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(54) Title: POWER SUPPLY - BAROMETRIC COMPENSATION CABLE FOR EQUIPMENTS COMPRISING ELECTRIC AND/OR ELECTRONIC COMPONENTS

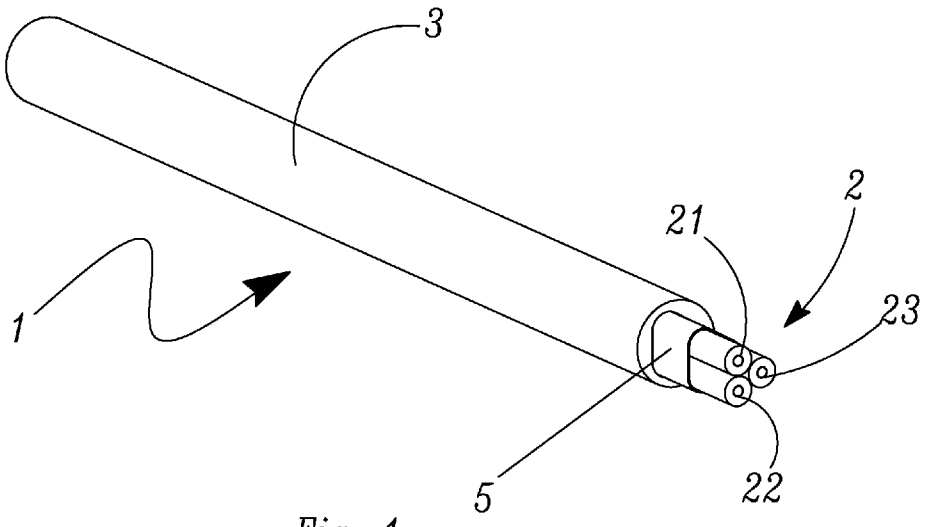

Fig. 1

(57) Abstract: A power supply cable (1; 101) comprising a conductor assembly (2; 102) including electric flexible unipolar conductors, each of them being covered with an insulating material, said conductor assembly being contained in a protective impermeable sheath (3; 103), is proposed to connect a branch opening with at least a tight equipment comprising a protective casing including electric and/or electronic components. The power supply cable (1; 101) comprises at least a fluid - dynamic communication duct (4; 104) between the inside of said branch opening and the inside of said protective casing.

WO 2009/010899 A2

Title

Power supply-barometric compensation cable for equipments comprising electric and/or electronic components

Description

[0001] The present invention relates to a power supply cable for equipments comprising electric and/or electronic components.

[0002] It is known that a correct functioning of an equipment comprising electric and/or electronic components is prejudiced in case moisture, dust or dirt get into the inside of the protective casing of said equipment.

[0003] A penetration of moisture, dust or dirt prejudices a correct operation of the electric and/or electronic components with the risk of provoking, for instance, a short circuit when the equipment is switched on.

[0004] The above problem is solved by utilizing equipments that are already on the market and comprise electric and/or electronic tight components. These components have a high IP degree (International Protection degree), as per IEC 60529 and IEC 60598 definitions. These components are conceived also for an external use and are, therefore, exposed to the atmospheric agents. Unrestricted examples of these components are the following: traffic light signalization devices, swimming-pool lamps, garden lamps and immersed lamps, reflectors, electric transmission devices, central stations and automotive sensors; electro-chemical sensors and gas detectors sensing an unwished presence of gas, maritime equipments such as GPS devices and radars, boilers, electric razors and tooth-brushes and antennas.

[0005] Obviously, said type of devices and equipments are connected through a power supply cable to a branch opening. The cable usually comprises three conductive wires, namely, the phase wire, the neutral wire and the ground wire. Each wire is inserted in a suitable seat. The wire seats are inserted in a protective sheath. Usually, the sheath is produced in a plastic extrusion process. During the functioning, the tight equipments develop heat because these equipments comprise, for instance, electric and/or electronic components that dissipate heat owing to the Joule effect, or

burners. In other cases, these equipments accumulate heat because they are exposed to a thermal radiation coming from adjacent equipments.

[0006] The heat provokes a warming of the air contained in said protective casing. According to the known laws of thermodynamics, the air warming causes a sensible increase in the inner pressure of the equipments.

[0007] After an initial transient period, the air existing in the tight equipments reaches a value of operative temperature at the end of a phase of dissipation of the heat in the ambient. The heat dissipation ends when a thermal stability has been reached.

