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(73) Octrooihouder(s):
Marciso B.V. te Nuth

(72) Uitvinder(s):
Marco Peter Hubertus Deuzings te Neerharen (BE)

(74) Gemachtigde:
dr. ir. G.J.C. Verdijck c.s. te Den Haag

(54) OUTDOOR CABLE CONNECTION PROTECTOR

(57) Outdoor cable connection protector for an electrical installation, comprising a housing defining an interior configured to accommodate a connection of at least two cables, having at least one cable entry into the interior for the at least two cables, and comprising a first section and a second section, wherein the first section and the second section are moveable from an opened state for arranging the connection in the interior to a closed state in which the first section and the second section are placed on each other to enclose the connection in the interior of the housing, a seal configured to prevent ingress of water into the interior of the housing in the closed state of the housing, and an intumescent material arranged in the interior of the housing and configured to expand into the interior of the housing when heated by electrical fault in the connection.

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OUTDOOR CABLE CONNECTION PROTECTOR

The present disclosure concerns an outdoor cable connection protector for an electrical installation. The disclosure also relates to an electrical installation comprising such outdoor cable connection protector, to the use of the outdoor cable connection protector, and to a method of protecting a connection of at least two cables with an outdoor cable connection protector.

Electrical installations generally include numerous electrical connections where cables are designed to make electrical contact and transfer a signal or power from one cable to another. Such cable connections must be reliable and safe for adequate operation of the electrical installation. Various cable connection protectors have therefore been developed to maintain the electrical connection in its intended state.

In outdoor electrical installations, such as photovoltaic installations often positioned on rooftops, cable connections may be exposed to varying environmental conditions including temperature fluctuations and precipitation and the quality of the cable connection may therefore deteriorate over time. Further, arranging electrical installations outdoors often presents an increased risk of human error. In photovoltaic installations, for example, each solar panel requires direct current connections that are critical to the operation of the solar panel yet positioned at locations that are difficult to reach and thereby may present in increased risk of human error. Wrongly installed connections present an increased risk of electrical fault and thereby pose a fire hazard.

Although connectors used to connect cables of e.g. solar panels may be water proof to a certain degree, corrosion can still occur when connectors are exposed to water (in particular repeatedly and/or over longer periods of time). This corrosion of connectors gives rise to contact resistance in the connector. The heat caused by such contact resistance can cause a fire, in particular when the connector is (again) dry. Even when the connector is still wet, laying in water puddles or even submerged, a risk of electrocution presents itself. Cabling should be installed in such a way that it is prevented from laying in water. However, most fires involving photovoltaic installations in the Netherlands have been reported to be caused by badly connected connectors. In part, this may be caused by cross-mating of connectors in which different types are connected to each other. Different types of connectors do not always fit, though these are sometimes forced into a connection anyway.

It is an objective of the present disclosure to provide an outdoor cable connection protector which addresses at least one of the above and/or other risks.

The disclosure according to a first aspect provides an outdoor cable connection protector for an electrical installation, said outdoor cable connection protector comprising:

- a housing defining an interior configured to accommodate a connection of at least two

cables, having at least one cable entry into the interior for the at least two cables, and comprising a first section and a second section, wherein the first section and the second section are moveable from an opened state for arranging the connection in the interior to a closed state in which the first section and the second section are placed on each other to enclose the connection in the interior of the housing;

- a seal configured to prevent ingress of water into the interior of the housing in the closed state of the housing; and

- an intumescent material arranged in the interior of the housing and configured to expand into the interior of the housing when heated by an electrical fault in the connection.

The outdoor cable connection protector shields a connection arranged in its interior from outside deteriorating influences and protects the environment from potential consequences of electrical fault in said connection. The housing can house the connection in the interior (i.e. the interior space defined by the housing) to protect the connection against impact. Installation is facilitated as the first section and a second section are closeable onto each other from the opened state in which the connection can be placed into the interior to the closed state enclosing the connection, so that e.g. risk of human error is reduced. The seal prevents ingress of water, which could otherwise cause corrosion of the connection and/or short circuiting. The intumescent material protects the electrical installation from electrical faults such as a short-circuit, open circuit or electrical arc, which could not only ruin the connection, but even cause a fire to spread to other components of the electrical installation or any other combustible material that happens to be nearby. As the intumescent material is arranged in the interior, it may readily expand upon heating by electrical fault in the connection (or indeed electrical fault in the cables of the connection) to prevent sparks or flames, or smother any flames that have arisen, by expelling oxygen from the interior. The seal also prevents deterioration of the intumescent material by e.g. water that could otherwise seep into the interior of the housing. Thus, the outdoor cable connection protector provides improved protection of not only to a connector inside the housing, but also the electrical installation and the direct environment outside the housing.

The outdoor cable connection protector may be applied in an electrical installation comprising at least two cables, wherein the at least two cables are connected to each other at their respective cable ends and the outdoor cable connection protector is arranged over the connection. The electrical installation may in particular be formed by an outdoor electrical installation, preferably a photovoltaic installation.

According to a second aspect the disclosure relates to an electrical installation comprising at least two cables, a connection of the at least two cables at their respective cable ends and an outdoor cable connection protector according to the present disclosure arranged over the

connection. The electrical installation may be an outdoor electrical installation, preferably a photovoltaic installation.

According to a third aspect a method of protecting a connection of at least two cables is provided, the method comprising providing an outdoor cable connection protector according to the present disclosure in the opened state, arranging the connection with the at least two cables inside the opened outdoor cable connection protector, and closing the first and second sections of the housing around the connection, the at least two cables passing through the one or more than one cable entry of the outdoor cable connection protector.

The method may in particular be applied to outdoor electrical connections. Further, the outdoor cable connection protector may be selected to have an appropriate number of cable entries for the at least two cables of the connection.

A fourth aspect of the disclosure relates to the use of an intumescent material in an outdoor cable connection protector for an electrical installation.

Various additional or alternative features of the disclosure are described below and in the claims.

Reference will now be made in detail to exemplary embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. Exemplary embodiments are described below with reference to the figures, in which:

FIG. 1 shows elements of the outdoor cable connection protector prior to assembly;

FIG. 2 shows an exterior view of the outdoor cable connection protector in the closed state;

FIG. 3 shows a cross-section at the height of a cable entry through the outdoor cable connection protector in the closed state;

FIG. 4 shows an end view of the cross-section of FIG. 3;

FIG. 5 shows a cross-section at the height of a coupling mechanism in the form of a snap lock through the outdoor cable connection protector in the closed state;

FIG. 6 shows an end view of the cross-section of FIG. 5;

FIG. 7 shows the outdoor cable connection protector in the opened state;

FIG. 8 shows a cross-section at the height of the cable entry through the outdoor cable connection protector in the opened state;

FIG. 9 shows an end view of the cross-section of FIG. 8;

FIG. 10 shows a cross-section at the height of the coupling mechanism through the outdoor cable connection protector in the opened state;

FIG. 11 shows an end view of the cross-section of FIG. 10;

FIG. 12 shows a photograph of a housing section of an outdoor cable connection protector in its opened state prior to an arc test; and

FIG. 13A-13C show photographs of outdoor cable connection protectors in the opened state after performing the arc test.

The following reference signs are used:

1	outdoor cable connection protector
2	housing
3	first section
4	second section
5	cable entry
6	seal
7	intumescent material
8	recess
9	edge
10	end
11	coupling mechanism
12	snap lock
13	hook
14	ridge
15	closing surface
16	groove
17	cable clamping portion
18	holding space
19	inlay channel
20	protrusion
21	matching surface
22	distal end
23	abutment surface
24	guiding surface
30	cable
31	connector
40	temperature sensor
50	gap
70	expanded intumescent material

Figures 1 to 11 show an outdoor cable connection protector 1 for an electrical installation. The outdoor cable connection protector 1 comprises a housing 2 having a first section 3 and a

second section 4 that are closeable onto each other from an opened state (FIG. 7 – 11) into a closed state (FIG. 2 – 6) to enclose a connection of at least two cables in an interior of the housing 2 and provide at least one cable entry 5 into the interior for the at least two cables, a seal 6 configured to prevent ingress of water into the interior of the housing 2 in the closed state of the housing 2, and an intumescent material 7 configured to expand into the interior of the housing 2 when heated by electrical fault in the connection.

The intumescent material 7 may in particular be arranged in the interior of the housing 2, which interior may be variously shaped, for example with a smooth interior surface as in the illustrated example, though an undulated interior surface, e.g. with pockets or slots in which the intumescent material 7 is arranged, is also contemplated.

The housing 2 defines the interior which is configured to accommodate the connection of the at least two cables. Further, the housing 2 has at least one cable entry 5 for the at least two cables passing from an exterior of the housing 2 into the interior. The housing 2 comprises the first section 3 and a second section 4, wherein the first section 3 and the second section 4 are moveable from the opened state for arranging the connection in the interior to a closed state in which the first section 3 and the second section 4 are placed on each other to enclose the connection in the interior of the housing 2.

FIG. 1 indicates with dashed lines how two cables 30 and their connection, e.g. in the form of a connector 31, can be arranged in the illustrated outdoor cable connection protector 1. It is readily observed that the outdoor cable connection protector 1 of the illustrated embodiment is only an example that can be adapted to another number of cables or connector types.

The outdoor cable connection protector 1 provides improved fire safety for electrical installations, in particular outdoor electrical installations such as photovoltaic installations, which may be arranged on a rooftop, as a floating installation or at other locations that are not readily accessible.

It is noted that the connection in this context refers to an electrical or electronic connection and the cables are electrical or electronic cables. Such connection may be formed by directly joining two cables or by a separate element that indirectly couples the cables or brings the cables into physical contact. For example, cables or cable wires can be twisted, soldered or welded together and thereby define a connection. The use of the outdoor cable connection protector 1 is, however, not limited to this application as optical or electro-optical connections and cables can also be used.

The combination of an enclosing housing 2 with a seal 6 and an intumescent material 7 configured to expand into the interior of the housing 2 upon heating by electrical fault in the connection provides improved reduction in fire hazard associated with outdoor electrical connections.

The intumescent material 7 is protected from ingress of water by means of the housing 2 and the seal 6 so that deterioration of the intumescent material 7 is prevented. Intumescent expansion smothers any spark or fire that could arise in the interior of the housing 2 due to e.g. electrical arc or shirt-circuit with a connection arranged inside the housing 2. Combustible materials of the connection may catch fire, including cable coverings. The outdoor cable connection protector 1 may prevent spreading of a fire from the connector and may even prevent a fire from starting as the intumescent material 7 expands into the interior of the housing 2 as soon as a spark or the like reaches it, even before it can start a fire.

One cable entry 5 may be provided for each of the at least two cables of the connection. Alternatively, one or more of the cable entries 5 may be configured to receive multiple cables therethrough.

The at least one cable entry 5 may be formed by a recess 8 in an edge 9 of at least one of the first section 3 and the second section 4. The edge 9 is in particular part of the closing surface 15 described below.

