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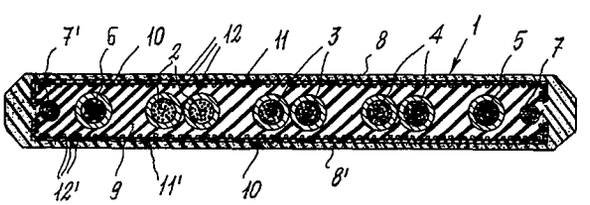
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(54) Flat electric cable.

(57) The cable (1), in particular for the power supply and/or control of mobile user appliances in general, is of the type comprising a flexible sheath of flat configuration, a plurality of electrical conductors (2-6) disposed side-by-side along a common plane lying between and parallel to the opposing major faces (8, 8') of said sheath, and continuous longitudinal mechanical elements (7, 7') resistant to axial traction, and is essentially characterised in that said sheath is constituted by a central flat portion (9) comprising first upper and lower faces and second lateral faces, and of a material which is flexible but highly compression-resistant, for housing at least said electrical conductors; an outer covering (10) of elastic material for said central portion; and at least one transverse armouring reinforcement (11, 11') disposed between said central portion and said outer covering.



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Flat electric cable

This invention relates to a flat electric cable, in particular for the power supply and/or remote control of mobile user appliances in general, comprising a sheath of diverse structure for mechanically protecting the conductors.

The expression "mobile user appliances in general" signifies apparatus and machines supplied by electric current and moving along a predetermined path of travel, such as cranes and other elevators provided on harbour docks, storage yards or similar loading and unloading areas, or machines for working in mines, in tunnels, in steelworks or in industrial plants in general.

When the path of travel is fixed, for example a rail track, the mobile user appliance can be supplied by way of contact rails or by cables of considerable length which wind on to and unwind from a cable winding drum carried by the user appliance itself.

When the path of travel is not defined by rail tracks (for example in a tunnel or mine), the power supply is provided only by means of electric cables.

The electric cables normally used for the power supply of mobile user appliances are flexible cables of circular cross-section constituted by a plurality of copper cables twisted together with a short pitch and covered with a sheath of elastomer (generally rubber) comprising suitably braided textile inserts to give the necessary mechanical resistance to the axial traction which arises during the use for which said cable is designed, this mechanical resistance being necessarily greater than that of normal flexible cables used for applications other than the electrical supply of mobile user appliances.

In this respect, it should be noted that a large proportion of modern cable winding drums is of the single-turn type, so that the ratio of the minimum winding diameter (with only a few turns wound on the drum) to the maximum winding diameter (with the cable entirely wound) can vary from 1:3 to 1:5, while the traversing speed of the mobile user appliance can vary from a few metres/min. to more than 100-120 metres/min. It follows that the traction on the cable can vary considerably, and said cable must therefore be necessarily sized so as to support without damage the maximum mechanical tensile

stress to which it can be subjected, this stress occurring particularly when in the case of constant torque drive systems the mobile user appliance starts from rest under maximun acceleration when only a few turns of cable are wound.

In order to satisfy this condition, cables of circular cross-section have large diameters, with the consequent need to accordingly structure the cable winding drums (large diameters for large cable lengths) and the relative drive members, in particular the torque generator, i.e. the member which enables the drum to wind and unwind the cable whatever the winding diameter, and the speed and acceleration of the mobile user appliance on which the cable winding drum is installed.

The armouring structure for cables of circular cross-section satisfies the traction resistance condition, but because of its circular configuration is not able to satisfy the condition of resistance to radial compression stresses (crushing) which can arise during the transit of vehicles or other appliances in ports, steelworks, mines or similar working environments. Because of this it is necessary when possible to provide suitable raceways along the path of travel for receiving and protecting the cable.

Flat cables are also known comprising non-twisted electrical conductors disposed parallel to each other and protected by a flat rubber sheath, and sometimes provided with continuous longitudinal armouring elements to give the cable greater resistance to axial traction.

