



(51) International Patent Classification:  
**H02G 1/12** (2006.01)

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(21) International Application Number:  
PCT/EP2010/051099

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(22) International Filing Date:  
29 January 2010 (29.01.2010)

(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,  
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,  
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,  
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,  
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,  
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,  
NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD,  
SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,  
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
10 2009 000 547.1  
2 February 2009 (02.02.2009) DE

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(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,  
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,  
TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE,

[Continued on next page]

(54) Title: METHOD FOR STRIPPING A CABLE MEANS

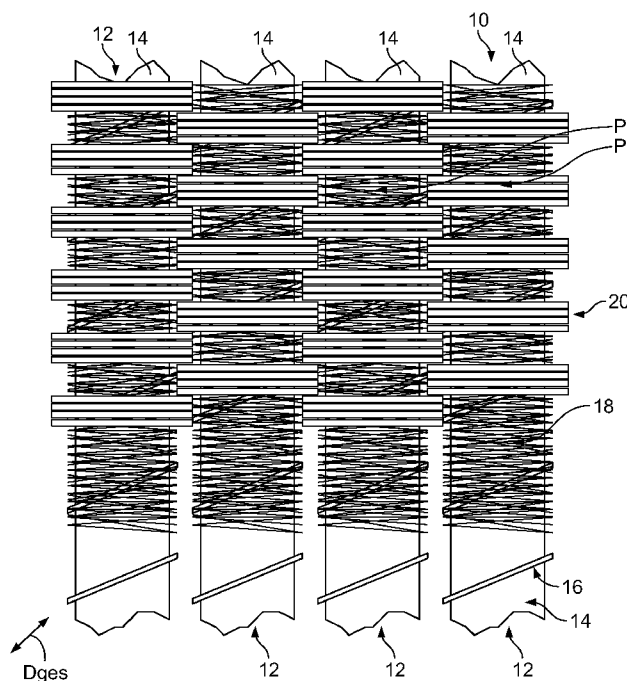


FIG. 1

(57) Abstract: Method for the stripping of a cable means  
(10), wherein the cable means (10) has at least one cable  
element (12), including the step: stripping at least a part  
of the cable element (12) using at least one chemical  
agent.



ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,  
MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG).

— *of inventorship (Rule 4.17(iv))*

**Published:**

— *without international search report and to be republished  
upon receipt of that report (Rule 48.2(g))*

**Declarations under Rule 4.17:**

— *as to applicant's entitlement to apply for and be granted  
a patent (Rule 4.17(ii))*

## **METHOD FOR STRIPPING A CABLE MEANS**

The invention relates to a method for stripping a cable means.

- 5 The so-called stranded wire or litz wire is for example known in the art. The stranded wire is in this case an electrical conductor which consists of thin individual wires and is therefore easy to bend. The individual wires of the stranded wire are normally surrounded by a common insulating casing. Conductors of this type are called a stranded wire line. If a plurality of lines of this type are combined in a cable, they are called conductor bunches. In  
10 a cable of this type, the insulating casing, which is normally made of plastics material, is removed by means of an appropriate pair of pliers and the cable is in this way stripped. There are however also cables around which a yarn is spun; such cables are difficult to strip.

The object of the invention is therefore to provide an improved method for the stripping of  
15 cables.

This object is achieved by a method according to claim 1.

- The invention provides a method for the stripping of a cable means, wherein the cable  
20 means has at least one cable element, including the step:  
- stripping at least a part of the cable element using at least one chemical material or chemical agent.

- The method has in this case the advantage that at least a part of the cable element, for  
25 example a core around which a wire element is wound or the sheathing thereof, can be removed by means of a chemical material or chemical agent. In the prior art, stripping was previously carried out mechanically, for example by means of an appropriate pair of pliers.

Preferred developments are defined in the dependent claims.  
30

In an embodiment according to the invention, the cable element has a core, a sheathing and/or a woven fabric for connecting to other cable elements. The core, the sheathing

and/or the woven fabric can in this case be at least partially or completely removed by means of one or more chemical agents. Depending on the manner in which the cable element is subsequently contacted, it may for example be sufficient if only the core or only the woven fabric or the sheathing is removed.

5

In a further embodiment according to the invention, the chemical agent is for example formic acid, developer solution, isopropyl ether, perchloroethylene, phenol, sulphuric acid, tartaric acid, dimethyl ether, methanoic acid and/or dichlorobenzene/phenol or at least comprises this.

