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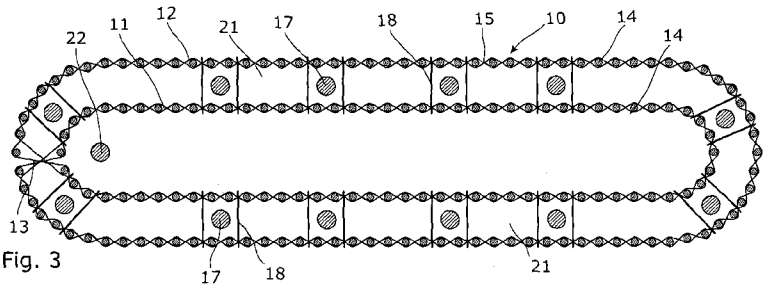


Fig. 3

(57) Abstract: A protective cover (10) is provided that is intended to provide cut-resistant protection, primarily but not exclusively, for wire ropes and cables. The cover comprises a seamless woven structure that defines an outer sleeve (12) and at least one inner sleeve (11; 11A, 11B), which are substantially unconnected by binder yarns other than along a selvage edge (13) of the cover (10). A plurality of wires, cables and/or flexible strips or rods (17) are incorporated into the cover (10) along its length during weaving of the woven structure and spaced around the periphery of the inner sleeve (11) or one of the inner sleeves (11A, 11B). Preferably, the wires, cables and/or flexible strips or rods (17) are retained in position between adjacent sleeves (11, 12; 11A, 11B, 12) by stitcher yarns (18) that tack the sleeves together at predetermined spaced intervals (19a, 19b) along the length of the cover (10).

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A CUT-RESISTANT, PROTECTIVE COVER PRIMARILY FOR WIRE ROPES AND CABLES

The present invention relates to a protective cover intended to provide cut-resistant protection, primarily but not exclusively, for wire ropes and cables. However, the cover may have wider application in the cut-resistant protection of other elongate structures such as lifting slings, telecommunication cables, electrical cables and the like.

Protective textile covers are already known and are primarily used to protect the fibre ropes that are used extensively in marine applications and in soft lifting slings. In both of these fields, the fibre ropes suffer from the same weaknesses, namely their low resistance to cutting and abrasion because of the nature of their predominantly textile construction. The protective covers used to protect the fibre ropes in these fields comprise seamless sleeves that are woven in one piece from ultra-high molecular weight polyethylene (UHMwPE) yarn, which is sold under the registered trade mark DYNEEMA® by DSM Dyneema B.V. and its sister companies. This yarn is 15 times stronger than steel, and 40% stronger than aramid yarns, such as that sold by Dupont under the registered trade mark KEVLAR®, for example, on a weight-for-weight basis. It is particularly good at withstanding abrasion.

Such a conventional cover 1 is shown in Figs. 1 and 2, which are both schematic weave diagrams illustrating, respectively, the weave patterns of a transverse cross-section through the cover and part of a longitudinal section of the cover. The cover comprises a seamless, 4-ply woven web that by virtue of its weave pattern can be opened out to form the tube that is located around the rope or other item to be protected. The web is woven from warp and weft yarns 2 and 3 respectively that are arranged to form four plies 4a, 4b, 4c, 4d, as shown in Fig. 2. The first and second plies 4a and 4b are connected by binder yarns 5 that comprise additional warp yarns which are crossed between the plies 4a and 4b. Similarly, the third and fourth plies 4c

and 4d are connected by binder yarns 6 that also comprise additional warp yarns which are crossed between the plies 4c and 4d. As the second and third plies 4b and 4c are unconnected except at selvage edges of the web, there is an interior space 7 between the plies 3b and 3c that allows the web to be opened up to form the tubular cover 1.

Metal theft has become an increasing problem in recent years owing to the high market price of metal. The heavy metal cables used on tower cranes and similar structures are being increasingly targeted by thieves because their long metal cables are exposed and can be cut through using hand tools, in particular powered hand tools. However, while conventional protective covers such as described above are excellent at protecting fibre cables and ropes from the everyday wear and tear effects of chafing, scuffing, rubbing, cutting, and scraping through use, they are not designed to prevent the ropes and cables from being deliberately cut through using a cutting tool. They are not, therefore, ideally suited for the protection of metal cables and ropes against deliberate cutting.

The object of the present invention is to provide a protective cover, primarily for wire ropes and cables that incorporates one or more cut-resistant features.

According to the present invention there is provided a protective cover for ropes, cables and similar elongate structures comprising a seamless woven structure that defines an outer sleeve and at least one inner sleeve, which sleeves are substantially unconnected by binder yarns other than along a selvage edge of the cover, and a plurality of wires, cables and/or flexible strips or rods that are incorporated into the cover along its length during weaving of the woven structure and spaced around the periphery of the inner sleeve or one of the inner sleeves.

Unlike the conventional cover described above, the cover of the present invention comprises inner and outer sleeves that can move around

and slide relative to one another. Hence, should an attempt be made to cut transversely through the cover, the inner sleeve slips relative to the outer sleeve and makes cutting through the cover with a cutting tool more difficult. In addition, the plurality of wires, cables and/or flexible strips or rods that are woven into the cover add to its cut-resistance.