[0008] At this stage, owing to micro-escapes of air that always occur in said equipments, for instance in the gaskets or cable pressers or other similar fittings, the inner pressure of the equipments diminishes to the value of the outer pressure.

[0009] When a sealed equipment is immersed in water or the equipment is subjected to substantial stresses by the atmospheric agents, for instance heavy precipitations or a considerable diminution of temperature etc., or it is subjected to a jet of water or it incurs other similar situations, the air in the protective casing of the equipment soon gets quite cold so that the inner pressure diminishes rapidly and a depression of a few bars is created.

[0010] Besides, it is possible that air is sucked in the sealed equipment through the same microscopic passages through which said micro-escapes of air also are possible. The air intake provokes an increase in the inner pressure value that tends to correspond to the outer pressure value. On the base of the same principle and at the same time, a sealed equipment could take in also damp, dust or dirt.

[0011] In particular, moisture reaches the inside of the protective casing not only through passages of the gaskets or cable-presses or other similar fittings, but also through capillarity, namely through the interstices in the electrical conductor seats of the power supply cable in case the cable is immersed at least partially in the water.

[0012] When said phenomena occur in the inside of the sealed equipment, there is a substantial risk of a malfunction of the equipment.

[0013] The known art consists in the utilization of gaskets and cable-presses that are conceived to provide a high efficiency as regards impermeableness and tightness and/or morphologic invariability. These characteristics are achieved by producing said fittings in plastic materials of great elasticity and return memory.

[0014] The main drawback of the known art is that even the more reliable gaskets and cable-presses incur a progressive and inevitable loss in impermeableness and tightness efficiency. Consequently, the user is compelled to incur the cost of a frequent substitution of said fittings in order to avoid the risk of a malfunctioning of the tight equipments owing to said hydro-thermo-dynamic phenomena.

[0015] The aim and function of this invention is to overcome the above-mentioned problems and other ones by carrying out a power supply cable avoiding the penetration of moisture, dust and dirt in the inside of the equipments connected through the cable.

[0016] The above aims and other ones are reached with a power supply cable comprising a conductor assembly including electric flexible unipolar conductors, each of them being covered with a nonconducting material, said conductor assembly being contained in a protective impermeable sheath, said cable connecting a branch opening with at least a tight equipment comprising a protective casing including electric and/or electronic components. The power supply cable is characterized by the presence of at least a fluid - dynamic communication duct between the inside of said branch opening and the inside of said protective casing.

[0017] At least one communication duct allows a mutual air passing between the inside of the branch opening and the inside of the protective casing to continuously balance the sudden changes of pressure in the inside of the tight equipment.

[0018] In particular, during the warming phase of the air in the inside of the tight equipment, the condition of barometric parity is obtained because the air passes from the protective casing to the branch opening. On the contrary during the cooling phase of the air in the inside of the tight equipment, the condition of barometric parity is obtained because the air is sucked from

the branch opening to the protective casing, such a suction being caused naturally owing to said thermo-dynamic phenomena.

[0019] The present invention permits to potentially keep the inner pressure of the tight equipment in a constant parity in respect to the outer pressure so that sudden positive or negative changes of pressure are avoided and the gaskets and/or the cable pressers and/or similar fittings are not exposed to stresses that could cause a suction of moisture, dust or dirt in the inside of the tight equipment. In addition, the above-mentioned capillarity phenomena causing a penetration of moisture in the tight equipment do not occur.

[0020] At least a part of at least a communication duct can be carried out in such a way as to be substantially coaxial to the protective sheath in which the communication duct is included so that the mechanical stresses suffered by the cable are transferred to said part in a substantially uniform manner.

[0021] In this way, the risk of throttling in the communication duct is avoided completely at the cable bends and/or at a cable sector locked in a cable presser or other similar accessories.

[0022] The power supply cable is made of neoprene or other plastic material having a high return memory and comprises at least three electric conductors that are made, for instance, as conventional rigid copper wires or strands. The three electric conductors form the “phase”, the “neutral” and the “ground”, respectively. In addition, the flexible unipolar electric conductors could be more than three in order to have separate supplies that are controlled by the user through suitable controlling means.