10

In accordance with a further embodiment according to the invention, the chemical agent or agents for removing the core, the sheathing and/or the woven fabric is or are in each case identical or different. That means that a different chemical agent or agents is or are suitable for removing the core, for example, to that or those which is or are suitable for removing the sheathing and/or the woven fabric.

15

In a further embodiment according to the invention, the concentration, the composition and/or the action time of the chemical agent or agents are adapted to whether the core, the sheathing and/or the woven fabric of the respective cable element is removed at least partially or substantially completely. That has the advantage that the chemical agent or agents are precisely adapted to the part of the cable element that is removed and how much is removed.

20

Preferred embodiments of the invention will be described hereinafter in greater detail with reference to the appended figures, in which:

25

- Fig. 1 is a schematic view of an exemplary embodiment of a cable means to be stripped;  
Fig. 2 is a plan view onto another exemplary embodiment of a cable means to be stripped;  
Fig. 3 is a plan view onto a further exemplary embodiment of a cable means to be stripped;  
Fig. 4 is a view of individual cable elements of a cable means to be stripped;  
Fig. 5 is a view of an individual cable element of the cable means to be stripped;

30

Fig. 6 shows a detail of a first embodiment of a stripping according to the invention of a cable means;

Fig. 7 shows a further detail of the first embodiment of the stripping of the cable means;

Fig. 8 shows a detail of a second embodiment of a stripping according to the invention of a  
5 cable means;

Fig. 9 shows a further detail of the second embodiment of the stripping of the cable means;

Fig. 10 shows another detail of the second embodiment of the stripping of the cable means with transverse weaving and individual sheathing of the cable elements;

Fig. 11 shows a detail of a third embodiment of a stripping according to the invention of a  
10 cable means;

Fig. 12 shows a further detail of the third embodiment of the stripping of the cable means;

Fig. 13 shows another detail of the third embodiment of the stripping of the cable means with transverse weaving and individual sheathing of the cable elements;

Fig. 14 shows a detail of a fourth embodiment of a stripping according to the invention of a  
15 cable means; and

Fig. 15 shows a further detail of the fourth embodiment of the stripping of the cable means.

In the figures, similar or identical components or elements are, unless otherwise stated,  
20 provided with the same reference numerals.

To begin with, Fig. 1 is a schematic view of a cable means 10 which can be stripped using the method according to the invention and can be contacted with a contacting means. The cable means 10 has in this case at least one, two, three, four or more or a large number of  
25 cable elements 12.

Each cable element 12 has in this case a core 14, for example in the form of at least one or a large number of resilient fibre elements or strand elements. The fibre element is e.g. a Lycra elastane fibre element or a PU (polyurethane) fibre element. However, the invention is not  
30 limited to these materials. Use may also be made of any other material suitable for the core or any other suitable combination of materials. The aforementioned materials are merely exemplary.

Furthermore, at least one wire element 16 is wound, for example helically, around the core 14, as illustrated in Fig. 1. The winding gradient of the wire element 16 during winding around the core 14 is in this case for example approx. 0.3 mm. However, this value is purely  
5 exemplary. The winding gradient of the wire element 16 can, depending on the function and purpose of use, also be less or greater than 0.3 mm. In addition, the cable element 12 can optionally be provided with a sheathing 18, e.g. as protection. The sheathing 18 consists in this case for example of at least one yarn which is spun around the core 14 around which the wire element 16 is wound. The yarn of the sheathing 18 for spinning the wire element 16  
10 around the core 14 is for example a nylon yarn, e.g. a PA66 nylon yarn. However, the invention is not limited to this material. Use may also be made of any other material suitable for the sheathing of the core 14 and the wire element 16 or any other suitable combination of materials. The aforementioned material is purely exemplary.

15 The wire element 16 used may for example be a wire, e.g. a coated wire such as for example a silver-plated copper wire (e.g. wire: silver-plated copper wire D: e.g. approx. 0.04 mm, i.e. approx. 4 m). The wire per metre of thread is for example 50 ohms per metre. However, this value is purely exemplary and the invention is not limited thereto; thus, the wire per metre of thread can be greater or less than 50 ohms, depending on the function and  
20 purpose of use.

