprises an outlet (105) in a lower area.
Description

INTRODUCTION

[0001] The present invention relates to a device for ventilating an electrical functional unit of high and moderate voltage.

PRIOR ART

[0002] In normal operation of electrical functional units of moderate and high voltage, such as switchgears, waste heat generated by the electrical functional unit is dissipated outward via a metal grating, in case of an internal fault of the electrical functional unit, such as an electrical arc occurring in a moderate voltage facility, the compressed air generated by the electric arc being exhausted via the same metal grating and a pressure relief flap opened in parallel.

[0003] Because of the ever more compact constructions of switchgears, electrical functional units of moderate and high voltage are often used in areas in which it is possible for individuals to travel through the pressure relief areas and the area of the exit opening of the metal grating used for heat dissipation.

[0004] However, such a configuration displays the disadvantage that in the event of a pressure increase generated by a malfunction such as an electric arc within the electrical functional unit, for example, a part of the hot gas having the high pressure also escapes outward via the metal grating, and endangers the individuals located there.

DESCRIPTION OF THE INVENTION

[0005] Proceeding therefrom, the present invention is based on the object of providing ventilation for an electrical functional unit of moderate and high voltage which offers high protection against hot gases exiting from the electrical functional unit at high pressure.

[0006] This object is achieved by a device for ventilating an electrical functional unit of high and moderate voltage, the device implementing at least one outflow path, which is impinged by exiting gases, located outside the electrical functional unit, which has a pressure-reducing and/or cooling effect on the exiting gases of the electrical functional unit, and at least one of the at least one outflow paths having at least one inlet opening, which is connectable to at least one exit opening located in an upper area of the electrical functional unit to receive exiting gases, wherein at least one of the at least one outflow paths is guided downward along a back side of the electrical functional unit and comprises an outlet in a lower area.

[0007] For example, waste heat from the electrical functional unit, which is generated, for example, by at least one electrical element, such as power switches and/or current/voltage converters and/or bus bars and/or other moderate and/or high voltage electrical components within the electrical functional unit, may be dissipated through the at least one exit opening of the at least one electrical functional unit through the connected at least one outflow path to the environment outside the functional unit, the at least one outflow path being implemented in such a way that it causes cooling and/or pressure reduction of exiting hot gases, so that cooled and/or pressure-reduced gas may be discharged through at least one outlet opening of the at least one outflow path.

[0008] The electrical functional unit may be closed except for the at least one outlet opening, so that, for example, hot gases must be exhausted through the at least one outflow path. The electrical functional unit may also, for example, have further closable openings, however, which are open in normal operation and dissipate waste heat to the environment, these closable openings being closed in the event of a high pressure increase, however, for example, using a flap, so that in the event of a malfunction no hot gases may escape through these further closable openings.

[0009] Because at least one of the at least one outflow paths is connectable to at least one outlet opening located in the upper area of the electrical functional unit for receiving exiting gases, for example, waste heat may be discharged by natural heat convection from the electrical functional unit through at least one outflow path. Thus, for example, a heat buildup during normal operation of the electrical functional unit, i.e., when there is no malfunction, may be avoided.

[0010] The at least one outflow path may be implemented, for example, from a heat-conductive material, such as sheet metal, so that a hot gas conducted through the at least one outflow path may be discharged via the at least one outlet path to the environment outside the electrical functional unit in a controlled way, i.e., with reduced pressure and/or cooled, without endangering individuals at the same time, however. Other suitable materials may also be used for the at least one outflow path. Thus, for example, a great heat suddenly arising inside the electrical functional unit may be dissipated partially in a controlled way to the environment slowly via the surface of the at least one outflow path, while another part of the heat, for example, may be discharged via the at least one outlet opening of the at least one outflow path, for example.

[0011] Furthermore, the cooling effect and/or pressure reduction caused by the at least one outflow path may be adjusted by parameters such as length and/or cross-section of the at least one outflow path and thus tailored to the conditions of the electrical functional unit. Thus, for example, the at least one outflow path may have a minimum length, such as the length of a lateral face of the electrical functional unit, so that sufficient cooling and/or damping of exiting gases may be ensured.