These cables are commonly used in overhead lines suspended slackly from trolleys running on a monorail, but as in the case of cables of circular cross-section they do not resist transverse mechanical compressive stresses (crushing), so that they cannot be used resting unprotected directly on the ground in working areas of vehicle transit.

Flat cables enable the dimensions of cable winding drums to be substantially reduced and the relative drive members to be considerably simplified, and the object of the present invention is therefore to provide a flat electric cable with a high resistance to axial tensile and transverse compressive stresses, so that it can be used for the power supply to mobile user appliances provided with either a vertically or horizontally disposed cable winding drum without the need to be contained in a suitable protection raceway.

These and further objects of the invention will be apparent to experts of the art from reading the description and claims given hereinafter.

The flat electric cable, in particular for the power supply and/or control of mobile user appliances in general, according to the invention, is of the type comprising a flexible sheath of flat configuration, a plurality of electrical conductors disposed side-by-side along a common plane lying between and parallel to the opposing major faces of said sheath, and continuous mechanical elements resistant to axial traction, and is essentially characterised in that said sheath is constituted by a central flat portion comprising first upper and lower faces and second lateral faces, and of a material which is flexible longitudinally but higly compression-resistant, for housing at least said electrical conductors; an outer covering of elastic material for said central portion; and at least one transverse armouring reinforcement disposed between said central portion and said outer covering.

The electric cable according to the invention is shown by way of non-limiting example in cross-section in the figure of the single accompanying drawing as a mixed cable for three-phase supply plus earth and with four auxiliary conductors for the remote control of a mobile user appliance.

With reference to the figure, the cable, indicated overall by the reference numeral 1, conventionally comprises three pairs of phase conductors 2, 3 and 4, an earth conductor 5, a four-core cable 6 for remote control, and two steel cables 7, 7' for absorbing longitudinal tractive forces. The conductors, four-core cable and steel cables are all disposed parallel to each other along a common central plane lying between the opposing major faces 8 and 8' of the flat cable 1.

According to the invention, the assembly formed from the constituent elements of the sheath has a particular structure arranged to also give the overall cable 1 a high resistance to transverse compression (crushing) for the reason stated heretofore.

For this purpose, the sheath comprises essentially a central filler portion 9 of material which is flexible but higly compression-resistant such as rubber, thermoplastic resins or mixtures thereof, having a high Shore hardness value. A practical example of material suitable for said central portion

9 is a styrene-butadiene rubber of high styrene content, known commercially as S.B.R.

The conductors 2, 3 and 4, the four-core cable 6 and the steel cables 7, 7' are contained within said central portion 9. Their method of insertion does not form part of the present invention, as this can be carried out in any conventional manner known to the expert of the art.

The portion 9 is enclosed by an outer covering 10 of suitable rubber or equivalent material, possibly chosen in order to offer maximum resistance to environmental conditions, such as resistance to abrasion, to hydrocarbons, to flame propagation, to agein and the like.

Between the central portion 9 and the outer covering 10 there are provided two opposing armouring reinforcements, one on each side of the central portion 9 and constituted by transverse rigid elements 11, 11' of high mechanical strength, disposed in side-by-side succession. These transverse rigid elements are advantageously steel strands or strips, suitably treated so that they bond to the adjacent material, and possibly interwoven with longitudinal elastic elements 12, 12', for example plastics filaments, in order to create a mesh structure able to resist any stresses deriving from penetration by pointed elements present on the area on which the cable 1 rests.

The function of the transverse rigid elements 11, 11' is essentially to uniformly transfer transverse crushing forces to the underlying central portion 9 which, by virtue of its highly compression-resistant structure, absorbs them without exerting any pressure effect on the conductors and cables contained therein.

In a modified embodiment, not shown, the armouring reinforcements can be joined together at their ends so as to form a cage which entirely wraps the central portion 9, so as to give the cable 1 compression resistance even when disposed edgewise, for example during winding on to and unwinding from a cable drum of vertical rotational axis.