The first section 3 and the second section 4 in the closed state jointly define the at least one cable entry 5 therebetween. In the illustrated example, both the first section 3 and the second section 4 comprise the recess 8 for the cable entry 5. The recesses 8 of the first and second sections 3,4 are aligned to jointly define the cable entry 5.

The outdoor cable connection protector 1 may comprise at least two cable entries 5. The at least one cable entry 5 may comprise at least two cable entries 5 with a cable entry 5 at each opposite end 10 of the housing 2.

The housing 2 may be elongate. A cable entry 5 may be arranged at each end 10 of the housing 2, in particular when the housing 2 is elongate. The illustrated example shows an elongate housing 2 with one cable entry 5 at each longitudinal end 10 of the elongated housing 2.

The housing 2 may comprise a coupling mechanism 11 configured to couple the first and second sections 3,4 in the closed state. The coupling mechanism 11 may be releasable to allow opening of the housing 2 from the closed state to the opened state, for example by means of a screw, push button or the like.

The coupling mechanism 11 comprises at least one snap lock 12, for example as the illustrated example. Multiple snap locks 12 can be arranged on the first and second sections 3,4 with one section 3,4 having a hook 13 and the other having a ridge 14 to engage the hook 13 and thereby couple said sections 3,4 in the closed state. The hook 13 and ridge 14 jointly forming the snap lock 12 may be arranged at each side of the housing 2.

The first section 3 may be pivotally coupled to the second section 4, preferably at one or more than one side of the housing 2 from which cable entries 5 are absent. For example, the coupling mechanism 11 may include a hinge (not illustrated) to enable pivotal coupling between

the first and second sections 3,4. The side of the sections 3,4 at which such hinge is arranged may not include a cable entry 5, while the sides of the sections that can be taken apart, may include cable entries 5 for ease of placing the connection with its cables into the interior of the housing 2.

The first section 3 may be identical to the second section 4. An example of this configuration is shown in the illustrated example. In addition or alternatively, the housing 2 may comprise or be formed of only two sections, preferably two identical sections.

The housing 2 may be made of a polymeric composition, preferably comprising at least one of a polyamide, an aramid, a polypropylene. In particular, the first and second sections 3,4 of the housing 2 may be made of said composition. A polymeric composition is preferred for ease of manufacturing the housing 2. The polymeric composition may be selected to be waterproof, to provide sufficient strength to the housing 2, e.g. withstand external pressures during use of the outdoor cable connection protector 1, and to provide sufficient resistance to heat to prevent melting thereof in normal use cases, e.g. externally due to outdoor conditions and internally due to current running through the cables 30 and the connection 31 and electrical fault therein.

The polymeric composition may further comprises a glass fiber. Examples of construction materials for the housing 2 and/or the first and second sections 3,4 include polyamide glass fiber composite, polyamide (in particular aramide) or polypropylene. Alternatively, the housing 2, or rather the sections 3,4 of the housing 2, can be made of a metal, alloy or ceramic.

The seal 6 is preferably arranged between the first section 3 and the section 4 when in the closed state. In the illustrated example, the seal 6 is positioned in the first section 3 when in the opened state and between the first and second sections 3,4 when in the closes state of the housing 2.

The seal 6 may be formed by a separate sealing element. Alternatively, the seal 6 may be formed monolithic with the housing 2, preferably with at least one of the sections 3,4 of the housing 2.

The seal 6 is preferably arranged along a closing surface 15 of at least one of the first section 3 and the second section 4. In the closed state, the seal 6 may be arranged between the sections, in particular along respective closing surfaces 15 of the first and second sections 3,4 of the housing 2.

The closing surface 15 may comprise a groove 16 in which the sealing element 6 is arranged. Said groove 16 may also run across the cable entries 5 or the recesses 6 and preferably runs all along the closing surface 15 of the first and/or second section 3,4 to fully circumscribe the interior of the housing 2. Preferably, each of the first section 3 and the second section 4 comprises the groove 16 to receive the seal 6 therein. An example of this configuration is illustrated.

The seal 6 preferably comprises a cable clamping portion 17 arranged at or in at least one of the one or more than one cable entry 5 and configured to receive at least one cable in a holding

space 18 of the clamping portion 17. The cable clamping portion 17 may be configured to clamp and/or surround the at least one cable when the sections 3,4 of the housing 2 are closed onto their closing surfaces 15. The seal 6 may in particular comprise such cable clamping portion 17 in addition to being arranged on at least one of the closing surfaces 15 of the sections 3,4 of the housing 2. Preferably, the seal 6, in particular when implemented as a separate sealing element, comprises a cable clamping portion 17 for each cable entry 5 of the housing 5. The cable clamping portion 17 is configured to clamp the at least one cable once received through the cable clamping portion 17 of the seal 6. The cable clamping portion 17 aids in preventing ingress of water into the housing 2 along cables running from an exterior of the housing 2 into its interior.

The cable clamping portion 17 may be deformable from a release state into a clamping state upon closing of the first and second sections 3,4 from the opened state to the closed state.

The clamping portion 17 may be configured to:

- in the release state, receive the at least one cable into the holding space 18 transversely in relation to a longitudinal direction of the cable, preferably via a transverse inlay channel 19; and
- in the clamping state, surround the holding space 18 and thereby clamp the at least one cable received therein.

For example, an inlay channel 19 may be provided in the clamping portion 17 of the seal 6 to enable transverse entry of the at least one cable into the holding space 18 of the cable clamping portion 17. Transverse in this context means transverse in relation to a longitudinal direction of the holding space 18 which allows passing a cable through the clamping portion 17 from an exterior of the housing 2 into the interior of the housing 2. The inlay channel 19 is preferably open in the opened state of the housing 2 while it is closed in the closed state of the housing 2, thereby clamping or locking the cable inside the holding space 18 of the cable clamping portion 17 of the seal 6. The housing 2 or it sections 3,4 may correspondingly be configured to close the inlay channel 19 by deformation such as bending or compression of the cable clamping portion 17.

The inlay channel 19 makes it possible to lay the cable(s) into the cable clamping portion 17 without decoupling any connectors that are too large to pass through the holding space 18.

The cable clamping portion 17 may comprises at least one protrusion 20 configured to protrude from the first section 3 onto the second section 4 in order to be deformed and/or bent by the second section 4 upon closing the housing 2 to surround the at least one cable received through the cable clamping portion 17. For example, the at least one protrusion 20 may close the inlay channel 19 in the clamping state while it may leave the inlay channel 19 open in the release state. The at least one protrusion 20 may surround the at least one cable received through the holding space 18 of the cable clamping portion 17. In particular when two protrusions 20 are provided (for example as illustrated), the protrusions 20 may comprise matching surfaces 21 at their distal ends

22 to come into contact when the housing 2 is closed and thereby seal the cable clamping portion 17 around the at least one cable passing therethrough.

The second section 4 may in particular comprise an abutment surface 23 configured to deform and/or bend the at least one protrusion 20 in the closed state. The housing 2, or at least one section 3,4 thereof, may comprises the abutment surface 23 defined by a curved surface configured to engage the protrusion 20 of the cable clamping portion 17 to deform it into clamping the at least one cable end passing through the cable clamping portion 17 when the housing 2 is closed, i.e. the sections 3,4 are closed onto their closing surfaces 15. It is observed that the abutment surface 23 is in fact the groove 16 at the cable entry 5 when the first and second sections 3,4 are identical, such as is the case in the illustrated example.

The at least one protrusion 17 may comprise a guiding surface 24 configured to facilitate entry into the second section 4 and preferably arranged at a distal end 22 of the at least one protrusion 20. The guiding surface 24 may be provided in the form of a chamfer at an exterior side of the cable clamping portion 17 facing away from the holding space 18 for the at least one cable.

The cable clamping portion 17 may comprise two protrusions 20, in particular be U-shaped in the release state. The protrusions or legs 20 of such U-shaped clamping portion 17 may be straight or inwardly curved in the release state and preferably do not make contact, i.e. the distal ends of the protrusions 20 are spaced apart to enable transverse entry of a cable therein. Additionally or alternatively, the cable clamping portion 17 may be O-shaped in the clamping state. The protrusions 20 or leg of the U-shape may protrude from a section (e.g. the first section 3) of the housing 2 into an opposing section (e.g. the second section 4) of the housing 2 when these two sections 3,4 are closed onto each other, in particular onto their closing surfaces 15 between which the seal 6 is arranged. This arrangement can result in fully surrounding and clamping the at least one cable end by the clamping portion 17 of the seal 6, i.e. the cable is engaged from all transverse directions.

As particularly clear from FIG. 6 (closed state of the housing 2 and clamping state of the cable clamping portion 17) compared to FIG. 9 (opened state of the housing 2 and release state of the cable clamping portion 17), the protrusions 20 or legs of the U-shaped cable clamping portion 17 of the illustrated example are closed to an O-shape when the sections 3,4 of the housing 2 engage, i.e. are closed onto their closing surfaces 15. In more general wording, the housing sections 3,4 are configured to deform the cable clamping portion 17 of the seal 6 to fully surround the cable when the housing sections 3,4 are closed onto their closing surfaces 15, while the cable clamping portion 17 of the seal 6 may enable transverse entry of cables therein when the sections 3,4 are opened.

It is noted that the cable clamping portion 17 as disclosed herein may be used separately, even in other types of cable connection protectors 1. For example, the intumescent material 7 may

be dispensed with and the protector need not be of an outdoor type. In the broadest sense, a cable connection protector 1 is provided comprising:

- a housing 2 having a first section 3 and a second section 4 that are closeable onto each other from an opened state into a closed state to enclose a connection of at least two cables in an interior of the housing 2 and provide at least one cable entry 5 into the interior for the at least two cables;

- a seal 6 configured to prevent ingress of water into the interior of the housing 2 in the closed state of the housing 2, wherein the seal comprises a cable clamping portion 17 arranged at or in at least one of the one or more than one cable entry 5 and configured to receive at least one cable in a holding space 18 of the clamping portion 17.

The seal 6, or at least the cable clamping portion 17 thereof, may be made of a resilient material, in particular an elastomeric composition. The elastomeric composition may comprise at least one of a thermoplastic elastomer (TPE), a natural rubber, a synthetic rubber, a silicone. A combination of materials is also considered for the seal 6 and/or the clamping portion 17, for example as a two-component system for injection molding.

The intumescent material 7 may be arranged in the interior of the housing 2 in various ways. The intumescent material 7 may be arranged along an interior surface of the housing 2, preferably as an interior lining of at least one of the first section 3 and the second section 4. The intumescent material 7 may be arranged in patches, strips or as a contiguous layer. For example, when the housing 2 has an internal void that is roughly cylindrical as in the illustrated example, the intumescent material 7 may be arranged at the flat heads and/or the curved side of such cylindrical shape. Though it may often be preferred to completely cover the interior surface of the housing 2 with intumescent material 7, it is also conceived to provide patches or distinct elements of intumescent material inside the housing. In the illustrated example, in particular visible in FIG. 1, the intumescent material 7 is arranged as a hollow half-cylinder in each of the first and second sections 3, 4, thereby lining the interior of the housing 2 and may even include the flat ends 10 of the roughly cylindrical interior space.