[0012] Thus, the device according to the present invention displays the advantage that hot gas exiting from the at least one outlet opening of the electrical functional unit which is generated, for example, in the event of a...
malfunction in the electrical functional unit such as an 
electric arc, is not discharged directly through the at least 
one opening of the electrical functional unit to the envi-
ronment, but rather is initially conducted through the at 
least one outflow path situated outside the electrical func-
tional unit, the hot gas being cooled and/or reduced in 
pressure by this at least one outflow path and only then 
being discharged to the environment to the at least one 
outlet opening of the at least one outflow path. Therefore, 
endangerment of individuals outside the electrical func-
tional unit may be prevented in the event of a malfunction 
in the electrical functional unit.

[0013] Since at least one of the at least one outflow 
paths is guided downward along a back side of the elec-
trical unit, at least one outlet opening of the at least one 
outflow path may be placed on the back side of the elec-
trical functional unit, in a lower area there, for example, 
so that high individual safety may be achieved in partic-
ular on the front side of the electrical functional unit.

[0014] Therefore, hot gases exiting from the electrical 
functional unit may not only be reduced in pressure 
and/or cooled, but rather additionally conducted away on 
the back side of the electrical functional unit, so that en-
dangerment of individuals located in front of the electrical 
functional unit in particular may be avoided.

[0015] The device for ventilating the electrical func-
tional unit may be installed fixed directly on the electrical 
functional unit, for example, or may represent a compo-


tection which is mountable, i.e., attachable, and dismount-
able on the electrical functional unit. For example, the 
device may be attachable to the electrical functional unit 
using fasteners, such as screws.

[0016] In one design of the present invention, at least 
one of the at least one outflow paths is guided at least 
partially long at least one exterior side of the electrical 
functional unit.

[0017] Therefore, the at least one outflow path may be 
implemented at least partially on at least one exterior 
side of the electrical functional unit, for example, by which 
a space-saving attachment of the device may be 
achieved. For example, the at least one outflow path may 
run on the top side of the electrical functional unit toward 
the back side of the electrical functional unit.

[0018] In one design of the present invention, at least 
one of the at least one outflow paths has at least one curva-


ture.

[0019] This curvature of the at least one outflow path 
may be a soft curvature or may also represent a sharp 
bend, for example.

[0020] Therefore, for example, the at least one outflow 
path on the top side of the electrical functional unit may 
be connected to at least one exit opening of the electrical 
functional unit, the at least one outflow path being able 
to run on the top side of the electrical functional unit, then 
having a bend and/or a curvature, and running further 
downward on the back side of the electrical functional 
unit, so that, for example, the at least one outlet opening 
of the at least one outflow path may be located in a lower 


area of the back side of the electrical functional unit.

[0021] Therefore, hot gas exiting from the at least one 
opening of the electrical functional unit, which is gener-
ated, for example, in the event of a malfunction in the 
electrical functional unit such as an electric arc, for ex-
ample, may be conducted through the exemplary at least 
one outflow path initially running on the top side of the 
electrical functional unit, cooled and/or reduced in pres-


sure, then redirected via the curvature of the at least one 
outflow path and guided through the further outflow path 
running downward on the back side behind the electrical 
functional unit, for example, into a lower area of the back 
side of the electrical functional unit, the hot gases being 
able to be cooled and/or reduced in pressure further at 
this time. A longer outflow path may thus be achieved 
using the at least one curvature of the at least one outflow 
path, by which a longer path may be achieved for the hot 
gases upon exiting the electrical functional unit, accom-
panied by better cooling and/or pressure reduction, by 
which an improvement of the personal protection in front 
of the electrical functional unit may be achieved, in par-


cular if a room height of a room in which the electrical 
functional unit having the device according to the present 
invention is used is lower than normal, i.e., < 2300 mm, 
for example. Endangerment of individuals outside the 
electrical functional unit may thus be prevented in the 
event of a malfunction in the electrical functional unit.

[0022] For example, at least one of the at least one outflow 
paths may also have multiple curvatures and run on 
the top and/or back sides of the electrical functional 
units, by which the length of the at least one outflow path 
may be lengthened further and greater pressure reduc-
tion and/or cooling of the exiting gases may thus also be 
achieved.

[0023] In one design of the present invention, at least 
one of the at least one outflow paths comprises a module 
for receiving at least one absorber element to absorb or 
damp hot gases.

[0024] This module for receiving at least one absorber 
element may be located, for example, in an area of the 
at least one outflow path on the top side of the electrical 
functional unit, but also in an area of the at least one 
outflow path on the back side of the electrical functional 
unit, or at another suitable point in at least one of the at 
least one outflow paths. Thus, for example, the at least 
one module for receiving at least one absorber element 
may be located at any position inside at least one of the 
at least one outflow paths, for example, it may also be 
placed directly in front of at least one of the at least one 
outflow paths or behind the at least one outlet opening 
of at least one of the at least one outflow paths.