Furthermore, the cable elements 12 can additionally be connected to one another in that they are mutually woven together via for example at least one yarn, e.g. nylon yarn such as PA66 nylon yarn, or are e.g. transverse woven, as is illustrated in Fig. 1, and are thus  
25 provided with a type of common woven fabric 20. However, in principle, any other type of connecting means can be provided for connecting the cable elements 12, for example a holding means (not shown) into which the cable elements are inserted and can be positioned relative to one another, wherein they can in this case additionally be e.g. clamped in the holding means in order to be in this way fixed in a desired position.

30 The cable elements 16 are integrated in the above-described woven fabric 20 and can optionally be positioned at a predetermined spacing or pitch P in relation to one another.

The spacing or pitch  $P$  of the cable elements 16 in the woven fabric 20 can in this case be, depending on the embodiment, for example greater than 0.85 mm. This value is purely exemplary and the invention is not limited thereto. Depending on the function and purpose of use, the spacing or the pitch  $P$  of the cable elements 16, which are connected to one  
5 another or woven together via the woven fabric 20 or yarn, can also be less than or equal to 0.85 mm. The yarn diameter is for example 0.4 mm to 0.5 mm and the woven fabric thickness is 0.6 mm. These values are also purely exemplary. Thus, the yarn diameter can also be less than 0.4 mm and greater than 0.5 mm, and the woven fabric thickness can be less than or greater than 0.6 mm, depending on the function and purpose of use.

10

The winding of the wire element 16 or the winding-round of a core 14, i.e. resilient core, with the wire element 16 allows an extensibility of the cable element 12 or cable elements 12, and thus of the cable means 10, of for example up to 300 % to be achieved.

15 In the example shown in Fig. 1, the core diameter  $d_K$  of the respective cable element 16 is for example approx. 0.3 mm. The core 14 is in this case a resilient Lycra core around which a silver-plated copper wire 16 is wound, as described hereinbefore. The total thickness  $D_{ges}$  of the woven fabric 20 is approx. 0.6 mm and the fibre woven fabric diameter  $d_F$  weaves around approx. 0.4 mm to 0.5 mm. These values are merely exemplary and the invention is  
20 not limited thereto.

Fig. 2 is a plan view onto a cable means 10 which can be stripped using the method according to the invention. The cable means 10 has in this case a large number of cable elements 12 which are additionally woven together, via at least one or more yarns, in the  
25 form of a woven fabric 20.

Furthermore, Fig. 3 shows an enlarged detail of a cable means 10. In this case too, the cable means 10 has a large number of cable elements 12. The cable elements are woven together or substantially transverse woven via a yarn and form a transverse weaving 20. The yarn is  
30 in this case for example first guided in alternation substantially transversely to the cable elements 12 in at least a first row 22 over a cable element 12 and then passed through below under the cable element 12 positioned next to it before it is again guided over the next cable

element 12 and then passed through below again under the subsequent cable element 12. In the adjoining second row 24, the yarn can instead first be passed through under the cable element 12 and then be guided over the cable element 12 positioned next to it before it is passed through under the next cable element 12 and is then guided over the following cable  
5 element 12 thereabove. In this way, the cable elements 12 are integrated or woven-in or woven-round in a yarn weave 20. In this case, yarns can be woven around the cable elements 12 at least in one, two, three or a large number of rows 22, 24 in order in this way to position the cable elements in a specific position, for example next to one another, as is shown in Fig. 2 and 3. In this case, the cable elements 12 can be set apart from one another  
10 at a predetermined spacing or pitch P.

Fig. 4 is a view of individual cable elements 12 of the cable means 10 without the woven fabric 20 with which cable elements 12 in Fig. 2 and 3 are connected to one another or woven together. The respective cable element 12, such as is shown in Fig. 4, has in this case  
15 a core 14 around which a wire element 16 and yarn are wound as the sheathing 18, as was described hereinbefore with reference to Fig. 1. At the free end of the respective cable element 12, the wire element 16 is partially exposed as a result of the coming-loose of individual yarn threads.