The intumescent material 7 may be arranged on an interior surface of each of the first section 3 and the second section 4 (contiguously or in patches). The intumescent material 7 may fully surround the connection, at least transversely seen from a longitudinal direction of the cables or the housing 2. The intumescent material 7 may be shaped to match a shape of an interior surface of at least one, preferably both, of the first section 3 and the second section 4.

The intumescent material 7 may also be shaped with a recess at the at least one cable entry 5 into the interior of the housing 2, to thereby leave the at least one cable entry 5 free from intumescent material 7. This facilitates installation of the connection and its cables in the outdoor cable connection protector 1. In the illustrated example (see in particular FIG. 1 and 6), the

intumescent material 7 is shaped as a hollow cylinder for each section 3,4 having a recess matching each cable entry 5.

The intumescent material 7 may comprises an intumescent composition comprising at least one of sodium silicate, graphite. The intumescent composition may further comprise additives such as glues and binders. In general, the intumescent material 7 is not combustible though the seal 6 and the sections 3,4 of the housing may in fact be combustible or melt if these would not be protected by the intumescent material 7.

The intumescent material 7 is preferably configured to at least partly fill the interior of the housing 2 by intumescent expansion. The sections 3,4 of the housing 2 in the closed state may define such interior hollow space. When an electrical fault occurs, local heating of the intumescent material 7 may cause expansion of the intumescent material, thereby smothering any spark or flame and reducing fire hazard. Intumescent expansion relates to expansion upon heating at or above an activation temperature of the intumescent material 7. The intumescent material 7 may expand locally to smother an electrical fault in the connection inside the outdoor cable connection protector 1, while the remaining intumescent material 7 is yet capable of intumescent expansion and smothering any additional heat sources.

FIG. 12 shows a photograph of a section 3 of the housing 2 of an outdoor cable connection protector 1 with the housing 2 in the opened state. In this example, the section 3 is made of polyamide and a sheet of graphitic intumescent material 7 is applied to its interior surface. A mesh structure is seen on the inside exposed to the interior space of the housing 2. The seal 6 comprises two cable clamping portions 17 to receive cables.

Tests were conducted using the illustrated design of the outdoor cable connection protector 1, the intumescent material 7 being arranged as a layer of intumescent graphite of about 2 mm in both sections 3, 4 of the housing 2. When the housing 2 was closed, the two layers of intumescent material 7 roughly formed a cylindrical surface, the interior ends 10 of the housing 2 being free from intumescent material 7.

FIG. 13A-13C shows photographs of the tested outdoor cable connection protectors 1 in their opened state, after the test was performed in the closed state. Various polymeric materials were tested for the sections 3, 4 of the housings 2 of the outdoor cable connection protectors 1 and comprised polyamide in FIG. 13A, polypropylene in FIG. 13B and glass-fiber reinforced polyamide in FIG. 13C. A temperature sensor 40 was arranged in the interior of the housing 2 as illustrated, with its wire passing through one of the cable clamping portions 17, to record the interior temperature during the test.

The test was conducted as follows. Two cables 30 in the form of metal bars were placed in the housing 2 with a gap 50 between the ends of the cables 30, the housing 2 was then brought in the closed state and an arc was generated between the cables 30 inside the housing 2 for up to 4

minutes. The temperature in the interior of the housing 2 rose to about 280°C while the exterior of the housing 2 was no warmer than 98°C throughout each test. The temperature of the arc itself is known to rise to well into a few thousand degrees Celsius.

After concluding the test and opening the housing 2 into the opened state, it was observed that the intumescent material 7 had swollen locally over an extend of about 2 cm around the position of the arc (the interior being about 12 cm in length). The expanded intumescent material 70 can be identified in the photographs as having a foamed or powdered appearance. The outdoor cable connection protector 1 of each test had successfully prevented the arc from causing a fire or even melting the sections 3,4 of the housing 2.

It is to be understood that the invention described herein is not limited to particular embodiments described, as such may vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to be limiting, since the scope of the invention will be limited only by the appended claims.

CONCLUSIES

1. Openluchtkabelverbindingsbeschermer voor een elektrische installatie, omvattende:

- een behuizing die een inwendige ruimte definieert die is geconfigureerd om een verbinding van ten minste twee kabels te accommoderen, met ten minste één kabelingang naar de inwendige ruimte voor de ten minste twee kabels, en omvattende een eerste sectie en een tweede sectie, waarbij de eerste sectie en de tweede sectie beweegbaar zijn van een geopende toestand voor het in de inwendige ruimte aanbrengen van de verbinding naar een gesloten toestand waarin de eerste sectie en de tweede sectie op elkaar zijn geplaatst om de verbinding in de inwendige ruimte van de behuizing op te sluiten;

- een afdichting die is geconfigureerd om het binnendringen van water in de inwendige ruimte van de behuizing te verhinderen in de gesloten toestand van de behuizing; en

- een intumescent materiaal dat in de inwendige ruimte van de behuizing is aangebracht en dat is geconfigureerd om in de inwendige ruimte van de behuizing op te zwellen wanneer het wordt verhit door een elektrisch falen in de verbinding.

2. Openluchtkabelverbindingsbeschermer van conclusie 1, waarbij één kabelingang is voorzien voor iedere van de ten minste twee kabels van de verbinding.

3. Openluchtkabelverbindingsbeschermer van conclusie 1 of 2, waarbij de ten minste één kabelingang is gevormd door een uitsparing in een rand van ten minste één van de eerste sectie en de tweede sectie.

4. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de eerste sectie en de tweede sectie in de gesloten toestand gezamenlijk de ten minste één kabelingang tussen hen in definiëren.

5. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de ten minste één kabelingang ten minste twee kabelingangen omvat met een kabelingang aan ieder tegenovergelegen einde van de behuizing.

6. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de behuizing langgerekt is.

7. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de behuizing een koppelmechanisme omvat dat is geconfigureerd om de eerste en tweede secties in de gesloten toestand te koppelen.

8. Openluchtkabelverbindingsbeschermer van conclusie 7, waarbij het koppelmechanisme ten minste één springslot omvat.

9. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de eerste sectie scharnierbaar aan de tweede sectie is gekoppeld, bij voorkeur aan één of meer dan één zijde van de behuizing waar kabelingangen afwezig zijn.

10. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de eerste sectie identiek is aan de tweede sectie.

11. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de behuizing van een polymeersamenstelling is gemaakt, bij voorkeur omvattende ten minste één van een polyamide, een aramide, een polypropyleen.

12. Openluchtkabelverbindingsbeschermer van conclusie 11, waarbij de polymeersamenstelling verder een glasvezel omvat.

13. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de afdichting tussen de eerste sectie en de sectie is aangebracht wanneer deze zich in de gesloten toestand bevinden.

14. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de afdichting is gevormd door een afzonderlijk afdichtingselement.

15. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de afdichting langs een sluitingsvlak van ten minste één van de eerste sectie en de tweede sectie is aangebracht.

16. Openluchtkabelverbindingsbeschermer van de voorgaande conclusie, waarbij het sluitingsvlak een gleuf omvat waarin de afdichting is aangebracht.

17. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de afdichting een kabelklemgedeelte omvat dat aan of in ten minste één van de ten minste één kabelingang is aangebracht en dat is geconfigureerd om ten minste één kabel in een vasthoudruimte van het kabelklemgedeelte te ontvangen.

18. Openluchtkabelverbindingsbeschermer van conclusie 17, waarbij het kabelklemgedeelte vervormbaar is van een vrijgavetoestand naar een klemtoestand bij het van de geopende toestand naar de gesloten toestand sluiten van de eerste en tweede secties.

19. Openluchtkabelverbindingsbeschermer van conclusie 18, waarbij het kabelklemgedeelte is geconfigureerd om:

- in de vrijgavetoestand, de ten minste één kabel in de vasthoudruimte dwars ten opzichte van een lengterichting van de kabel te ontvangen, bij voorkeur via een dwars inlegkanaal; en
- in de klemtoestand, de vasthoudruimte te omgeven en daardoor de ten minste één kabel in te klemmen die daarin is ontvangen.

20. Openluchtkabelverbindingsbeschermer van conclusie 18 of 19, waarbij het kabelklemgedeelte ten minste één uitsteeksel omvat dat is geconfigureerd om uit te steken vanaf de eerste sectie tot in de tweede sectie om door de tweede sectie te worden vervormd en/of gebogen bij het sluiten van de behuizing om de ten minste één kabel te omgeven die door het kabelklemgedeelte is ontvangen.

21. Openluchtkabelverbindingsbeschermer van conclusie 20, waarbij de tweede sectie een aanligoppervlak omvat dat is geconfigureerd om het ten minste één uitsteeksel in de gesloten toestand te vervormen en/of buigen.

22. Openluchtkabelverbindingsbeschermer van conclusie 20 of 21, waarbij het ten minste één uitsteeksel een geleidingsoppervlak omvat dat is geconfigureerd om invoer in de tweede sectie te faciliteren en dat bij voorkeur aan een distaal einde van het ten minste één uitsteeksel is aangebracht.

23. Openluchtkabelverbindingsbeschermer van enige van de conclusies 17 – 22, waarbij het kabelklemgedeelte U-vormig is in de vrijgavetoestand en bij voorkeur O-vormig is in de klemtoestand.

24. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij de afdichting is gemaakt van een elastomeersamenstelling, bij voorkeur omvattende ten minste één van een thermoplastische elastomeer, een natuurlijk rubber, een synthetisch rubber, een silicone.

25. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij het intumescent materiaal langs een inwendig oppervlak van de behuizing is aangebracht, bij voorkeur als een inwendige voering van ten minste één van de eerste sectie en de tweede sectie.

26. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij het intumescent materiaal op een inwendig oppervlak van ieder van de eerste sectie en de tweede sectie is aangebracht.

27. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij het intumescent materiaal is gevormd om overeen te komen met een vorm van een inwendig oppervlak van ten minste één, bij voorkeur beide, van de eerste sectie en de tweede sectie.

28. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij het intumescent materiaal is gevormd met een uitsparing aan de ten minste één kabelingang in de inwendige ruimte om de ten minste één kabelingang vrij te laten van intumescent materiaal.

29. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij het intumescent materiaal een intumescente samenstelling omvat die bij voorkeur ten minste één omvat van natriumsilicaat, grafiet.

30. Openluchtkabelverbindingsbeschermer van enige voorgaande conclusie, waarbij het intumescent materiaal is geconfigureerd om de inwendige ruimte van de behuizing ten minste gedeeltelijk door intumescente opzwelling te vullen.

31. Elektrische installatie omvattende ten minste twee kabels, een verbinding van de ten minste twee kabels aan hun respectievelijk kabeleinden en een openluchtkabelverbindingsbeschermer van enige van de conclusies 1 – 30 die over de verbinding heen is aangebracht.

32. Elektrische installatie van de voorgaande conclusie gevormd door een elektrische openluchtinstallatie, bij voorkeur een fotovoltaïsche installatie.