[0025] Together with the at least one absorber element 
used, this module for receiving at least one absorber el-


ement may also achieve further cooling and/or pressure 
reduction of hot gases conducted through at least one of 
the at least one outflow paths, by which increased indi-


vidual safety may be achieved in case of malfunction, for 
example.
[0026] In one design of the present invention, the at least one absorber element is at least one ceramic monolith having channels for the passage of gases.

[0027] The at least one absorber element may, for example, be at least one monolithic ceramic body, which has channels for the passage of hot gases and withdraws heat and has a pressure-reducing effect on introduced gas, so that gas guided through this at least one absorber element may be cooled and have its pressure reduced further in addition to the cooling effect and/or pressure reduction caused by the at least one outflow path. For example, this module for receiving at least one absorber element may represent the module disclosed in German Patent Specification DE 103 13 723 B3, and the at least one absorber element disclosed in this patent specification may be used, however, any other suitable module for receiving at least one absorber element for damping and absorbing hot gases may also be used.

[0028] In one design of the present invention, at least one of the at least one outflow paths has at least one additional opening closable using a closure element, the closure element closing the additional opening if a predetermined pressure-dependent threshold is exceeded.

[0029] The closure element may be open in normal operation of the electrical functional unit, for example, i.e., when no malfunction which generates hot gas exists, so that waste heat generated during normal operation in the electrical functional unit may be discharged directly to the environment by the heated air through the exit opening of the electrical functional unit and the at least one open additional opening, by which a heat buildup may be avoided, for example.

[0030] If the pressure in the electrical functional unit rises above a predetermined threshold, for example, in the event of a malfunction in the electrical functional unit, for example, which may be an electric arc at a power switch, for example, the at least one additional opening is closed by the particular closure element, and the hot gases are conducted along the at least one outflow path to the at least one outlet opening of the at least one outflow path to the environment and reduced in pressure and/or cooled, so that endangerment of individuals may be prevented. At least one module for receiving an absorber element may also optionally be located in at least one of the at least one outflow paths.

[0031] In one design of the present invention, the closure element represents a flap mounted so it is pivotable.

[0032] The pivotably mounted flap may be located on a top side of the at least one outflow path, for example, which may run along the top side of the electrical functional unit, for example, and the at least one flap may be situated hanging on the bottom side of the at least one additional opening, so that in the event of high pressure in the at least one outflow path, which is generated, for example, by exiting hot gases in the event of a malfunction in the electrical functional unit, for example, i.e., if a predetermined pressure-dependent threshold is exceeded, the at least one flap closes automatically and thus seals the at least one additional opening.

[0033] However, the at least one closure element may also be implemented by other alternative embodiments, such as a valve, a configuration similar to a valve, or the like.

[0034] In one design of the present invention, the device represents a module attachable to the electrical functional unit.

[0035] The device may be attachable, i.e., mountable on the electrical functional unit using fasteners, such as a screw connection or snap connection or the like. For example, the device may thus be used for retrofitting electrical functional units. Furthermore, advantages may result in the construction of electrical functional units, because the device according to the present invention may thus be transported separately from the electrical functional unit.

[0036] In one design of the present invention, the attachable module forms at least one of the at least one outflow paths together with at least one exterior wall of the electrical functional unit.

[0037] Therefore, for example, at least a part of at least one exterior wall of the electrical functional unit may also be used to implement at least one of the at least one outflow paths, so that the at least one of the at least one outflow paths is first implemented when the device is attached to the electrical functional unit. For example, the top side of the electrical functional unit may also be used to implement at least one outflow path and/or the back side of the electrical functional unit.

[0038] For example, lateral faces of the electrical functional unit may also be used.

[0039] For example, the attachable module may have an oblong U-profile for at least one outflow path to be implemented, the open side of the oblong U-profile being closed by a side wall of the electrical functional unit in the attached state of the device and thus an outflow path being implemented. By the additional use of at least one side wall to implement at least one outflow path, material costs may be reduced, for example, and a weight advantage may be achieved for the device, for example.

[0040] In one design of the present invention, the attachable module is L-shaped and forms at least one of the at least one outflow paths with at least a part of the back side and at least a part of the top side of the electrical functional unit in the attached state, the gases exiting from the electrical functional unit through at least one opening on the top side of the electrical functional unit being guided in the at least one of the at least one outflow paths and conducted to the back side of the electrical functional unit.

