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Description

The invention relates to a hybrid electric cable.

- 5 A hybrid cable is understood to be an electric cable comprising at least one power conductor and one data transmission cable.

By way of an example, such a cable is well known in the field of underwater installations, where it is called umbilical cable.

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An umbilical cable is described in patent document EP 1691377, which describes a cable comprising, in a common outer sheath, a core of three central power cables surrounded by a coiled steel strip and data transmission cables arranged on the periphery around this core. Filler elements are disposed between some elements in order to stabilize the assembly.

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This umbilical cable is specifically intended for use in an underwater environment.

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Document CN-U-201503715 describes an environmentally friendly multipurpose computer cable. Document CN 2020/13773 U describes a hybrid electric cable.

- 25 However, the invention proposes a cable intended for land transportation and more specifically for equipping at least one railway network points switch.

The invention relates to a hybrid electric cable according to claim 1 comprising, in a common outer sheath, at least two power cables and at least two data transmission cables, comprising a common layer of conductive material for electromagnetic protection, at least one common steel mechanical protection screen further being arranged below said outer sheath, characterized in that said common mechanical protection screen has a thickness of between 0.1 and 0.8 mm and in that it comprises, below said steel screen, a layer of insulating material, a laminate of aluminium insulating material glued on

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the preceding layer and a sheet of plastic maintaining material.

The purpose of this common screen is to protect the cables from damages that can be caused by impacts or by attacks from rodents.

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According to a preferred embodiment, a first power cable is a triplet of conductors, a second power cable is a pair of conductors and said data transmission cables are quadruplets of conductors.

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By selecting the number of power cables and of data transmission cables, it is thus possible to equip one or more points switches using a single cable, which significantly simplifies the work and reduces the cost thereof.

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According to one embodiment, the hybrid electric cable comprises at least three power cables and at least three data transmission cables and at least three of said data transmission cables form a central core and said power cables are arranged on the periphery around this core.

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Advantageously, said core is surrounded by a sheet of plastic maintaining material or by a layer of plastic maintaining material.

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The thickness of this common steel mechanical protection screen preferably can be substantially equal to 0.2 mm.

Said insulating material can be polyethylene.

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Preferably, said layer of common conductive material for electromagnetic protection is aluminium.

The thickness of this aluminium layer can be between 0.05 and 0.5 mm, and preferably substantially equal to 0.15 mm.

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The diameter of each conductor of said triplets can be between 1.13 and 2.20 mm, and preferably substantially equal to 1.38 mm.

The diameter of each conductor of said pairs can be between 1.35 and 3.50 mm, and preferably substantially equal to 1.75 mm.

- 5 The diameter of each conductor of said quadruplets can be between 0.60 and 1.80 mm, and preferably substantially equal to 0.9 mm.

Said conductors are preferably made from copper.

- 10 The invention is described in further detail hereafter using figures that represent preferred embodiments of the invention.

Figure 1 is a transverse section view of a hybrid cable according to the invention, according to a first embodiment.

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Figure 2 is a transverse section view of a hybrid cable according to the invention, according to a second embodiment.

- Figure 3 is a transverse section view of a hybrid cable according to the invention, according to a third embodiment.

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Figure 1 is a transverse section view of a hybrid electric cable particularly intended for equipping a railway network points switch.

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This hybrid cable comprises, in a common outer sheath 1, two power cables 2, 3 and two data transmission cables 4, 5.

- A first power cable 2 is a triplet of conductors, a second power cable 3 is a pair of conductors and the data transmission cables 4, 5 are quadruplets of conductors. These cables 2 to 5 are stranded around a central support rod 6, made from insulating material, for example, from polyethylene. The conductors are preferably made from copper.

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A common steel mechanical protection screen 7 is arranged below the outer sheath 1 made from insulating material, the thickness of said screen is between 0.1 and 0.8 mm, and preferably

substantially equal to 0.2 mm. The purpose of this steel screen is to protect the cables from damages that can be caused by impacts or by attacks from rodents.