20 Furthermore, Fig. 5 is a view of a portion of an individual cable element 12 of the cable means 20. A cable element 12 of this type, such as is shown in Fig. 4 and 5, can optionally be connected, as is shown in Fig. 2 and 3, to other cable elements 12, e.g. by weaving one or more yarns around the cable elements 12, thus producing a woven fabric 20. The cable element 12 is provided, as is shown in Fig. 4 and 5, with a sheathing 18 in the form, for  
25 example, of at least one yarn which is spun or spins around the core 14 around which a wire element 16 is wound. However, in principle, the respective cable element 12 can also have only the core 14 and at least one wire element 16 which is wound around the core 14. A sheathing 18 made of yarn is an optional feature, as is the woven fabric 20 with which individual cable elements 12 are connected to one another. Furthermore, the cable element  
30 12, as the sheathing 18, can, instead of having at least one yarn spun around it, also have e.g. a plastics material jacket (not shown) as the sheathing 18, to name a further example of a sheathing. The invention is not limited to these two examples. It is in principle possible to

provide on the respective cable element any further type of sheathing which can later be removed by means of the chemical stripping method according to the invention, which will be described hereinafter in greater detail.

- 5 In accordance with the invention, for the stripping according to the invention of the core sheathing of the respective cable element of a cable means, use is made of chemical processes such as are illustrated by way of example in the following Table 1.

Table 1

| Chemical agent or in this case solvent | Selectivity of the jacket/core | Test result                                                                                                                  |
|----------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Formic acid                            | 4 – 3                          | Immediate loosening of the PA fibres from approx. 5 s<br>Transverse weave stable                                             |
| Isopropyl ether                        | 4 – 1                          | Diethyl ether<br>Contraction, slight initial loosening of the PA fibres may be observed after approx. 10 min                 |
| Phenol RT                              | 4 – 3                          |                                                                                                                              |
| Dilute sulphuric acid, RT              | 4 – 3                          | Effect only from approx. 50 %, contraction, initial loosening/detaching of the PA fibres may be observed after approx. 5 min |

10

- Fig. 6 and 7 show the stripping according to the invention of the core sheathing of a cable element 12 of the cable means 10 by means of dimethyl ether as an example of a chemical agent which can be used for the stripping of the cable means 10. The first view in Fig. 6 shows in this case a detail of a plurality of cable elements 12 which are woven together by means of yarn via a woven fabric 20. It may be seen in this case that the dimethyl ether causes a first initial loosening and even already partial detaching of the transverse weave 20 with which the cable elements 12 are connected to one another. The same also applies to the detail shown in Fig. 7. In this case, the woven fabric 20 with which the cable elements
- 15

12 were woven together has already been completely unravelled by the dimethyl ether. Furthermore, the dimethyl ether already causes an initial loosening of the yarn with which the individual cable elements 12 are in each case spun-round or provided with a sheathing 18.

5

Furthermore, Fig. 8, 9 and 10 show the stripping according to the invention of the core sheathing of a cable element 12 of a cable means 10 by means of (e.g. 50 %) sulphuric acid as a further example of a chemical agent which can be used for the stripping of the cable means 10. The detail in Fig. 8 shows cable elements 12 of a cable means 10, the cable  
10 elements being woven together by means of yarn and having in this case a transverse weave 20. The 50 % sulphuric acid causes in this case a first initial loosening and unravelling of the transverse weave 20. In Fig. 9 the transverse weave 20 of the cable elements 12 is, in turn, already completely unravelled. The 50 % sulphuric acid causes in this case an initial loosening and even already a detaching of the respective yarn braiding or sheathing 18 of  
15 the individual cable elements 12. As may be seen from the detail in Fig. 9, individual portions of a respective wire element 16 and its core 14 of a cable element 12 become partially exposed or visible. This process progresses onward, as is shown in the subsequent detail in Fig. 10. Fig. 10 also shows the further unravelling and detaching of the transverse weave 20 and the sheathing 18 of the cable elements 12. What remain there are, in the first  
20 place, substantially the wire element 16 and its core 14 around which the wire element 14 of the respective cable element 12 is wound.

Fig. 11, 12 and 13 also illustrate the stripping according to the invention of the core sheathing of a cable element 12 of a cable means 10, this time by means of methanoic acid  
25 as another example of a chemical agent which can be used for the stripping of the cable means 10. The detail in Fig. 11 shows in this case cable elements 12 of a cable means 10 with their transverse weave 20 via which they are woven together. The methanoic acid causes in the process an initial loosening and already a detaching of the transverse weave 20. In the detail shown in Fig. 12, the transverse weave 20 of the cable elements 12 is  
30 already completely unravelled and detached. From the detail in Fig. 12, it can be seen in this case that the sheathing 18 or braiding of the cable elements 12 by means of yarn is also for the most part already unravelled and detached by the methanoic acid. This leaves

substantially, in the first place, the wire element 16 and the core 14 of the respective cable element 12 around which the wire element 16 is wound. The detail in Fig. 13 shows the unravelling and detaching of the transverse weaving 20 of the cable elements 12 and the unravelling and almost complete detaching of the braiding or sheathing 18 thereof by the  
5 methanoic acid.