The proposed structure therefore gives the cable 1 resistance both to mechanical compressive and tensile stresses, and enables said cable to be used for electrically supplying and/or transmitting signals to the mobile user appliance, and in addition can be wound on to and unwound from a verti

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cally or horizontally disposed winding drum, and does not require any protection raceway along the path of the user appliance.

Claims:

1. An electric cable (1), in particular for the power supply and/or control of mobile user appliances in general, of the type comprising a flexible sheath of flast configuration, a plurality of electrical conductors (2-6) disposed side-by-side along a common plane lying between and parallel to the opposing major faces (8,8') of said sheath, and continuous longitudinal mechanical elements (7,7') resistant to axial traction, characterised in that said sheath is constituted by a central flat portion (9) comprising first upper and lower faces and second lateral faces, and of a material which is flexible but highly compression-resistant, for housing at least said electrical conductors; an outer covering (10) of elastic material for said central portion; and at least one transverse armouring reinforcement (11,11') disposed between said central portion and said outer covering.

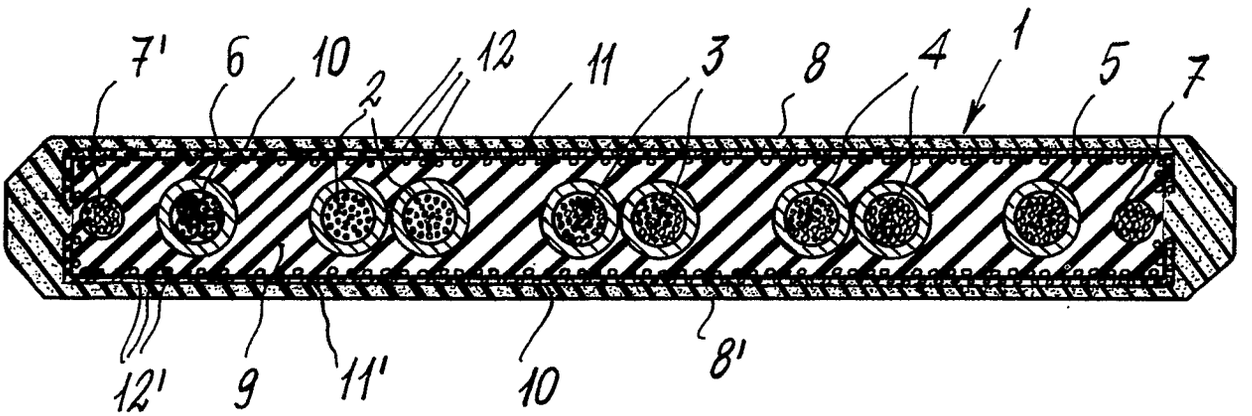
2. An electric cable as claimed in claim 1, characterised in that said armouring reinforcement is constituted by a side-by-side succession of transverse rigid elements (11,11') of high mechanical strength, in particular wires, strands or strips.

3. An electric cable as claimed in claim 2, characterised in that said transverse rigid elements are interwoven with longitudinal flexible elements (12,12').

4. An electric cable as claimed in claim 3, characterised in that said longitudinal flexible elements are plastic monofilaments.

5. An electric cable as claimed in claim 1, characterised in that said at least one armouring reinforcement is constituted by a first set of elements disposed between said first upper face of said central portion and the opposing inner major face of said sheath, and by a second set of elements disposed between said first lower face of said central portion and the opposing inner major face of said sheath.

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EUROPEAN SEARCH REPORT

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Application number

EP 82 20 0565

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	CH-A- 452 630 (HUBER) *Column 2, line 19 to column 4, line 59; figure 3*	1,2	H 01 B 7/08
Y	FR-A-1 417 339 (THOMSON-HOUSTON) *Page 2, column 2, paragraph 8 to page 4, column 2, paragraph 1; figure 1*	1	
A	FR-A-2 162 306 (RENAULT-PEUGEOT) *Page 2, line 30 to page 3, line 2; figures 3,4*	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	01-09-1982	DEMOLDER J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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T : theory or principle underlying the invention
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