5 Furthermore, below this steel screen 7, the hybrid cable comprises, from the outside to the inside, a layer 8 of insulating material, preferably made from polyethylene, a laminate of aluminium insulating material 9 glued on the preceding layer and a sheet of plastic maintaining material 10.
10 The common aluminium layer provides electromagnetic protection and is between 0.05 and 0.5 mm thick, preferably substantially equal to 0.15 mm thick.

Said insulating material advantageously is polyethylene.

15 Preferably, such a hybrid cable equips a railway network points switch, with the triplet of conductors 2 powering the motor of this points switch, the pair of conductors 3 being able to power a device for heating this points switch and the data transmission
20 cables 4, 5 controlling the positioning of this points switch. One of the two data transmission cables is a backup cable, in the event of a fault in the other data transmission cable.

Figure 2 is a transverse section view of a hybrid electric cable
25 particularly intended for equipping three railway network points switches.

This hybrid cable comprises, in a common outer sheath 1, six power cables 2' to 7' and four data transmission cables 8' to
30 11'.

Three first power cables 2', 3', 4' are triplets of conductors, three second power cables 5', 6', 7' are pairs of conductors and the data transmission cables 8' to 11' are quadruplets of
35 conductors. These cables are stranded.

Below the outer sheath 1 made from insulating material, preferably from polyethylene, the arrangement is identical to

that previously described, namely, from the outside to the inside, a common steel mechanical protection screen 7, a layer 8 of insulating material, preferably made from polyethylene, a laminate of aluminium insulating material 9 glued on the preceding layer and a sheet of plastic maintaining material 10.

In order to obtain an arrangement that is optimally stable both on the electrical or data transmission level and on the mechanical level, three data transmission cables 8', 9' and 10' form a central core surrounded by a sheet of plastic maintaining material 12', and the power cables 2' to 7' are stranded on the periphery around this core, with three filler cylinders 13', 14' and 15', made from insulating material, preferably from polyethylene.

Preferably, such a hybrid cable equips three railway network points switches, with the triplets of conductors 2', 3', 4' powering the motor of this points switch, the pairs of conductors 5', 6', 7' being able to power a device for heating this points switch and the data transmission cables 8' to 11' controlling the positioning of this points switch. The fourth data transmission cable 11' arranged on the periphery is a backup cable, in the event of a fault in one of the three data transmission cables of the central core.

Figure 3 is a transverse section view of a hybrid electric cable particularly intended for equipping six railway network points switches and formed in a similar manner.

This hybrid cable comprises, in a common outer sheath 1, twelve power cables arranged on the periphery and seven data transmission cables forming a central core.

Six first power cables are triplets of conductors, six second power cables are pairs of conductors and the data transmission cables are quadruplets of conductors.

According to this embodiment, the central core is surrounded by

a layer of extruded plastic maintaining material 12'', preferably made from polyethylene.

5 Preferably, such a hybrid cable equips six railway network points switches, with the triplets of conductors powering the motor of this points switch, the pairs of conductors being able to power a device for heating this points switch and the data transmission cables controlling the positioning of this points switch. The seventh data transmission cable arranged on the
10 periphery is a backup cable, in the event of a fault in one of the six data transmission cables of the central core.

In general, the invention relates to a hybrid electric cable comprising, in a common outer sheath, at least two power cables
15 and at least two data transmission cables, preferably intended to equip at least one railway network points switch.

According to all the embodiments, advantageously, the diameter of each conductor of the triplets powering the points switch
20 motor is between 1.13 and 2.20 mm, and preferably substantially equal to 1.38 mm, the diameter of each conductor of said pairs able to power a device for heating the points switch is between 1.35 and 3.50 mm, and preferably substantially equal to 1.75 mm, and the diameter of each conductor of said quadruplets
25 controlling the positioning of the points switch is between 0.60 and 1.80 mm, and preferably substantially equal to 0.9 mm.