Fig. 14 and 15 also show the stripping according to the invention of the core sheathing of a cable element 12 of a cable means 10 by means of dichlorobenzene/phenol as a further example of a chemical agent which can be used for the stripping of the cable means 10. The  
10 detail in Fig. 14 shows, in the first place, cable elements 12 of a cable means 10 which are connected to one another via a transverse weaving 20. As many in this case be seen from the detail in Fig. 14, the transverse weaving 20 is not only unravelled but is already beginning to become markedly detached. In the detail shown in Fig. 15, the transverse weaving 20 is already completely detached from the cable elements 12. In this case, the  
15 braiding or sheathing 18 of the individual cable elements 12 is also unravelled and substantially completely detached by the dichlorobenzene/phenol. What is left is substantially the core 14, around which the wire element 16 is wound, of the cable element 12.

20 Should e.g. the core 14 for example also become partially or substantially completely detached at the ends of the respective cable element 12, the action time, composition and/or the concentration of the corresponding chemical agent can for example, as described hereinbefore, be suitably adapted; for example, the action time and/or concentration can be increased or reduced accordingly. In this case, the same chemical agent can be used for  
25 unravelling the core as for removing the transverse weave 20 and/or the sheathing 18 of the cable element 12. Alternatively, a different chemical agent can also be used for removing the core 14 of the cable element 12. Likewise, the same chemical agent or in each case a different chemical agent can be used for removing the transverse weave 20 and the sheathing 18 of the cable element 12. In this case, the composition, concentration and/or  
30 action time of the chemical agent can be adapted accordingly, depending on whether the core 14, the sheathing 18 and/or the woven fabric 20 is to be partially or substantially completely removed for connecting the cable elements 12. The aforementioned chemical

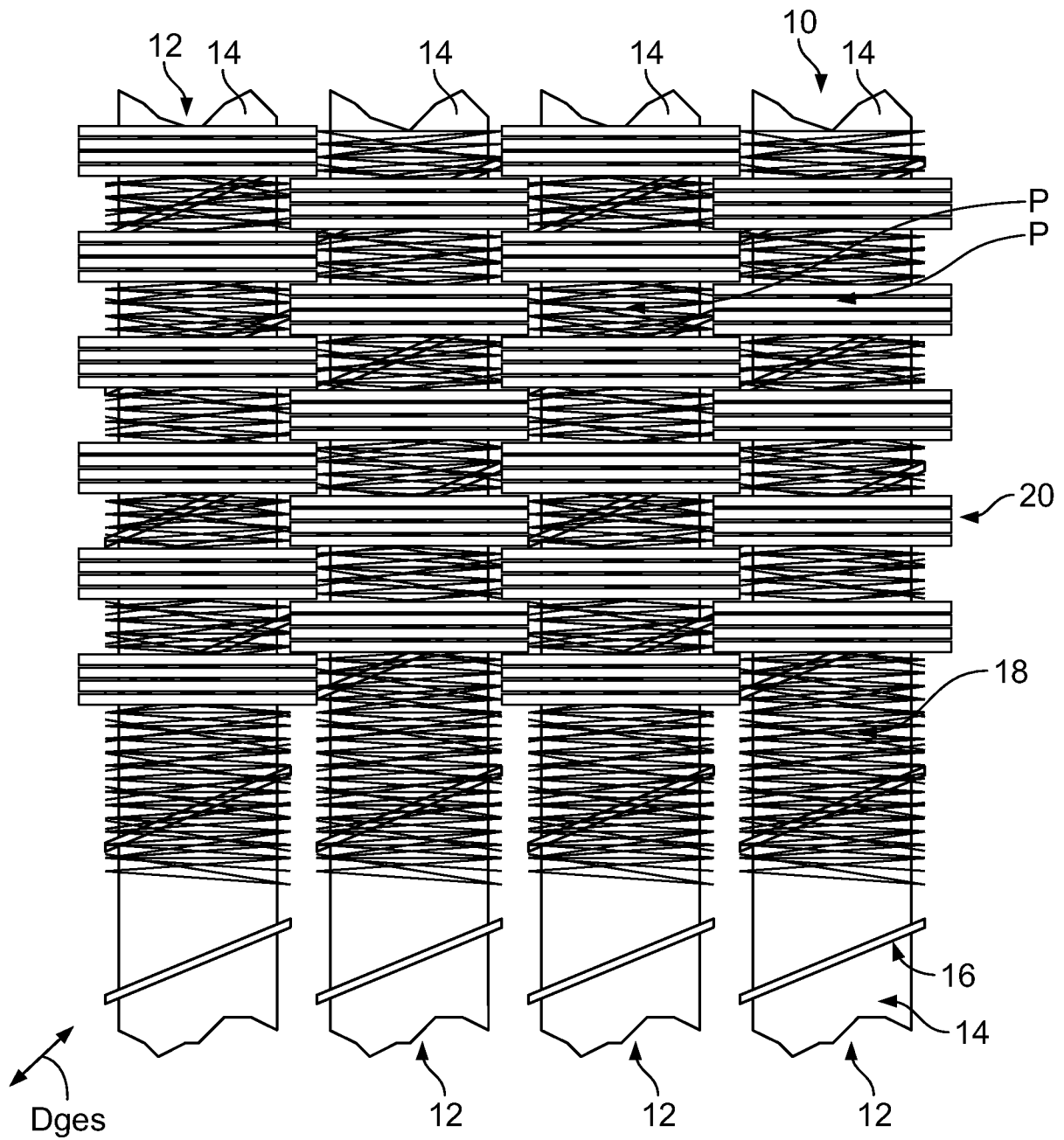
agents are merely examples and the invention is not limited to these particular chemical agents. In principle, use may be made, for the stripping according to the invention of cable elements, of any chemical agent which is suitable for at least partially or completely removing the core 14, the sheathing 18 and/or the woven fabric 20 of the cable elements.