[0023] Further features and details of the invention will be better understood from the following specification that is given as an unrestricted example with reference to the accompanying drawings wherein:

[0024] Figure 1 is an axonometric section plane of the power supply cable according to the invention;

[0025] Figura 2 is a cross section of the cable of Figure 1;

[0026] Figure 3 is an axonometric section plane of a power supply cable according to another version of the invention; and

[0027] Figure 4 is a cross section of the cable of Figure 3.

[0028] With reference to the accompanying drawings, number 1 denotes a power supply cable which connects a branch opening (not represented in the drawings since it is known and not relevant for the understanding of the invention) with at least a tight equipment (not represented in the drawings since it is included in a very broad class of equipments known and belonging to the prior art) and comprises a protective casing in which electric and/or electronic components are housed.

[0029] Power supply cable 1 comprises a conductor assembly 2 including electric flexible unipolar conductors, each of them being covered with an insulating material, said conductor assembly being contained in a protective impermeable sheath 3 as well as a fluid - dynamic communication duct 4 between the inside of said branch opening and the inside of said protective casing.

[0030] The communication duct 4, which is included in the power supply cable 1, allows air to flow from the inside of the branch opening to the inside of the protective casing and vice versa so that there is a continuous compensation of the sudden changes of pressure occurring in the inside of the tight equipment comprising electric and/or electronic components.

[0031] In this way, the present invention carries out, advantageously, the technical effect of keeping the inner pressure and the outer pressure of the tight equipment in constant parity in order to avoid a risk of penetration of moisture, dust or dirt in the tight equipment.

[0032] More particularly, according to Figures 1 and 2, the conductor assembly 2 comprises three electric unipolar conductors 21, 22, 23, namely, the “phase”, the “ground” and the “neutral”. The communication duct 4 corresponds to an empty space obtained in the inside of an impermeable binding 5 which in turn is inserted in the sheath 3 and covers, in a continuous way, said conductors 21, 22, 23 which are adjacent to each other.

[0033] Binding 5 is made, for instance, of a material comprising nylon or a material comprising aluminium. Binding 5 is impermeable and therefore, it creates an internal duct without openings or fissures toward the outside except both binding ends.

[0034] According to a different embodiment of the invention as represented in Figures 3 and 4, a cable 101 comprises a conductor assembly 102 which includes conductors and is covered by a protective sheath 103. A plastic annular element is disposed in the inside of cable 101 and is internal to the conductors of the conductor assembly 102. Said plastic annular element forms a communication duct 104. In particular, the annular element is disposed so as to be substantially coaxial to said sheath 3.

[0035] In this embodiment, the conductor assembly of electric flexible unipolar conductors comprises five conductors in order to obtain separate supplies to be controlled by the user through suitable controlling means.

[0036] In both represented embodiments the communication duct 4, 104 is so shaped that at least a duct part is substantially coaxial to the sheath 3, 103 and the mechanical stresses on cable 1, 101 are transferred to the duct 4, 104 in a substantially even manner. In this way, it is possible to avoid a throttling and a consequent risk of plugging of the communication duct at the duct bends and/or a duct sector locked in a cable presser or other similar fittings.

[0037] A technician of the field can conceive changes and versions which are to be considered as included in the scope of protection of the invention.

Claims

1) Power supply cable (1; 101) comprising a conductor assembly (2; 102) including electric flexible unipolar conductors, each of them being covered with an insulating material, said conductor assembly being contained in a protective impermeable sheath (3; 103) and being adapted to connect a branch opening with at least a tight equipment comprising a protective casing including electric and/or electronic components, said power supply cable (1; 101) being characterized by the fact of comprising at least a fluid dynamic communication duct (4; 104) between the inside of said branch opening and the inside of said protective casing.
2) Power supply cable (1) as claimed in claim 1, wherein a binding (5) covers, in a continuous way, the conductor assembly (2) in order to define an empty space corresponding to the duct (4).
3) Power supply cable (1) as claimed in claim 2, wherein said binding (5) is impermeable.
4) Power supply cable (1) as claimed in claim 2 or 3, wherein said binding (5) is made of a material comprising nylon and/or aluminium.
5) Power supply cable (101) as claimed in claim 1, wherein at least an annular element is comprised and it acts as a communication duct (104).
6) Power supply cable (101) as claimed in claim 5, wherein at least an annular element is made of a plastic material.
7) Power supply cable (1; 101) as claimed in one of the foregoing claims, wherein said conductor assembly (2) comprises at least three electric flexible unipolar conductors (21, 22, 23).
8) Power supply cable (1; 101) as claimed in claim 7, wherein said conductor assembly (2; 102) comprises more than three electric flexible unipolar conductors in order to obtain separate supplies controlled by controlling means.
9) Power supply cable as claimed in any of the foregoing claims, wherein said sheath (3) is made of neoprene.
10) Power supply cable (1; 101) as claimed in any of the foregoing claims, wherein at least a duct (4) is disposed in the inside of the cable (1; 101) in an

internal position in respect to the conductors included in the assembly (2; 102).