33. Werkwijze van het beschermen van een verbinding van ten minste twee kabels, de werkwijze omvattende de stappen van:

- het verschaffen van een openluchtkabelverbindingsbeschermer van enige van de conclusies 1 – 30 in de geopende toestand;
- het in de geopende openluchtkabelverbindingsbeschermer aanbrengen van de verbinding met de ten minste twee kabels; en
- het sluiten van de eerste en tweede secties van de behuizing rond de verbinding, waarbij de ten minste twee kabels door de ten minste één kabelingang van de openluchtkabelverbindingsbeschermer lopen.

34. Gebruik van een intumescent materiaal in een openluchtkabelverbindingsbeschermer voor een elektrische installatie.

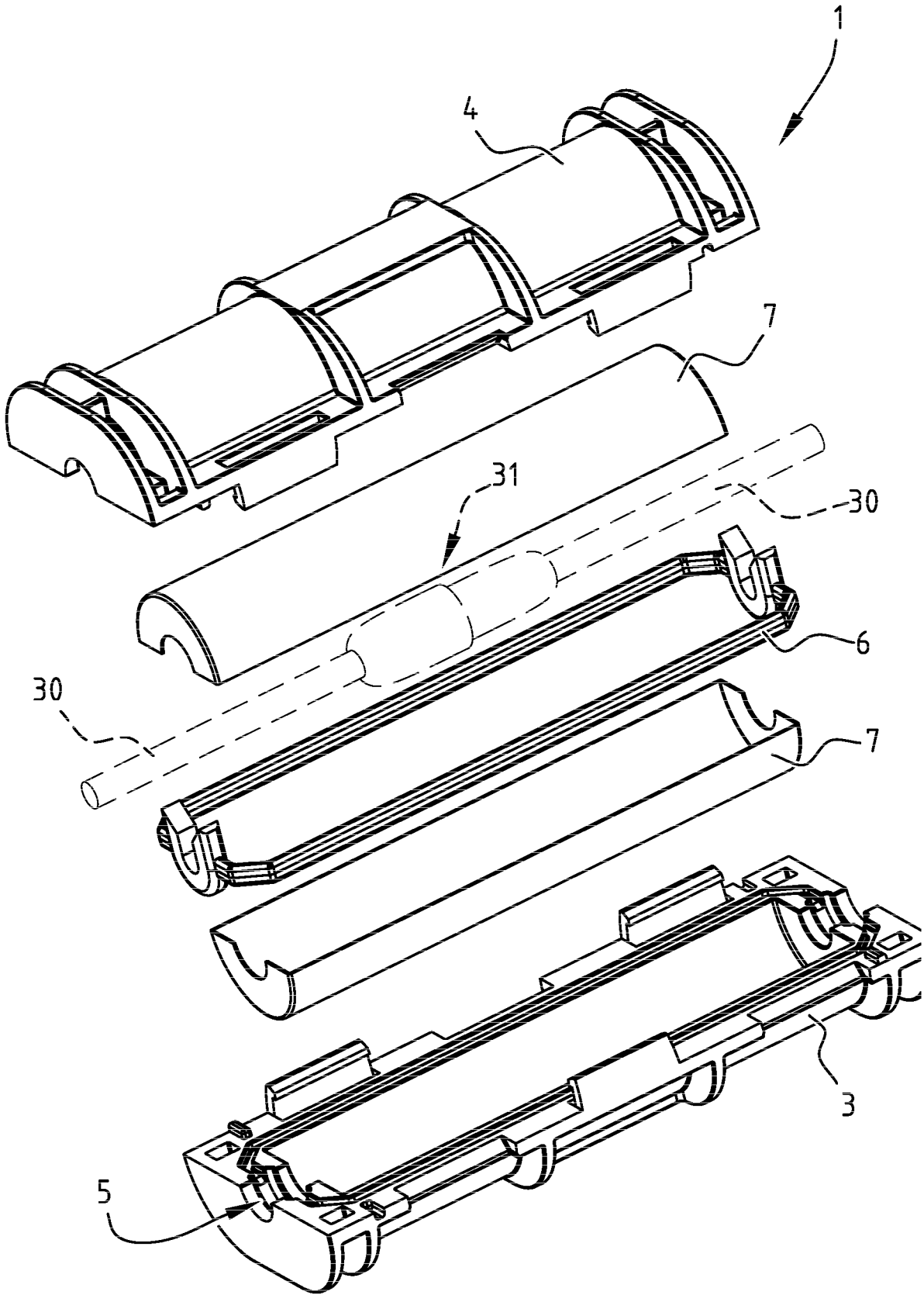

FIG. 1

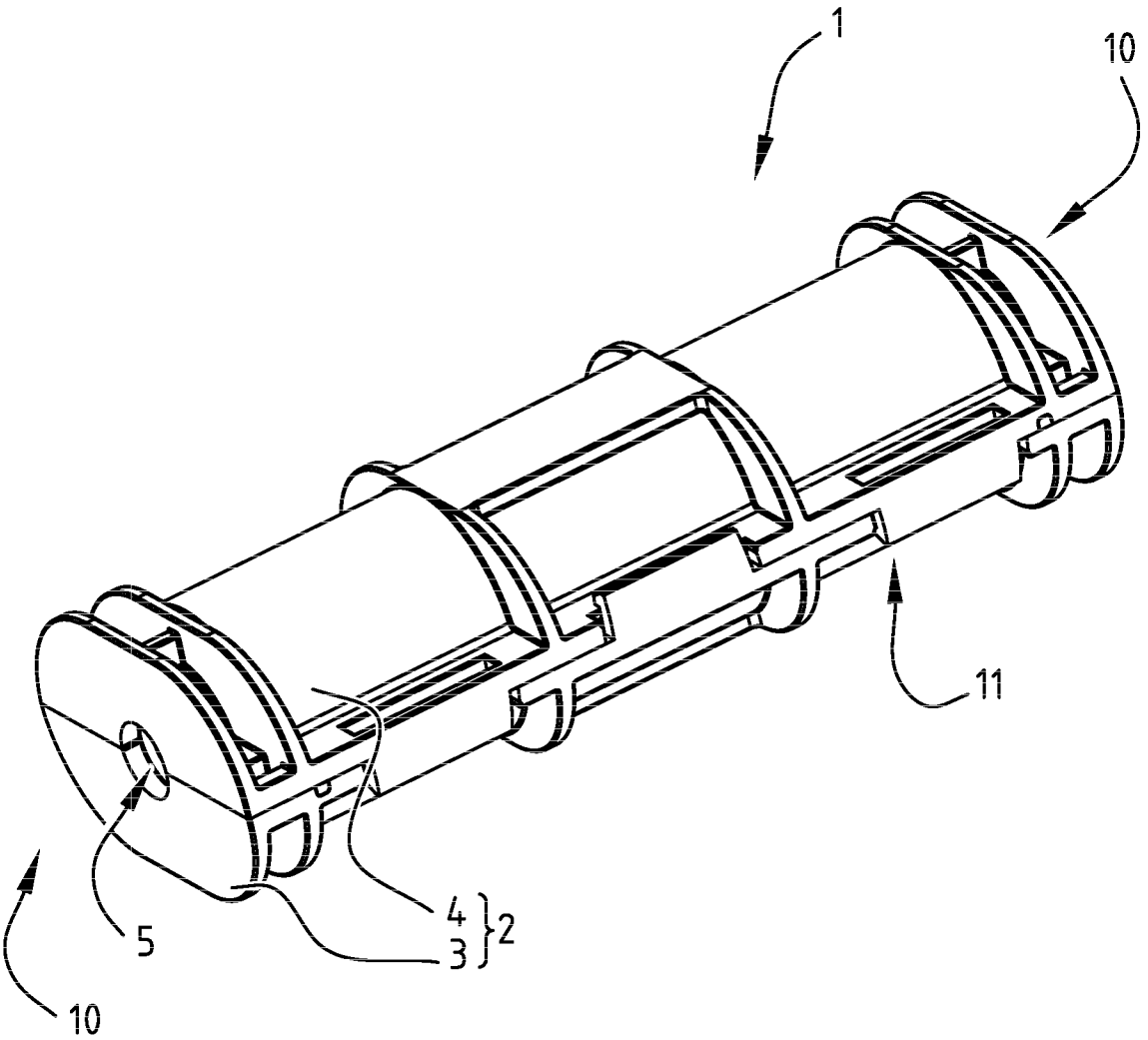

FIG. 2

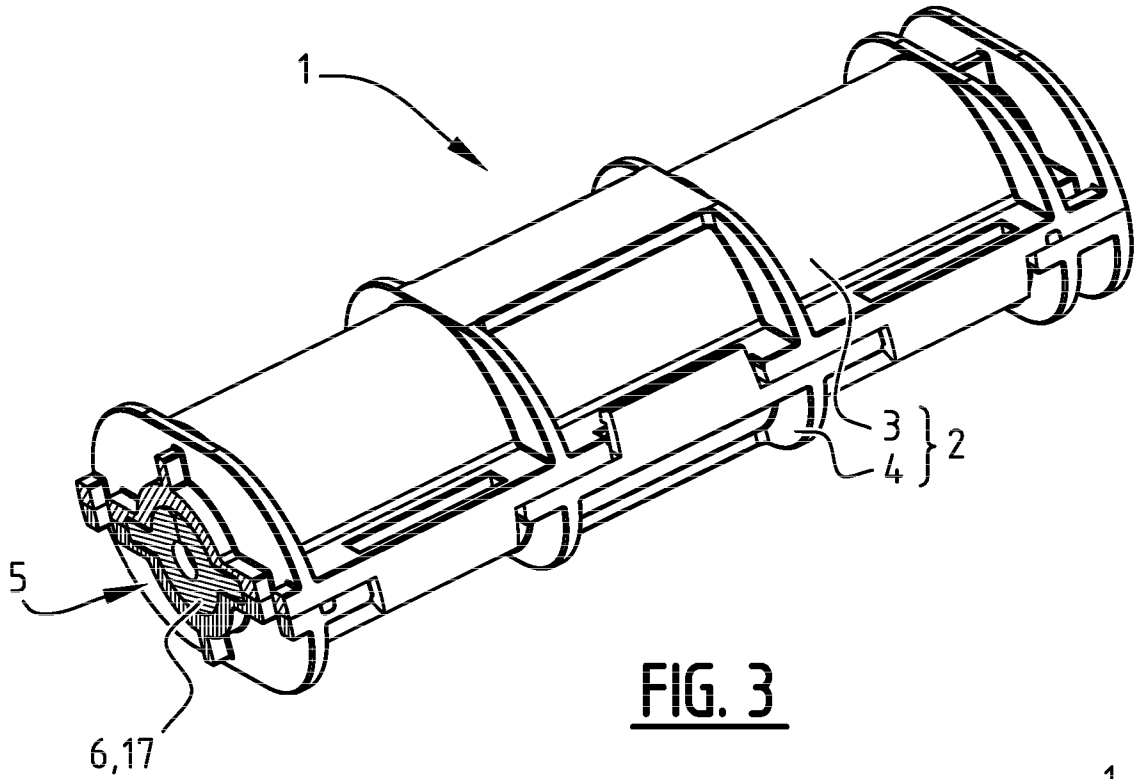

FIG. 3

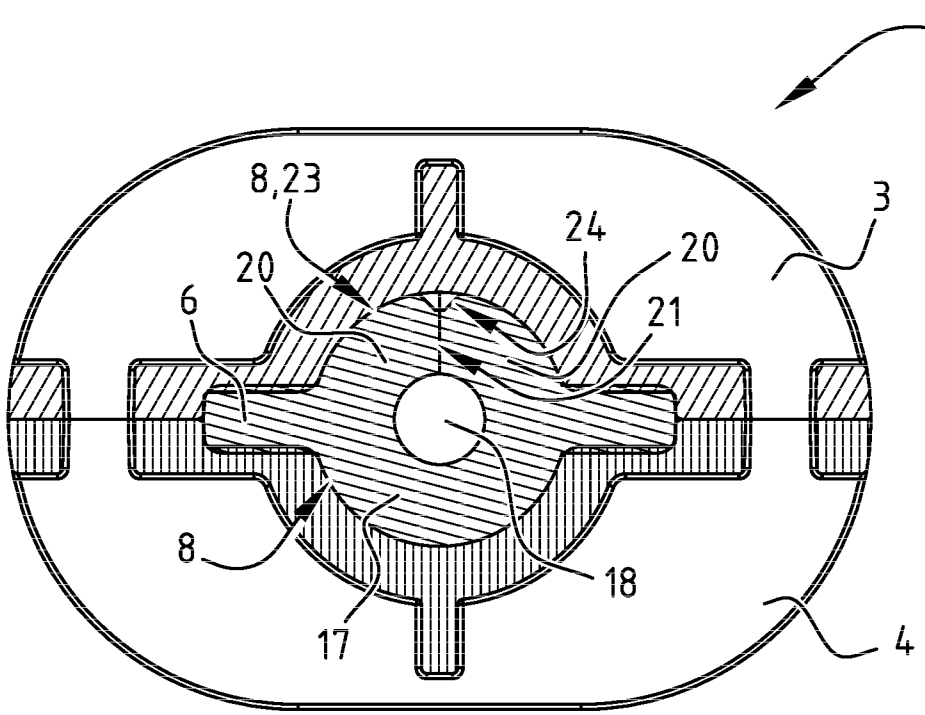

FIG. 4