- 5 The chemical agent is in this case for example a liquid, a gas, a paste and/or a powder. However, the invention is not limited to these examples. In addition to a yarn for the sheathing and the woven fabric, any other type of sheathing or connection of cable elements can be provided, for example a plastics material casing or a connecting clasp, etc. Accordingly, it is possible to provide for the core, instead of a fibre, also a resilient tube or a
- 10 resilient rod element. Accordingly, the chemical agent or agents are selected in such a way as to be able likewise to at least partially or completely remove this type of core or sheathing and connection of cable elements. The invention is not limited to yarns or fibres for the sheathing, the woven fabric and the core.

## CLAIMS

1. Method for the stripping of a cable means (10), wherein the cable means (10) has at  
5 least one cable element (12), including the step:  
- stripping at least a part of the cable element (12) using at least one chemical agent.
2. Method according to claim 1, characterised in that the cable element (12) has a core  
(14) and a wire element (16) is wound around the core (14), wherein the core (14), as a part  
10 of the cable element (12), can be removed by means of the chemical agent.
3. Method according to claim 2, characterised in that the core (14) is made of Lycra  
elastane or PU, the core (14) having at least one or a large number of Lycra elastane fibres  
or PU fibres.
- 15 4. Method according to at least one of claims 1 to 3, characterised in that the cable  
element (12) has a sheathing (18), the sheathing (18) consisting of a nylon yarn, and  
wherein the sheathing (18), as a part of the cable element (12), can be removed by means of  
the chemical agent.
- 20 5. Method according to at least one of claims 1 to 4, characterised in that the cable  
means (10) has at least two cable elements (12), the cable elements (12) being connected to  
one another via a woven fabric (20), and wherein the woven fabric (20), as a part of the  
respective cable element (12), can be removed by means of the chemical agent.
- 25 6. Method according to at least one of claims 1 to 5, characterised in that the chemical  
agent comprises formic acid, developer solution, isopropyl ether, perchloroethylene, phenol,  
sulphuric acid, tartaric acid, dimethyl ether, methanoic acid and/or dichlorobenzene/phenol  
or consists thereof.