11) Power supply cable (1; 101) as claimed in claim 11, wherein at least a part of duct (4; 104) is disposed so as to be substantially coaxial to said sheath (3; 103).

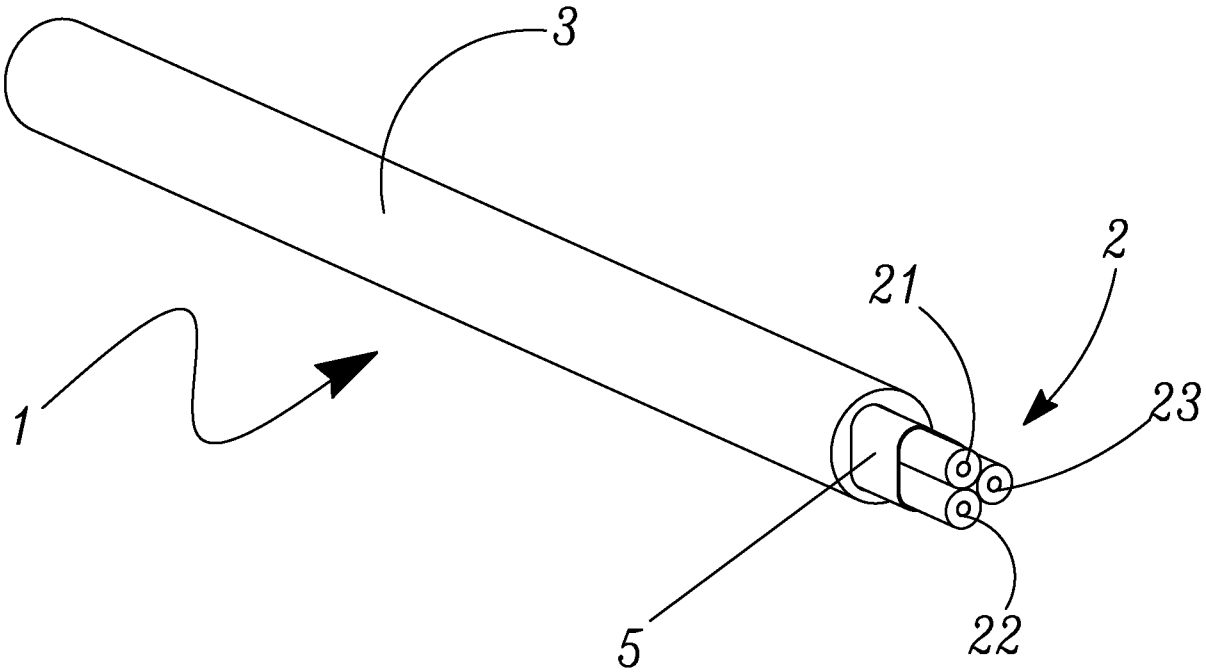

Fig. 1

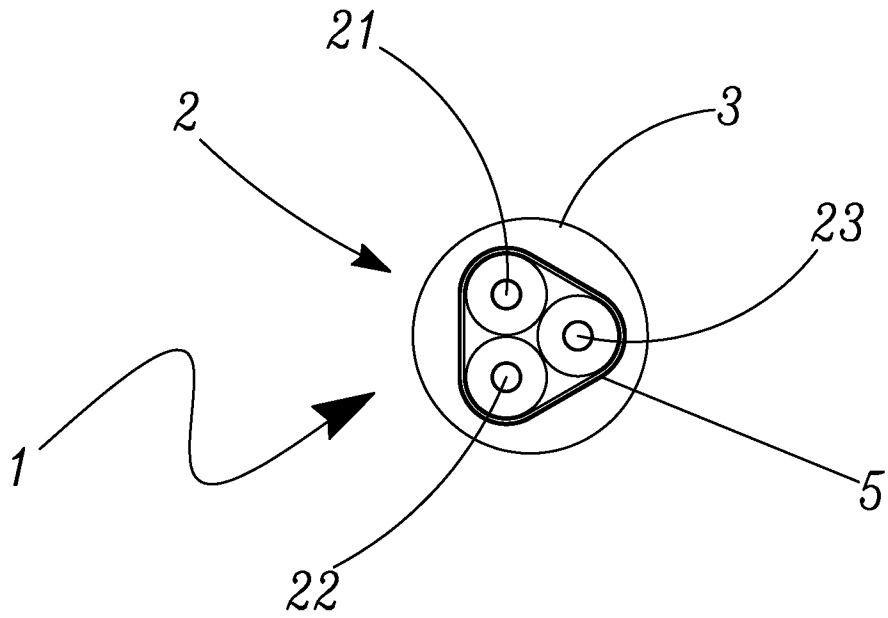

Fig. 2

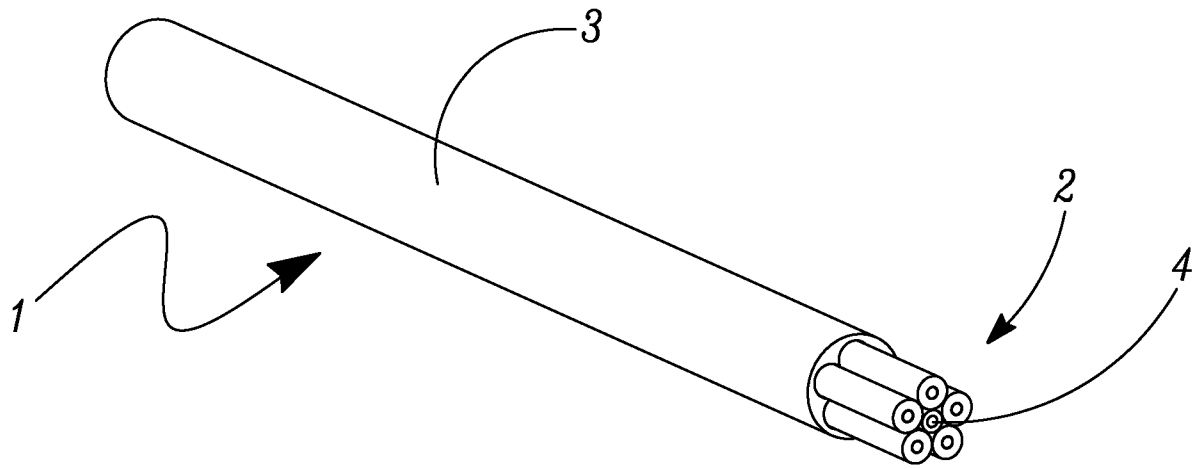

Fig. 3

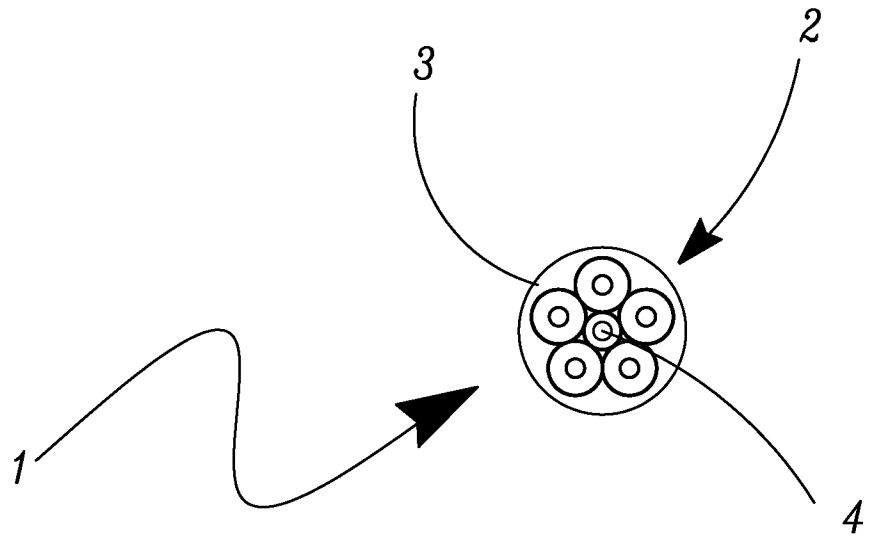

Fig. 4