[0041] In one design of the present invention, the electrical functional unit represents a switchgear for moderate voltage and/or high voltage.

[0042] The switchgear may be traversable, for example, and may comprise one or more switch rooms, a separate outflow path through the device being able to be implemented for each of the switch rooms, for example.
[0043] In one design of the present invention, the switchgear is air-insulated.

[0044] In one design of the present invention, the switchgear is gas-insulated.

[0045] The switchgear may be gas-insulated by SF6, for example, however, other suitable gases may also be used for the insulation.

[0046] In one design of the present invention, the switchgear is solid-insulated.

[0047] In one design of the present invention, the switchgear is insulated by a liquid.

[0048] In one design of the present invention, the electrical functional unit represents a transformer unit.

[0049] The transformer unit comprises at least one transformer, however, it may also comprise still further electrical elements such as at least one switching device, for example.

[0050] The transformer unit may represent a transformer station, for example, furthermore, the transformer unit may also comprise a switchgear.

[0051] The electrical functional unit may also represent a combination of a switchgear and a transformer unit.

[0052] The device according to present invention has the further advantage that it may be used for retrofitting electrical functional units.

**BRIEF DESCRIPTION OF THE FIGURES**

[0053] The present invention is explained in greater detail in the following on the basis of drawings which show exemplary embodiments.

Figure 1: shows a schematic illustration of a first embodiment of the present invention;

Figure 2: shows a schematic illustration of a second embodiment of the present invention;

Figure 3: shows a schematic illustration of a third embodiment of the present invention;

Figure 4: shows a schematic illustration of a fourth embodiment of the present invention;

Figure 5a: shows the side view of a schematic illustration of the fifth embodiment of the present invention;

Figure 5b: shows the diagonal view of a schematic illustration of a fifth embodiment of the present invention;

Figure 5c: shows the schematic illustration of a fifth embodiment of the present invention in the attached state.

[0054] All explanations and advantages cited in the description, for example, of the various designs of the present invention, also apply for the embodiments shown in the figures.

[0055] Figure 1 shows a first embodiment of the device 100 for ventilating an electrical functional unit 110 in a schematic illustration.

[0056] In all figures, similar elements are provided with identical reference numerals, therefore, statements such as designs or advantages about elements in one embodiment also apply equally for similar elements in the other embodiments.

[0057] The electrical functional unit 110 may be a switchgear of moderate and/or high voltage, for example, or a transformer unit, or represent another facility of moderate and/or high voltage, the functional unit being able to be traversable or non-traversable.

[0058] The embodiment of the device 100 shown in Figure 1 only shows one outflow path 101 as an example, which is implemented outside the electrical functional unit 110 and has a pressure-reducing and/or cooling effect on the gases exiting from the electrical functional unit 110. However, the device 100 may also implement still further outflow paths for reducing the pressure and/or cooling gases exiting from the electrical functional unit 110.

[0059] The at least one outflow path 101 may be connected to at least one exit opening 115 of the electrical functional unit 110. This at least one exit opening 115 may be located on the top side of the electrical functional unit 110, for example, as shown in Figure 1, or may also be located in another area of one of the side walls of the electrical functional unit 110.

[0060] For example, waste heat from the electrical functional unit 110, which is generated, for example, by at least one electrical element such as power switches and/or current/voltage converters and/or bus bars and/or other moderate and/or high voltage electrical components inside the electrical functional unit 110, may be dissipated through the at least one exit opening 115 of the electrical functional unit 110 through the connected at least one outflow path 101 to the environment outside the functional unit 110. The at least one outflow path 101 is implemented in such a way that it causes cooling and/or pressure reduction of exiting hot gases, so that gas which is cooled and/or has its pressure reduced is discharged through the at least one outlet opening 105 of the at least one outflow path 101.

[0061] The at least one outflow path 101 may be implemented for this purpose from a heat conductive material, such as sheet metal, for example, so that a hot gas conducted through the at least one outflow path 101 may be discharged via the at least one outflow path 101 to the environment outside the electrical functional unit 110 in a controlled way, i.e., at a reduced pressure and/or cooled, without endangering individuals, a pressure reduction being able to be influenced by the selection of the cross-section of the heat-conductive material and/or the length and/or the shape of the at least one outflow path, for example. Other suitable materials may also be
used for the at least one outflow path 101. Therefore, a great heat suddenly arising inside the electrical functional unit may partially be dissipated slowly via the surface of the at least one outflow path 101 in a controlled way to the environment.