Patentkrav

1. Hybridt elektrisk kabel, der i en fælles ydre kappe (1) omfatter mindst to strømkabler (2, 3; 2' til 7') og mindst to
5 datatransmissionskabler (4, 5; 8' til 11'), og som omfatter et fælles lag af ledende materiale til elektromagnetisk beskyttelse, idet mindst én fælles skærm til mekanisk beskyttelse (7) af stål i øvrigt er placeret under den ydre kappe, kendetegnet ved, at den fælles skærm til mekanisk beskyttelse (7) af stål har en
10 tykkelse på mellem 0,1 og 0,8 mm, samt ved, at den under den fælles skærm til mekanisk beskyttelse (7) af stål omfatter et lag af isolerende materiale (8), et laminat af isolerende materiale og aluminium (9), der er limet på det foregående lag, og en støttefolie af plasticmateriale (10).
- 15 2. Kabel ifølge krav 1, kendetegnet ved, at den fælles skærm til mekanisk beskyttelse (7) har en tykkelse i størrelsesordenen 0,2 mm.
- 20 3. Kabel ifølge krav 1 eller 2, kendetegnet ved, at et første strømkabel (2; 2', 3', 4') er en gruppe på tre ledere, et andet strømkabel (3; 5', 6', 7') er et par ledere, og datatransmissionskablerne (4, 5; 8' til 11') er grupper på fire ledere.
- 25 4. Hybridt elektrisk kabel ifølge et af de foregående krav, der omfatter mindst tre strømkabler (2' til 7') og mindst tre datatransmissionskabler (8', 9', 10', 11'), kendetegnet ved, at mindst tre af datatransmissionskablerne (8', 9', 10') udgør en
30 midterste kerne, og at strømkablerne (2' til 7') er placeret ved periferien omkring denne kerne.
5. Kabel ifølge det foregående krav, kendetegnet ved, at kernen er omgivet af en støttefolie af plasticmateriale (12').
- 35 6. Kabel ifølge krav 4, kendetegnet ved, at kernen er omgivet af et støttelag af plasticmateriale (12").

7. Kabel ifølge et af de foregående krav, kendetegnet ved, at det isolerende materiale er polyethylen.

5 8. Kabel ifølge et af de foregående krav, kendetegnet ved, at det fælles lag af ledende materiale til elektromagnetisk beskyttelse er fremstillet af aluminium.

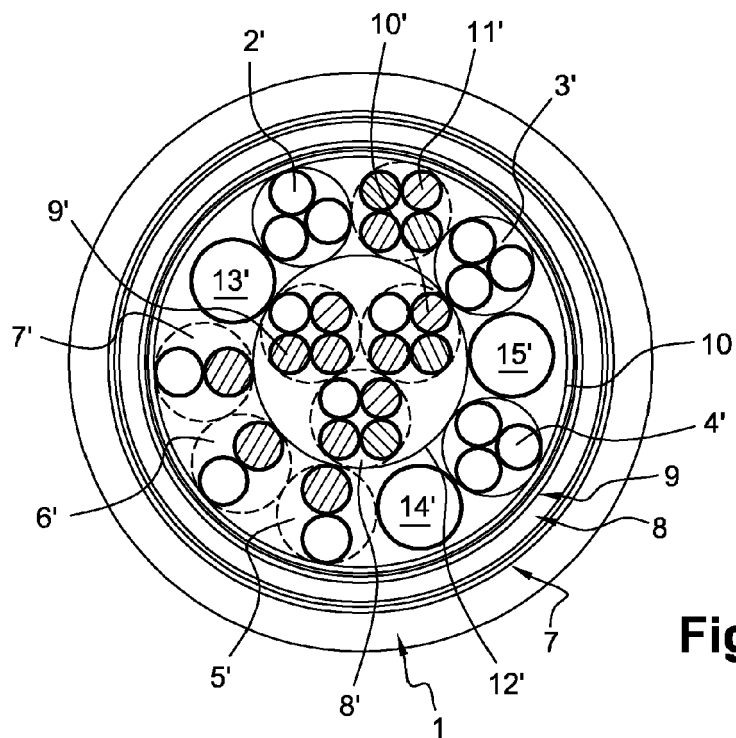
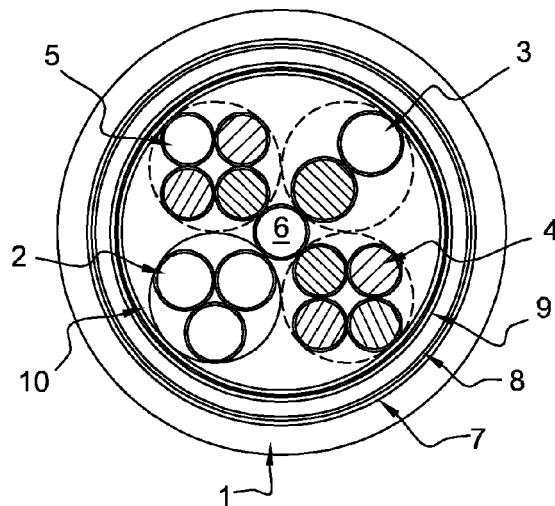
10 9. Kabel ifølge det foregående krav, kendetegnet ved, at laget af aluminium har en tykkelse på mellem 0,05 og 0,5 mm og fortrinsvis lig med tilnærmelsesvis 0,15 mm.