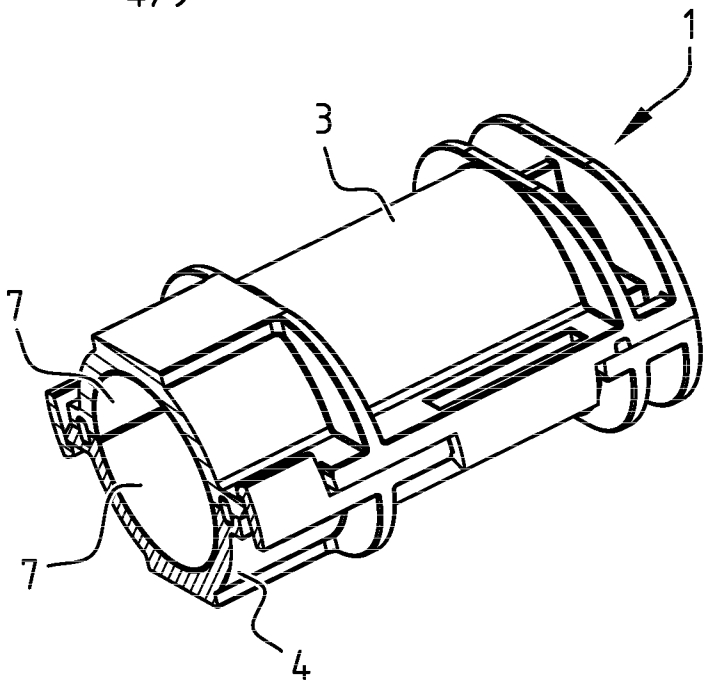

FIG. 5

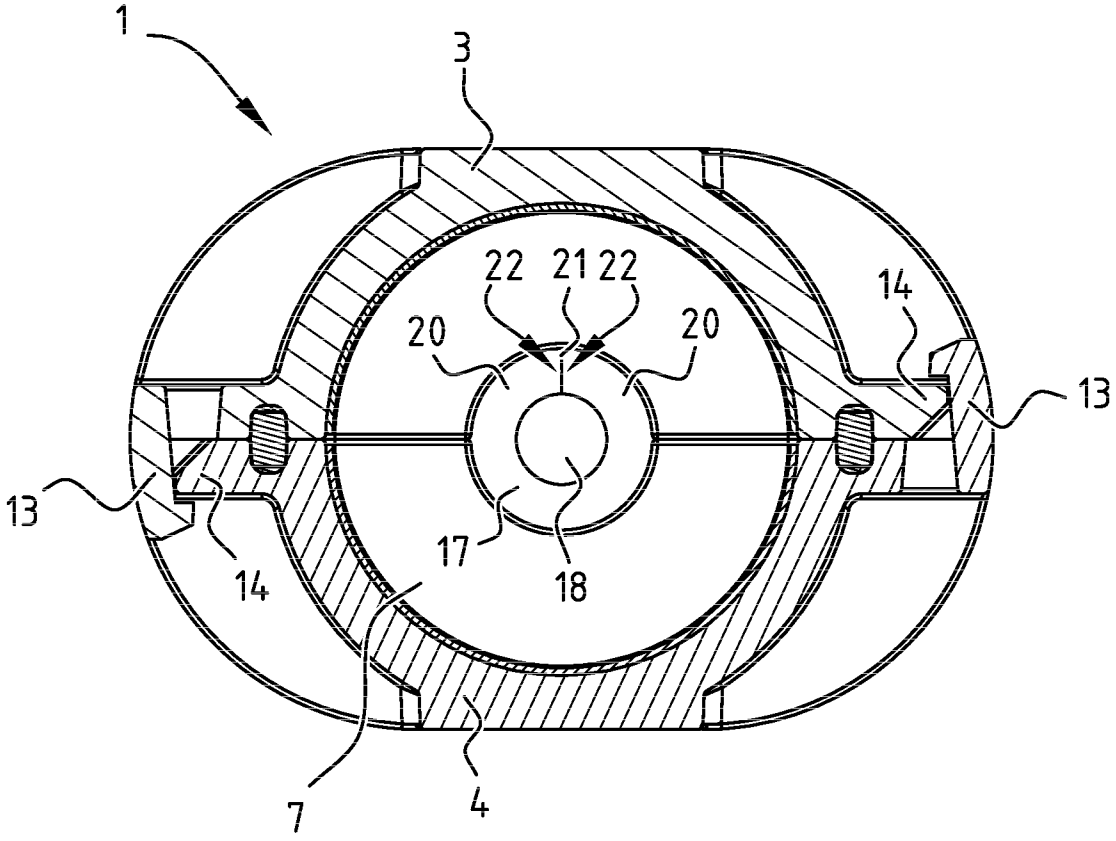

FIG. 6

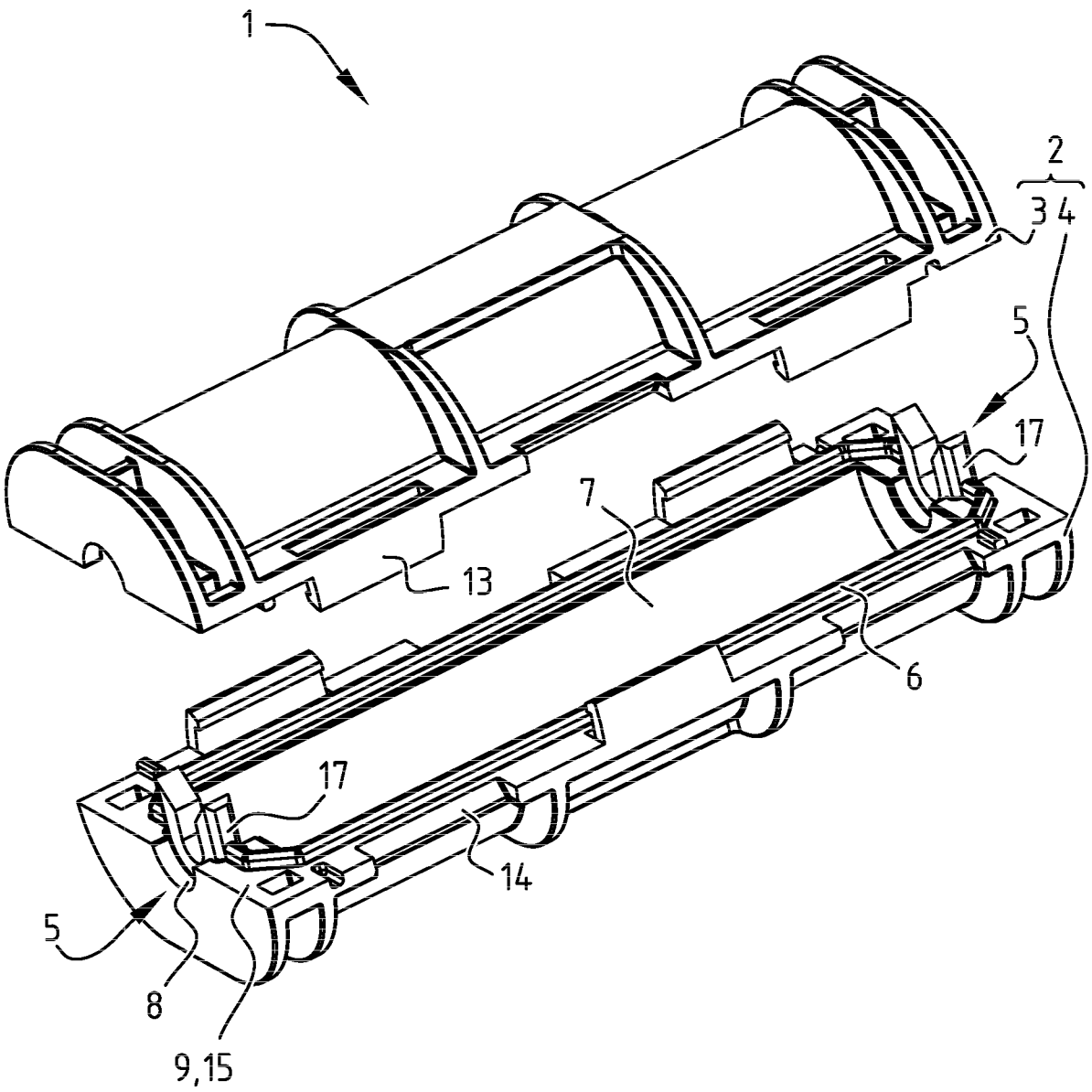

FIG. 7

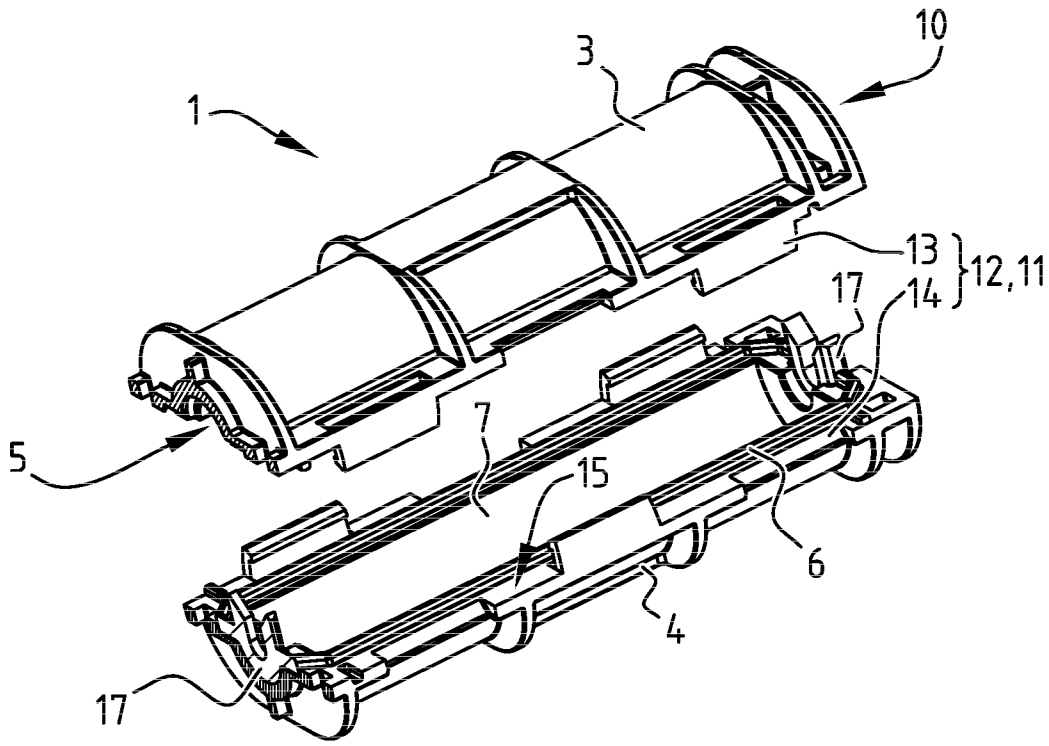

FIG. 8

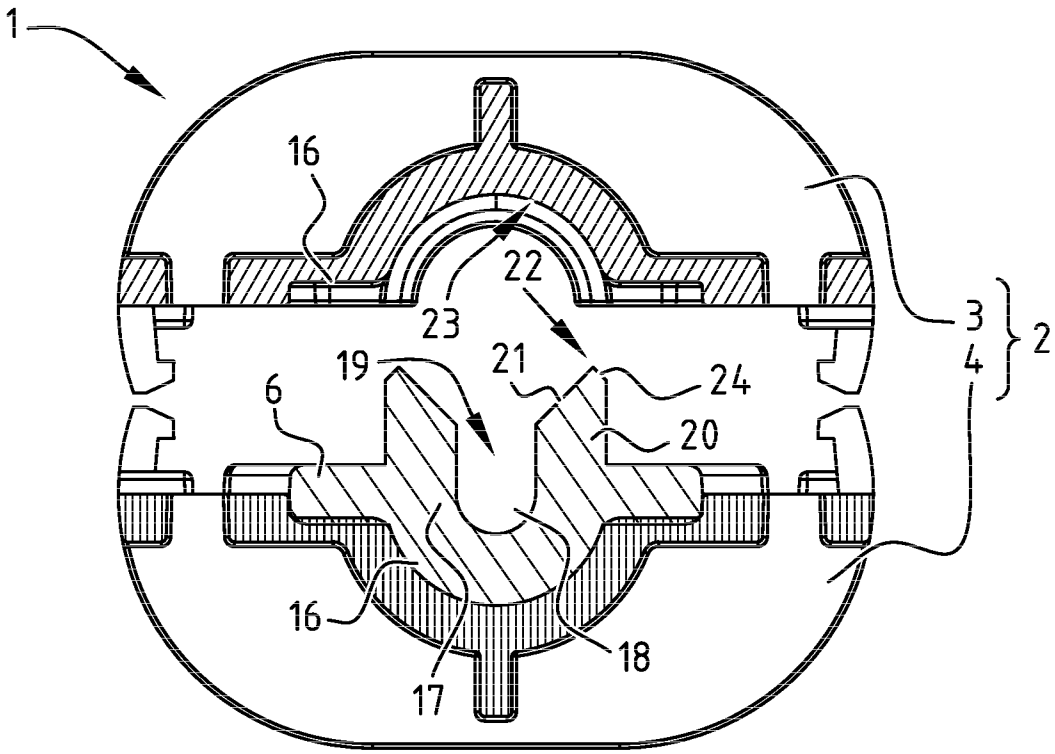

FIG. 9

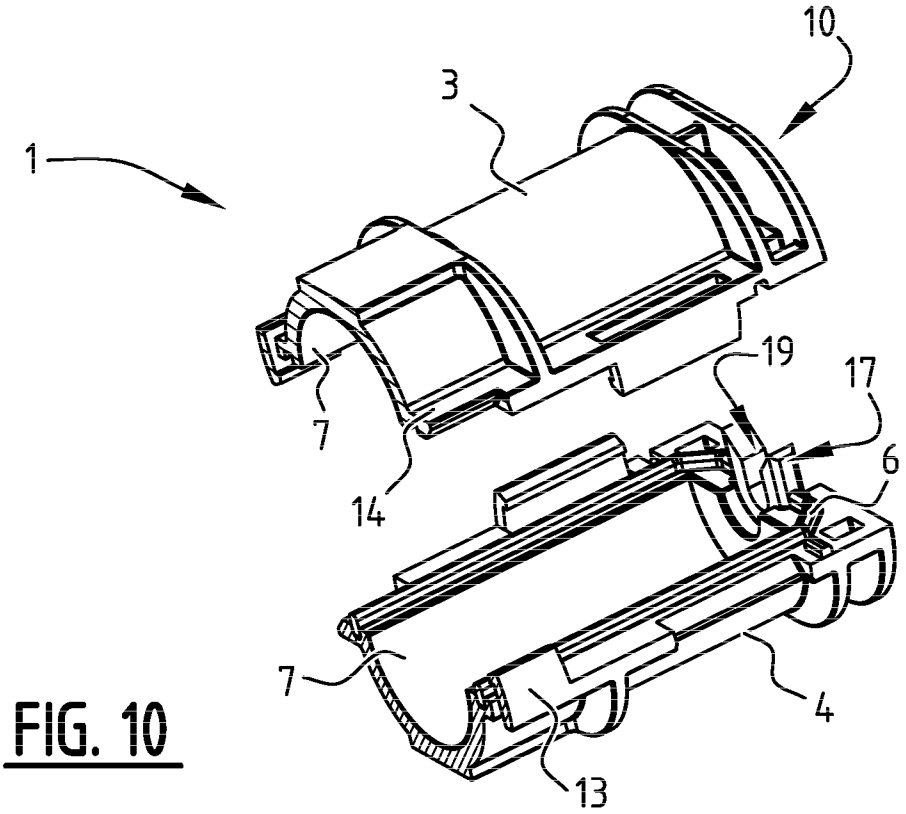
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FIG. 10

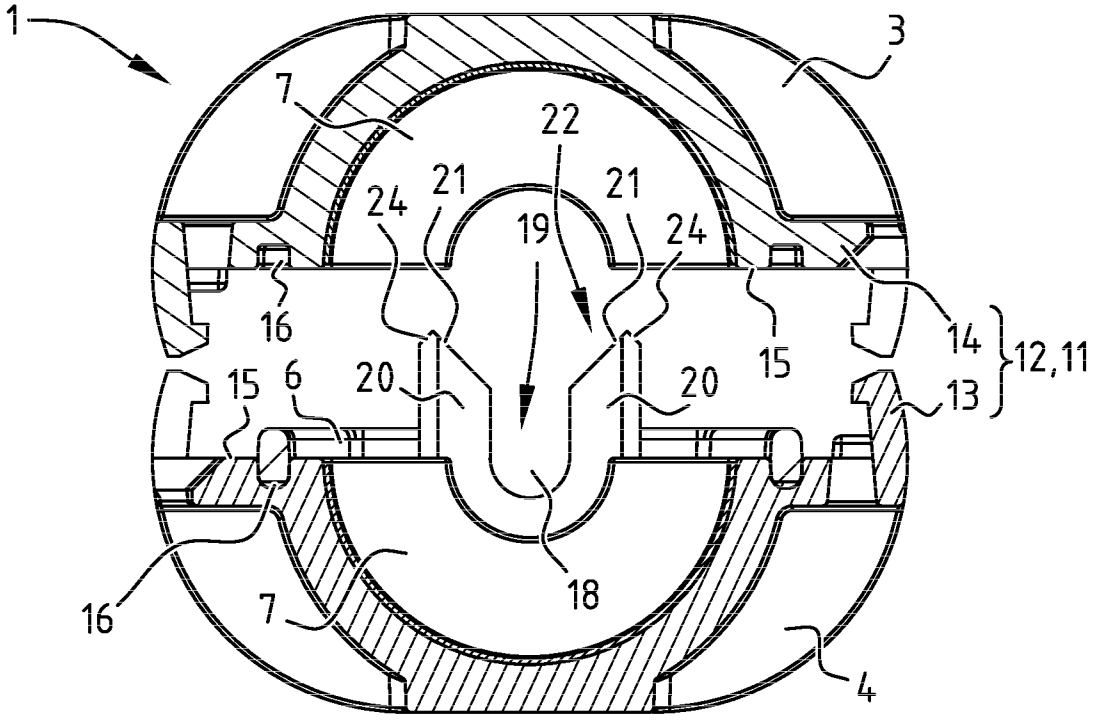
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FIG. 11