[0062] Furthermore, the cooling effect and/or pressure reduction caused by the at least one outflow path 101 may be adjusted by parameters such as length and/or cross-section of the at least one outflow path and thus tailored to the conditions of the electrical functional unit 110. Thus, the at least one outflow path 101 may have a minimum length, such as the length of a lateral face of the electrical functional unit 110, so that sufficient cooling and/or damping of exiting gases may be ensured.

[0063] The device according to the present invention thus displays the advantage that hot gas exiting from the at least one opening 115 of the electrical functional unit 110 which is generated, for example, in the event of a malfunction in the electrical functional unit 110 such as an electric arc is not discharged directly through the at least one opening 115 of the electrical functional unit 110 to the environment, but rather is first conducted through the at least one outflow path 101 situated outside the electrical functional unit, the hot gas being cooled and/or reduced in pressure by this at least one outflow path 101, and only then being discharged to the environment through the at least one outlet opening 105. Therefore, endangerment of individuals outside the electrical functional unit 110 in the event of a malfunction in the electrical functional unit 110 may be prevented.

[0064] Because at least one of the at least one outflow paths is connectable to at least one exit opening for receiving exiting gases located in an upper area of the electrical functional unit, waste heat may also be discharged through at least one outflow path from the electrical functional unit by natural heat convection, for example. Thus, for example, a heat buildup during normal operation of the electrical functional unit, i.e., when no malfunction exists, may be avoided.

[0065] For example, the at least one outflow path 101 may be implemented in such a way that the at least one outlet 105 of the at least one outflow path 101 is located on the back side of the electrical functional unit 110. Therefore, hot gases exiting from the electrical functional unit 110 may not only be reduced in pressure and/or cooled, but rather additionally conducted away to the back side of the electrical functional unit 110, so that endangerment of individuals located in front of the electrical functional unit 110 in particular may be avoided.

[0066] The device 100 for ventilating the electrical functional unit 110 may, for example, be installed fixed directly on the electrical functional unit 110, or may represent a component 100 which is mountable, i.e., attachable, and dismountable to and from the electrical functional unit 110. For example, the device 100 may be attachable to the electrical functional unit 110 using fasteners, such as screws.

[0067] Figure 2 shows a second embodiment of the device 100 for ventilating an electrical functional unit 110 in a schematic illustration. [0068] The explanations and advantages just cited in regard to the first embodiment apply equally for the second embodiment shown in Figure 2.

[0069] In relation to the device 100 illustrated in Figure 1, the device 100' illustrated in Figure 2 has the difference that the at least one outflow path 101' has at least one curvature. This curvature may be a soft curvature, i.e., a curvature having a large radius of curvature, or may also represent a sharp bend, as shown in Figure 2. Therefore, the at least one outflow path 101' may be connected to the at least one exit opening 115 on the top side of the electrical functional unit 110, for example, the at least one outflow path 101' running on the top side of the electrical functional unit 110, then having a bend and/or a curvature, and running downward on the back side of the electrical functional unit 110, so that, for example, the at least one outlet 105 of the at least one outflow path 101' may be located in a lower area of the back side of the electrical functional unit 110, as shown as an example in Figure 2.

[0070] Therefore, hot gas exiting from the at least one opening 115 of the electrical functional unit 110, which is generated, for example, in the event of a malfunction in the electrical functional unit 110, such as an electric arc, may be conducted through the at least one outflow path 101' initially running on the top side of the electrical functional unit 110, cooled and/or reduced in pressure here, then redirected via the curvature of the at least one outflow path 101' and guided through the outflow path 101' running further on the back side downward behind the electrical functional unit 110 into a lower area of the back side of the electrical functional unit 110, for example, the hot gases being able to be cooled and/or reduced in pressure further here. Therefore, a significantly longer path results for the hot gases upon exit from the electrical functional unit 110, by which an improvement of the personal protection in front of the electrical functional unit may be achieved, in particular if a room height of a room in which the electrical functional unit having the device 100, 100' according to the present invention is used is lower than normal, i.e., < 2300 mm. Therefore, endangerment of individuals outside the electrical functional unit may be prevented in the event of a malfunction in the electrical functional unit 110.