7. Method according to at least one of claims 2 to 6, characterised in that the chemical agent for removing the core (14), the sheathing (18) and/or the woven fabric (20) is in each case the same chemical agent or is a different chemical agent.
- 5 8. Method according to at least one of claims 2 to 7, characterised in that the core (14), the sheathing (18) and/or the woven fabric (20) for stripping the cable element (12) can be removed at least partially or substantially completely by means of the chemical agent.
9. Method according to at least one of claims 2 to 8, characterised in that the  
10 concentration, composition and/or the time for which the chemical agent acts on the cable element (12) can be set depending on whether the core (14), the sheathing (18) and/or the woven fabric (20) of the respective cable element (12) is removed at least partially or substantially completely.
- 15 10. Cable means (10) with at least one or more cable elements (12) which are stripped using the method according to at least one of claims 1 to 9.



**FIG. 1**

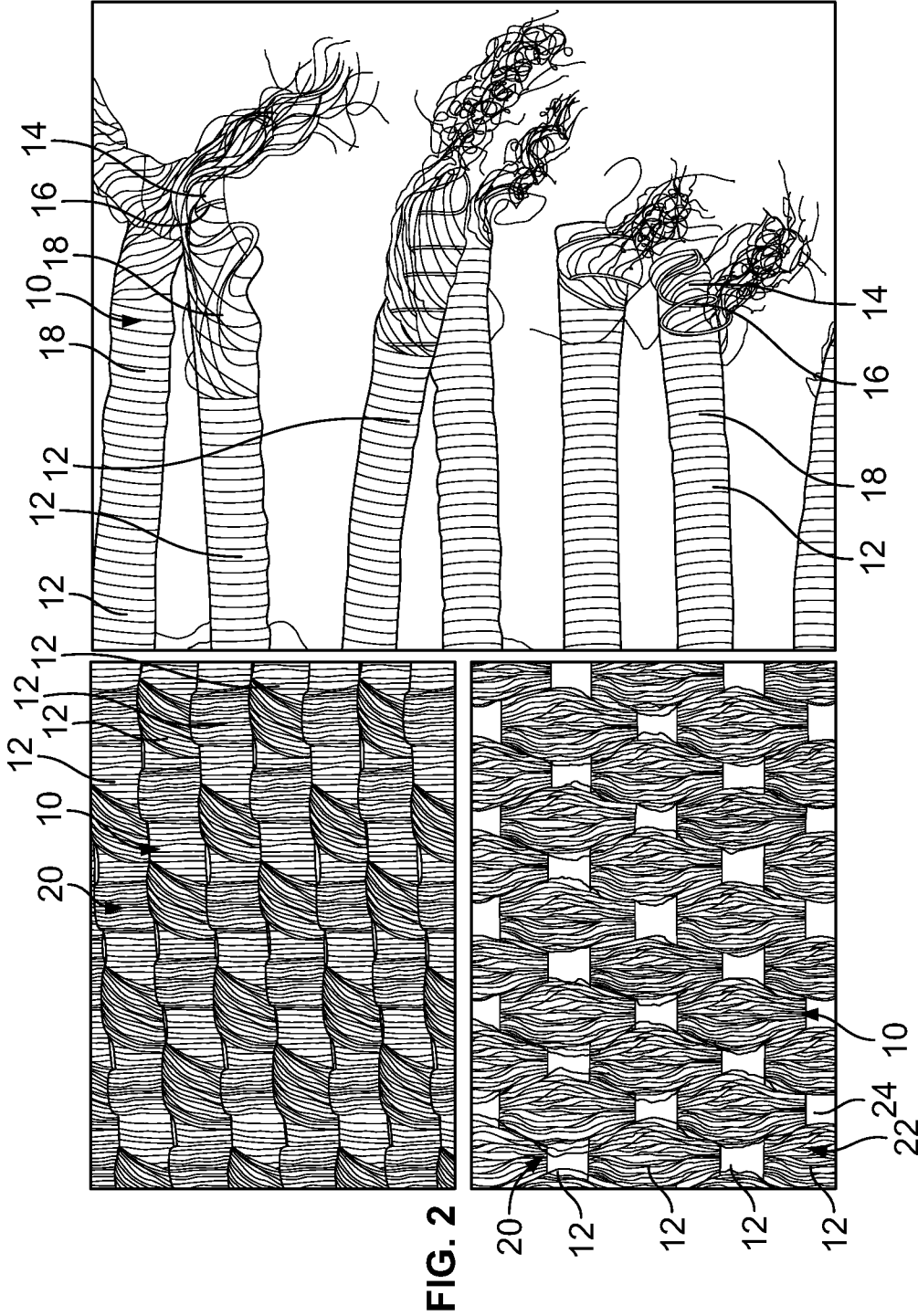


FIG. 4

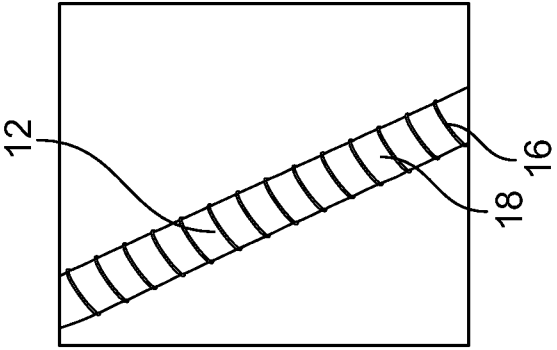
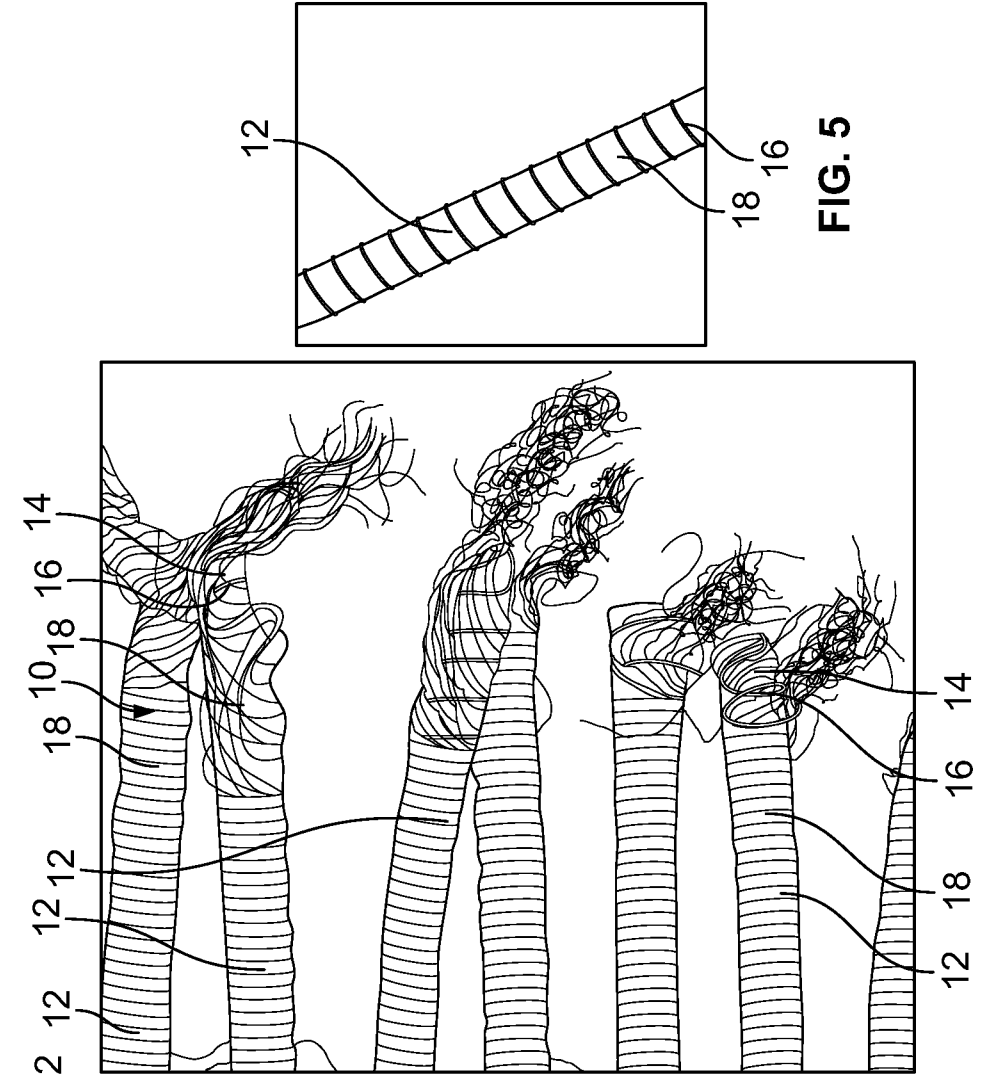


FIG. 5