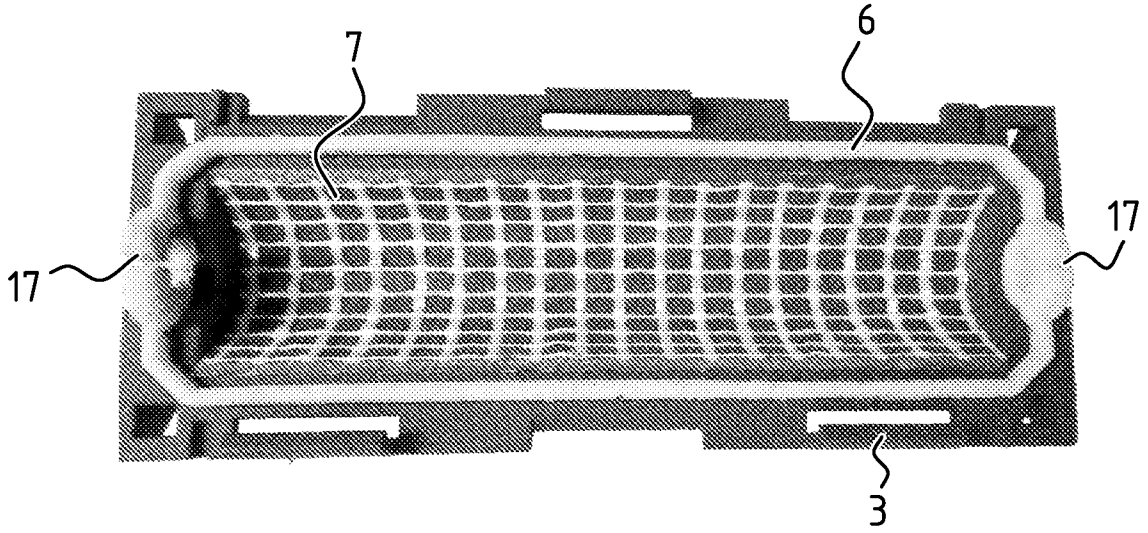

FIG. 12

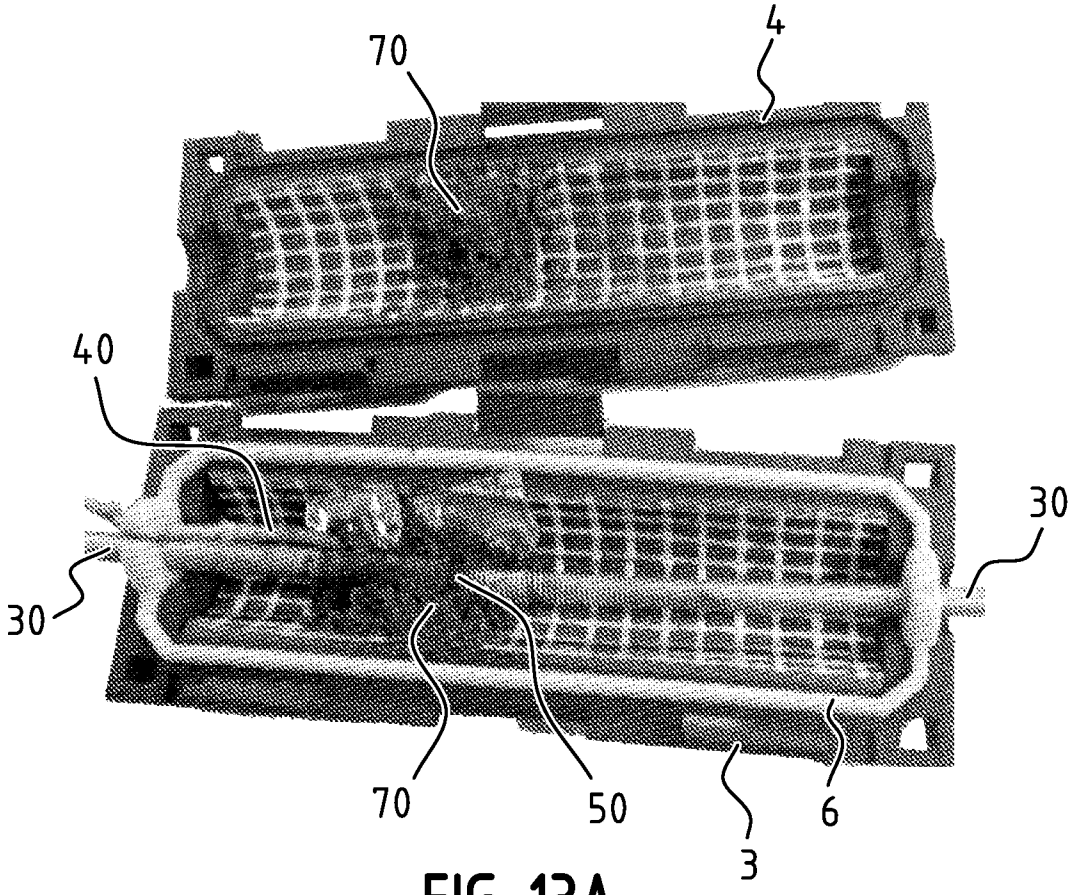

FIG. 13A

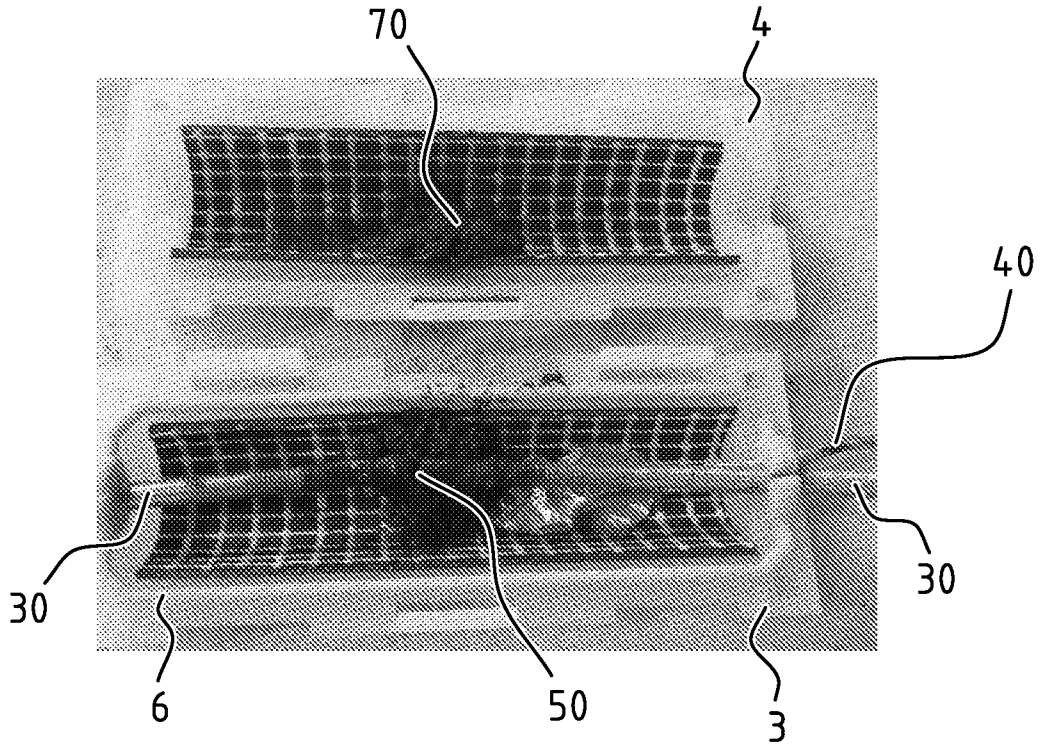

FIG. 13B

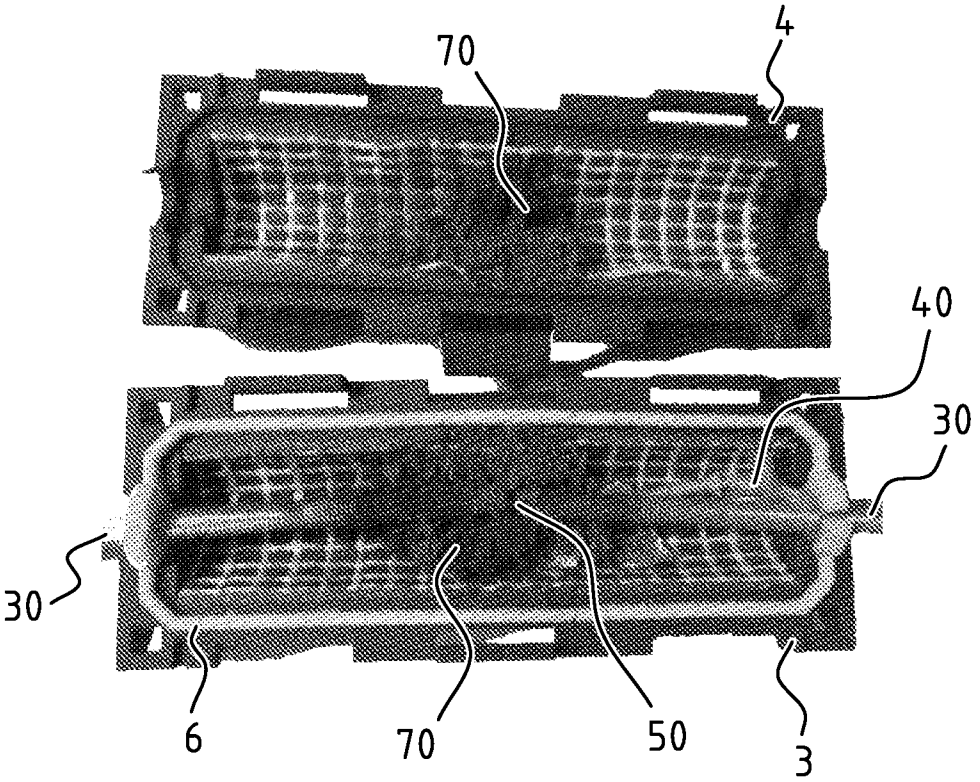

FIG. 13C

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
Nederlands aanvraag nr. **2033540**	Indieningsdatum **16-11-2022**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **Marciso B.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **21-01-2023**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN83122**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

Zie onderzoeksrapport

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**Zie onderzoeksrapport**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III.	☐	**GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES**	(opmerkingen op aanvullingsblad)
IV.	☐	**GEBREK AAN EENHEID VAN UITVINDING**	(opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2033540

A. CLASSIFICATIE VAN HET ONDERWERP

INV. H02G15/113 H01R13/639
ADD. H01R13/52 H01R13/527

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)

H02G H01R

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)

EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
Y	DE 10 2018 005772 A1 (TKW ELEKTROTECHNISCHE SPEZIALKABEL LEITUNGEN & ZUBEHOER E K [DE]) 23 januari 2020 (2020-01-23) * alineas [0002] - [0005], [0023] - [0028], [0042] - [0046], [0013]; figuren 1-11 *	1-33
Y	KR 101 578 057 B1 (HEEWON INFORMATION COMM [KR]) 16 december 2015 (2015-12-16) * alineas [0021], [0026] - [0029], [0025]; figuren 1-2 *	1-33
Y	US 7 285 725 B1 (SAMAN RICK [US]) 23 oktober 2007 (2007-10-23) * kolom 2, regels 31-42; figuren 1-7 *	1-33

-/--

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
16 mei 2023	

Naam en adres van de instantie	De bevoegde ambtenaar
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	**Hermann, Robert**