[0071] Furthermore, at least one of the at least one outflow paths 101, 101' may comprise at least one module 130 for receiving at least one absorber element for absorbing or damping hot gases, as shown as an example in the third and/or fourth embodiment in Figures 3 and 4. This module 130 for receiving at least one absorber element may be located, for example, in an area of the at least one outflow path 101 on the top side of the electrical functional unit 110, as shown in Figure 3, for example, or may also be located in an area of the at least one outflow path 101' on the back side of the electrical functional unit 110, as shown in Figure 4, for example.
The at least one absorber element may be, for example, at least one monolithic ceramic body, which has channels for the passage of hot gases and withdraws heat and has a pressure-reducing effect on introduced gas, so that the gas guided through this at least one absorber element is cooled and reduced in pressure further in addition to the cooling effect and/or pressure reduction caused by the at least one outflow path. For example, this module for receiving at least one absorber element may represent the module disclosed in German Patent Specification DE 103 13 723 B3, and the at least one absorber element disclosed in this patent specification may be used, however, any other suitable module for receiving at least one absorber element for damping and absorbing hot gases may also be used.

The positioning possibilities of the module 130 for receiving at least one absorber element schematically illustrated in Figures 3 and 4 only represent exemplary positioning possibilities, the at least one module 130 for receiving at least one absorber element may be located at any position inside at least one of the at least one outflow paths, for example, it may also be placed directly in front of at least one of the at least one outflow paths 101, 101’ or behind the at least one outlet 105 of the at least one outflow path 101, 101’.

As shown as an example in the third and fourth embodiments in Figures 3 and 4, at least one of the at least one outflow paths 101, 101’ may optionally have at least one additional opening 140 sealable using a closure element 150, the closure element 150 sealing the additional opening 140 in the event a predetermined pressure-dependent threshold is exceeded.

For example, the closure element 150 may be open in the normal operation of the electrical functional unit 110, i.e., when there is no malfunction generating a hot gas, so that waste heat generated during the normal operation in the electrical functional unit 110 may be discharged by the heated air through the exit opening 115 and the at least one open opening 140 directly to the environment, by which a heat buildup may be avoided, for example.

For example, if the pressure in the electrical functional unit 110 rises above a predetermined threshold, for example, in the event of a malfunction in the electrical functional unit 110, which may be an electric arc at a power switch, for example, the at least one additional opening 140 is closed by the particular closure element 150, and the hot gases are exhausted along the at least one outflow path 101, 101’ to the at least one outlet 105 of the at least one outflow path 101, 101’ to the environment and reduced in pressure and/or cooled at the same time, so that endangerment of individuals may be prevented. At least one module 130 for receiving at least one absorber element may optionally also be located in at least one of the at least one outflow paths 101, 101’, as shown as an example in Figures 3 and 4.

The closure element 150 may, for example, represent at least one pivotably mounted flap 150, as shown as an example in Figures 3 and 4, the at least one additional opening 140 being able to be located on the top side of the at least one outflow path 101, 101’ and the at least one flap 150 being situated hanging on the bottom side of the at least one opening 140, so that in the event of high pressure in the at least one outflow path, which may be generated, for example, by exiting hot gases in the event of a malfunction in the electrical functional unit 110, i.e., if a predetermined pressure-dependent threshold is exceeded, the at least one flap 150 closes automatically and thus closes the at least one additional opening 140. The at least one closure element 150 may also be implemented by other alternative embodiments, however, such as a valve, a configuration similar to a valve, or the like.

The positioning possibilities of the module 130 for receiving at least one absorber element schematically illustrated in Figures 3 and 4 only represent exemplary positioning possibilities, the at least one module 130 for receiving at least one absorber element may be located at any position inside at least one of the at least one outflow paths, for example, it may also be placed directly in front of at least one of the at least one outflow paths 101, 101’ or behind the at least one outlet 105 of the at least one outflow path 101, 101’.

As shown as an example in the third and fourth embodiments in Figures 3 and 4, at least one of the at least one outflow paths 101, 101’ may optionally have at least one additional opening 140 sealable using a closure element 150, the closure element 150 sealing the additional opening 140 in the event a predetermined pressure-dependent threshold is exceeded.

For example, the closure element 150 may be open in the normal operation of the electrical functional unit 110, i.e., when there is no malfunction generating a hot gas, so that waste heat generated during the normal operation in the electrical functional unit 110 may be discharged by the heated air through the exit opening 115 and the at least one open opening 140 directly to the environment, by which a heat buildup may be avoided, for example.