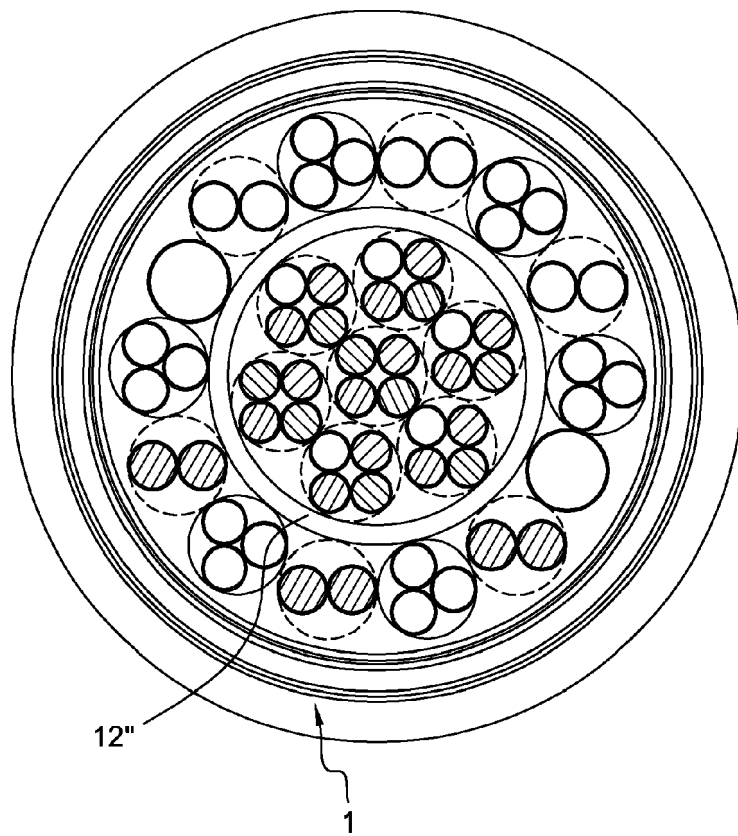
15 10. Kabel ifølge et af kravene 2 til 9, kendetegnet ved, at diameteren af hver leder i gruppen på tre ledere ligger mellem 1,13 og 2,20 mm og fortrinsvis er tilnærmelsesvis lig med 1,38 mm.

20 11. Kabel ifølge et af kravene 2 til 10, kendetegnet ved, at diameteren af hver leder i parret af ledere ligger mellem 1,35 og 3,50 mm og fortrinsvis er tilnærmelsesvis lig med 1,75 mm.

25 12. Kabel ifølge et af kravene 2 til 11, kendetegnet ved, at diameteren af hver leder i gruppen på fire ledere ligger mellem 0,60 og 1,80 mm og fortrinsvis i det væsentlige er lig med tilnærmelsesvis 0,9 mm.

13. Kabel ifølge et af kravene 2 til 12, kendetegnet ved, at lederne er fremstillet af kobber.

Fig. 1**Fig. 2**

**Fig. 3**