1

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2033540

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	US 2016/339281 A1 (MUENZENBERGER HERBERT [DE]) 24 november 2016 (2016-11-24)	34
Y	* alineas [0004] - [0015], [0024]; figuren 1, 2 *	1-33
X	GB 2 531 598 A (INTUMESCENT SYSTEMS LTD [GB]) 27 april 2016 (2016-04-27)	34
Y	* het gehele document *	1-33
X	DE 298 04 203 U1 (SCHULTE GUENTER [DE]) 7 mei 1998 (1998-05-07)	34
Y	* het gehele document *	1-33
E	WO 2023/281066 A1 (VIRIDIAN SOLAR LTD [GB]) 12 januari 2023 (2023-01-12) * alineas [0054] - [0061]; figuren 1A-1C *	1-6,13, 14, 24-28, 31-34

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek

NL 2033540

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
DE 102018005772 A1	23-01-2020	DE 102018005772 A1	23-01-2020
		DE 202019005335 U1	31-03-2020
		EP 3598597 A1	22-01-2020
KR 101578057 B1	16-12-2015	GEEN	
US 7285725 B1	23-10-2007	GEEN	
US 2016339281 A1	24-11-2016	CA 2916315 A1	08-01-2015
		EP 2821108 A1	07-01-2015
		EP 3016718 A1	11-05-2016
		US 2016339281 A1	24-11-2016
		WO 2015001005 A1	08-01-2015
GB 2531598 A	27-04-2016	GEEN	
DE 29804203 U1	07-05-1998	GEEN	
WO 2023281066 A1	12-01-2023	GB 2608637 A	11-01-2023
		WO 2023281066 A1	12-01-2023

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN83122	16.11.2022		NL2033540

International Patent Classification (IPC)
INV. H02G15/113 H01R13/639 ADD. H01R13/52 H01R13/527

Applicant
Marciso B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

	Examiner
	Hermann, Robert

Application number

WRITTEN OPINION

NL2033540

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the application as filed.

   b. ☐ furnished subsequent to the filing date for the purposes of search,

      ☐ accompanied by a statement to the effect that the sequence listing does not go beyond the disclosure in the application as filed.

3. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the application, this opinion has been established to the extent that a meaningful opinion could be formed without a WIPO Standard ST.26 compliant sequence listing.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	1-34
	No:	Claims	
Inventive step	Yes:	Claims	
	No:	Claims	1-34
Industrial applicability	Yes:	Claims	1-34
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VI Certain documents cited

☒ Certain published documents

see the Search Report

☐ Non-written disclosures

WRITTEN OPINION

Box No. VII Certain defects in the application

see separate sheet

1 **Re Item V**

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1 Reference is made to the following documents:

D1	DE 10 2018 005772 A1 (TKW ELEKTROTECHNISCHE SPEZIALKABEL LEITUNGEN & ZUBEHOER E K [DE]) 23 januari 2020 (2020-01-23)
D2	KR 101 578 057 B1 (HEEWON INFORMATION COMM [KR]) 16 december 2015 (2015-12-16)
D3	US 7 285 725 B1 (SAMAN RICK [US]) 23 oktober 2007 (2007-10-23)
D4	US 2016/339281 A1 (MUENZENBERGER HERBERT [DE]) 24 november 2016 (2016-11-24)
D5	GB 2 531 598 A (INTUMESCENT SYSTEMS LTD [GB]) 27 april 2016 (2016-04-27)
D6	DE 298 04 203 U1 (SCHULTE GUENTER [DE]) 7 mei 1998 (1998-05-07)
D7	WO 2023/281066 A1 (VIRIDIAN SOLAR LTD [GB]) 12 januari 2023 (2023-01-12)

1.2 The present application does not meet the criteria of patentability, because the subject-matter of claim1 does not involve an inventive step.

1.2.1 D1 may be regarded as being the prior art closest to the subject-matter of claim1, and discloses (the references in parentheses referring to this document, missing documents in strike-through font)

Openluchtkabelverbindingsbeschermer **(fig. 1 - 11. .'Sicherheitsbox 10', see also §2-5 on the outdoor use)** voor een elektrische installatie, omvattende:
- een behuizing **('Sicherheitsbox 10')** die een inwendige ruimte **(see the inner space in fig. 1)** definieert die is geconfigureerd om een verbinding **(fig. 6 'Steckverbindungen 26')** van ten minste twee kabels **(fig. 6 34)** te accommoderen, met ten minste één kabelingang **('Kabeleinlass' 22)** naar de inwendige ruimte voor de ten minste twee kabels **(34)**, en omvattende een eerste sectie **('Gehäusehälfte' 12)** en een tweede sectie **('Gehäusehälfte' 14)**, waarbij de eerste sectie **(12)** en de tweede sectie **(14)** beweegbaar zijn van een

geopende toestand **(fig. 1, 2, 3, 5, 6)** voor het in de inwendige ruimte aanbrengen van de verbinding **(see above)** naar een gesloten toestand **(fig. 4, 8, 10 and 11)** waarin de eerste sectie **(12)** en de tweede sectie **(14)** op elkaar zijn geplaatst om de verbinding in de inwendige ruimte van de behuizing op te sluiten;
- een afdichting **(§23 - 28 and 42 - 46, 36 and 44)** die is geconfigureerd om het binnendringen van water in de inwendige ruimte van de behuizing **(10)** te verhinderen in de gesloten toestand van de behuizing; en
- ~~een intumescent materiaal dat in de inwendige ruimte van de behuizing is aangebracht en dat is geconfigureerd om in de inwendige ruimte van de behuizing op te zwellen wanneer het wordt verhit door een elektrisch falen in de verbinding.~~

The subject-matter of claim1 therefore differs from this known Openluchtkabelverbindingsbeschermer in providing

'een intumescent materiaal dat in de inwendige ruimte van de behuizing is aangebracht en dat is geconfigureerd om in de inwendige ruimte van de behuizing op te zwellen wanneer het wordt verhit door een elektrisch falen in de verbinding.'

Intumescent material will swell as a result of heat exposure and thus help to extinguish or prevent a fire in the device.

The problem to be solved by the present invention may therefore be regarded as improving the fire resistance of the device.

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step for the following reasons:

D1 already mentions to provide the outdoor box with a self-extringuishing manner, see §15. D1 does not provide how this property is provided. Hence, there is a gap in the teaching of D1. However, one of the well known solutions to provide a self-extinguishing structure is to use intumescent material which the person skilled in the art would use without an inventive step involved. In particular since the use of intumescent material inserts in electrical boxes is well known in the technical field of electrical cable installations (see D4 **fig. 1 and 2 see the 'intumescent insert 10'**, D5 **fig. 1 and 2 show a liner with intumescent material for use in electrical boxes, see page 4 line 24 - page 5 line 8**, D6 **Fig. 3 2, page 5 lines 3 - 15 'Brandschutzeinsatz 2'**).

Based on the references and arguments above (which apply mutatis mutandis) the present application does also not meet the criteria of patentability, because the subject-matter of the corresponding method claim 33 does not involve an inventive step.

The teaching of the following documents is equivalent to the teaching of D1 and thus the above argumentation applies also with respect to these two documents as closest prior art:

D2, see behuizing **(fig. 1 and 2 100, §21)**, eerste sectie **(110)**, tweede sectie **(120)**, afdichting **(§26-29)**;

D3, see behuizing **(fig. 1 - 7 weatherproof restraining apparatus 10)**, eerste sectie **(15 upper half)**, tweede sectie **(20 lower half)**, afdichting **(50)**.

1.2.2 D4 may be regarded as being the prior art closest to the subject-matter of claim 34, and discloses (references in parentheses referring to this document, missing features in strike-through font):

Gebruik van een intumescent materiaal **(fig. 1 and 2 see the 'intumescent insert 10')** in een ~~openlucht~~kabelverbindingsbeschermer **('electrical junction box 12')** voor een elektrische installatie.

D4 does not disclose whether the electrical junction box is for interior or open air use.

The subject-matter of claim 34 therefore differs from this known use in that the installation box is an *openluchtkabelverbindingsbeschermer*.

This definition limits the use to an outdoors environment.

The problem to be solved by the present invention may therefore be regarded as determining the environment for the use.

The solution proposed in claim 34 of the present application cannot be considered as involving an inventive step for the following reasons:

D4 does not define the environment in which the junction box/ cover is being used. In view of the problem indicated above the person skilled in the art knows however that junction boxes exist for indoor and outdoor use. For this reason the it is obvious for the person skilled in the art to use the device of D4 also for outdoor junction boxes/ covers and thus to solve the problem above in an obvious manner and arrive at the subject-matter of claim 34.

The teaching of D5 **(fig. 1 and 2 show a liner with intumescent material for use in electrical boxes, see page 4 line 24 - page 5 line 8)** and D6 **(fig. 3 2, page 5 lines 3 - 15 'Brandschutzeinsatz 2')** is equivalent to the teaching of D4 and thus this reasoning applies also mutatis mutandis to D5 or D6 as closest prior art.

1.3 Dependent claims 2 - 32 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of inventive step.

Remark:

The set of dependent claims of the present invention can be grouped into six blocks which address different non corresponding problems and would thus constitute six groups of non unitary inventions. A formal objection is however not raised as the subject-matter of these claims is seen as not inventive. The groups are:

I: claims 2 - 5: Definition of the cable entry structure and arrangement.

II: claims 6 - 10: Definition of the housing shape and closing mechanism.

III: claims 11 - 12: Material of the housing.

IV: claims 13 - 24: Structure of the sealing of the device.

V: claims 25 - 30: Placement of the intumescent material.

VI: claims 31 - 32: Electrical installation with the previously defined device.

The reasons the dependent claims are not considered to involve an inventive step are for:

claims 2 - 5: see the figures references above for D1 - D3, all of these documents show housings with the features defined for these claims;

claims 6 - 10: see the figures above for D1 - D3, these documents show half cover elements which are arranged together with hinges and coupled by snap coupling mechanisms (see D1 fig. 1 and D3 fig. 1 - 3), D2 shows a box with halves coupled without an hinged link;

claims 11 and 12: D1, see §13, D2 §25, D3 col. 2 lines 31 - 42; the use of glass fibre reinforced material is common knowledge for electrical installation boxes;

claims 13 - 24: see the sealing structures referenced above for D1 - D3; the particular shape of the cable clamping seal in claims 17 - 23 is an obvious workshop type modification of the U-shaped seals know e.g. from D1 (see 36);

claims 25 - 30: the intumescent inserts of D4 - D6 are shaped to conform to the inner surfaces of the installation boxes and allow for cable entries, see the figures cited; hence, the person skilled in the art would apply this installation also to the shape of the outdoor covers known from D1 - D3.

2 **Re Item VII**

Certain defects in the application

2.1 Independent claims 1, 33 and 34 are not in the two-part form, which in the present case would be appropriate, with those features known in combination from the prior art (see above) being placed in the preamble and the remaining features being included in the characterising part.

2.2 The features of the claims are not provided with reference signs placed in parentheses.

2.3 The relevant background art disclosed in D1 - D7 is not mentioned in the description, nor are these documents identified therein.

3 **Re Item VI**

Certain documents cited

Certain published documents

Application No Patent No	Publication date *(day/month/ year)*	Filing date *(day/month/ year)*	Priority date *(valid claim) (day/month/year)*
WO2023/281066A1	12/01/2023	08/07/2022	08/07/2021