For example, if the pressure in the electrical functional unit 110 rises above a predetermined threshold, for example, in the event of a malfunction in the electrical functional unit 110, which may be an electric arc at a power switch, for example, the at least one additional opening 140 is closed by the particular closure element 150, and the hot gases are exhausted along the at least one outflow path 101, 101’ to the at least one outlet 105 of the at least one outflow path 101, 101’ to the environment and reduced in pressure and/or cooled at the same time, so that endangerment of individuals may be prevented. At least one module 130 for receiving at least one absorber element may optionally also be located in at least one of the at least one outflow paths 101, 101’, as shown as an example in Figures 3 and 4.

The closure element 150 may, for example, represent at least one pivotably mounted flap 150, as shown as an example in Figures 3 and 4, the at least one additional opening 140 being able to be located on the top side of the at least one outflow path 101, 101’ and the at least one flap 150 being situated hanging on the bottom side of the at least one opening 140, so that in the event of high pressure in the at least one outflow path, which may be generated, for example, by exiting hot gases in the event of a malfunction in the electrical functional unit 110, i.e., if a predetermined pressure-dependent threshold is exceeded, the at least one flap 150 closes automatically and thus closes the at least one additional opening 140. The at least one closure element 150 may also be implemented by other alternative embodiments, however, such as a valve, a configuration similar to a valve, or the like.

A fifth exemplary embodiment of the device 100" for ventilating an electrical functional unit 110 is schematically illustrated in Figures 5a, 5b, and 5c, this device 100" being implemented in the fifth embodiment in such a way that it forms a module 100" attachable to the electrical functional unit 110, which implements at least one outflow path 101" together with at least one exterior wall 111, 112 of the electrical functional unit 110.

The device 100, 100’ shown in Figures 1-4 may also be implemented in such a way that it forms an attachable module 100, 100’, which implements at least one outflow path 101, 101’ together with at least one exterior wall 111, 112 of the electrical functional unit 110 (not shown in Figures 1-4).

Figure 5a shows a side view of the device 100", Figure 5b shows a diagonal view of the device 100", and attachable device 100" is attached to the electrical functional unit 110 in Figure 5c, so that the attached device 100" implements at least one outflow path 101" together with the top side 111 and the back side 112 of the electrical functional unit.

In Figures 5a-5c, the attachable module 100" is L-shaped, for example, so that the attachable module 100" may be pushed against the electrical functional unit 110 and fastened like a cassette, e.g., by a screw connection or other fasteners, and thus at least one outflow path 101 is implemented. The electrical functional unit 110 may have a box shape, for example. However, other shapes may also be used for the attachable module 100". The L-shaped module 100" comprises two oblong U-profiles, the particular open side of the U-profile of the attachable module 100" being closed in the attached state by the top side 111 and the back side 112 of the electrical functional unit 110 and the at least one outflow path 101" being implemented.

The at least one outflow path 101" has a curvature and/or a bend, this curvature being optimized for flow by an arc 103. This arc 103 is not shown in Figure 5b.

The attachable module 100" may be shaped from sheet metal, for example, the at least one outflow path 101 representing a sheet-metal duct. For example, lateral faces of a switching room wall of the electrical functional unit 110 may also be used to implement at
The device according to claim 4,

5. The device according to claim 1,

4. The device according to claim 1, characterized in that at least one of the at least one outflow paths (101, 101', 101") comprises a module (130) for receiving at least one absorber element for absorbing or damping hot gases.

5. The device according to claim 4, characterized in that at least one absorber element is at least one ceramic monolith having channels for the passage of gases.

6. The device according to one of the preceding claims, characterized in that at least one of the at least one outflow paths (101, 101', 101") has at least one additional opening (140) sealable using a closure element (150), the closure element (150) sealing the additional opening (140) if a predetermined pressure-dependent threshold is exceeded.

7. The device according to claim 6, characterized in that the closure element (150) represents a pivotally mounted flap (150).

8. The device according to one of the preceding claims, characterized in that the device represents a module (100") attachable to the electrical functional unit (110).

9. The device according to claim 8, characterized in that the attachable module (100") forms at least one of the at least one outflow paths (101, 101', 101") together with at least one exterior wall (111, 112) of the electrical functional unit (110).

10. The device according to claim 9, characterized in that the attachable module (100") is L-shaped and, in the attached state, forms at least one of the at least one outflow paths (101, 101', 101") with at least a part of a back side (112) and at least a part of the top side (111) of the electrical functional unit (110), the gases exiting from the electrical functional unit (110) being guided through at least one opening (115) on the top side (111) of the electrical functional unit (110) in the at least one of the at least one outflow paths and being conducted to the back side (112) of the electrical functional unit (110).

11. The device according to one of the preceding claims, characterized in that the electrical functional unit (110) represents a switchgear for moderate voltage and/or high voltage.

12. The device according to claim 11, characterized in that the switchgear is air-insulated.

13. The device according to claim 11, characterized in that the switchgear is gas-insulated.

14. The device according to one of claims 1 through 11, characterized in that the electrical functional unit (110) represents a transformer unit.

15. The device according to claim 11, characterized in that the switchgear is solid-insulated.

16. The device according to claim 11, characterized in that the switchgear is insulated by a liquid.

[0084] Furthermore, the explanations and advantages cited for the first four embodiments apply equally for the fifth embodiment of the device 100" for ventilating an electrical functional unit 110 illustrated in Figures 5a-5c. Thus, for example, at least one module for receiving absorber elements for absorbing and damping hot gases may be placed in at least one of the at least one outflow paths 101", for example, and the device 100" may have at least one additional opening 140 closable using a closure element 150.

[0085] For all five embodiments described, the advantage is displayed that these devices 100, 100', 100" for ventilating an electrical functional unit 110 may be used for retrofitting electrical functional units, for example.

Claims

1. A device (100, 100', 100") for ventilating an electrical functional unit (110) of high and moderate voltage, the device (100, 100', 100") implementing at least one outflow path (101, 101', 101") located outside the electrical functional unit (110), which is impinged by exiting gases, and which has a pressure-reducing and/or cooling effect on the exiting gases of the electrical functional unit (110), and at least one of the at least one outflow paths (101, 101', 101") having at least one inlet opening, which is connectable to at least one exit opening (115) located in an upper area of the electrical functional unit to receive exiting gases, and wherein at least one of the at least one outflow paths (101, 101', 101") is guided downward along a back side (112) of the electrical functional unit (110) and comprises an outlet (105) in a lower area.

2. The device according to claim 1, characterized in that at least one of the at least one outflow paths (101, 101', 101") is at least partially guided along at least one exterior side of the electrical functional unit.

3. The device according to one of claims 1 or 2, characterized in that at least one of the at least one outflow paths (101, 101', 101") has at least one curvature.

4. The device according to claim 1, characterized in that at least one of the at least one outflow paths (101, 101', 101") comprises a module (130) for receiving at least one absorber element for absorbing or damping hot gases.

5. The device according to claim 4, characterized in that at least one absorber element is at least one ceramic monolith having channels for the passage of gases.

6. The device according to one of the preceding claims, characterized in that at least one of the at least one outflow paths (101, 101', 101") has at least one additional opening (140) sealable using a closure element (150), the closure element (150) sealing the additional opening (140) if a predetermined pressure-dependent threshold is exceeded.

7. The device according to claim 6, characterized in that the closure element (150) represents a pivotally mounted flap (150).

8. The device according to one of the preceding claims, characterized in that the device represents a module (100") attachable to the electrical functional unit (110).

9. The device according to claim 8, characterized in that the attachable module (100") forms at least one of the at least one outflow paths (101, 101', 101") together with at least one exterior wall (111, 112) of the electrical functional unit (110).

10. The device according to claim 9, characterized in that the attachable module (100") is L-shaped and, in the attached state, forms at least one of the at least one outflow paths (101, 101', 101") with at least a part of the back side (112) and at least a part of the top side (111) of the electrical functional unit (110), the gases exiting from the electrical functional unit (110) being guided through at least one opening (115) on the top side (111) of the electrical functional unit (110) in the at least one of the at least one outflow paths and being conducted to the back side (112) of the electrical functional unit (110).

11. The device according to one of the preceding claims, characterized in that the electrical functional unit (110) represents a switchgear for moderate voltage and/or high voltage.

12. The device according to claim 11, characterized in that the switchgear is air-insulated.

13. The device according to claim 11, characterized in that the switchgear is gas-insulated.

14. The device according to one of claims 1 through 11, characterized in that the electrical functional unit (110) represents a transformer unit.

15. The device according to claim 11, characterized in that the switchgear is solid-insulated.

16. The device according to claim 11, characterized in that the switchgear is insulated by a liquid.
REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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