Preferably, the cover comprises a 4-ply woven structure without binder yarns, the first and fourth plies forming the outer sleeve and the second and third plies forming a single sleeve. However, the cover according to the present invention is not limited to the provision of only two sleeves. The cover could be woven such that it comprises two or more substantially unconnected inner sleeves. When there are only two sleeves, these are unconnected except along one selvage edge. However, when there are more than two sleeves, the outer and an adjacent intermediate sleeve may be connected along one selvage edge of the woven structure but this intermediate sleeve and an adjacent inner sleeve may be connected either along the same selvage edge or, preferably, along an opposite selvage edge. The same applies regardless of the number of sleeves. This maximizes the freedom of the various sleeves to move around relative to one another and therefore increases the difficulty required to cut through the cover.

It will be appreciated that the cover of the invention may be woven from any tough, cut-resistant yarn suitable for the structure it is intended to protect. However, for use in the protection of wire ropes and cables the cover is preferably woven from a cut-resistant, high-strength synthetic yarn. Advantageously, the yarn is an ultra-high molecular weight polyethylene yarn, such as DYNEEMA® but could also be an aramid yarn, such as KEVLAR® or a high temperature resistant yarn such as that sold under the registered trade mark ZYLON® by Toyobo Corporation. ZYLON® is made from fibres of thermoset liquid crystalline polyoxazole. Combinations of these yarns or other suitable yarns may also be used. For example, to withstand an attack by a heated cutter, the outer sleeve of the cover may be woven from a high temperature resistant yarn such as ZYLON® and the

inner sleeve or sleeves may be woven from an abrasion- and cut-resistant yarn such as DYNEEMA®. In addition, yarns comprising metal strands or wire may also be woven into the structure of the cover as warp. These metal yarns may have textile Dref-spun outer coverings. In a modification, metal fibres, such as stainless steel fibres may be incorporated with textile fibres in the Dref-spun outer covering. Alternatively, the metal may be twisted with or around a textile yarn.

The plurality of wires, cables and/or flexible strips or rods that are incorporated into the cover along its length may be made from any suitable elongate materials that are cut-resistant. Advantageously, stranded steel cables are used for this purpose, each cable being preferably of the order of 1 to 3 mm thick and comprising, for example, eight wire strands. The use of a stranded cable increases the difficulty of cutting through the cover as each strand of each of the cables has to be severed and these also will tend to slip relative to on another in such a cutting operation. However, metal wire, flexible plastics rods, for example made of nylon, plastics ropes or cables, and/or flexible strips incorporating ceramic blocks could be used in addition or instead. These wires, cables and flexible rods or strips may also comprise an outer textile wrapping that will snag a cutting tool and that will also protect personnel handling the cover during fitting around the structure being protected. Any appropriate number of wires, cables and/or flexible strips or rods may be incorporated into the cover dependent on its size.

Preferably also, the wires, cables and/or flexible strips or rods are retained in position between the sleeves by stitcher yarns that tack the sleeves together at predetermined spaced intervals along the length of the cover. The stitcher yarns are included to prevent the wires, cables and/or flexible strips or rods from bunching together between the sleeves. However, as the stitcher yarns connect the sleeves together, which is inevitable but undesirable, the actual tacks between the sleeves are preferably spaced as far apart as practically possible. This means that not only are the sleeves still capable of relative movement, the wires, cables and/or flexible strips or rods

are also capable of some movement relative to the sleeves. This increases the difficulty an attacker faces in trying to cut through the cover.

In some embodiments of the invention, thicker wires, cables and/or flexible strips or rods, for example of the order of 3 mm in diameter, are individually tacked into position by the stitcher yarns. In this case, the tacks formed by the stitcher yarns retaining each wire, cable or flexible strip or rod are preferably located on each side of the wire, cable or flexible strip or rod and are staggered with respect to one another down the length of the wire, cable or flexible strip or rod.

Alternatively, instead of individual wires, cables and/or flexible strips or rods being individually tacked into position, bunches of thinner wires, cables and/or flexible strips or rods, for example each of the order of 1 mm in diameter, may be tacked into position into position by two rows of stitcher yarns. This may also improve the cut-resistance of the cover because the individual wires, cables and/or flexible strips or rods in each bunch will slip and slide relative to one another if an attempt is made to cut through the cover and impede the cutting operation.

Although the stitcher yarns may tack the sleeves together at any suitable spacing, preferably the predetermined spaced intervals are at least 150 mm. This ensures that the sleeves are still capable of sliding relative to one another and that the wires, cables and/or flexible rods are capable of slippage relative to the sleeves. Preferably also, the tacks formed by the stitcher yarns used for adjacent wires, cables or flexible strips or rods or bunches of same are also staggered with respect to one another to ensure that the wires, cables and/or flexible strips or rods are not all tacked along the same transverse cross-section of the cover.

Preferably also, the stitcher yarns are either stuffer warp yarns or warp yarns that form a cross-over between the sleeves.

Advantageously, the cross-over warp yarns are additional warp yarns inserted into the woven structure purely for the purpose of retaining the wires, cables and/or flexible rods. This ensures that the woven structure of the cover is not weakened.

Preferably also, at least one electrical alarm cable is woven into the structure of the outer sleeve and/or at least one of the wires, cables and/or flexible strips or rods incorporates an electrical alarm cable. Advantageously, at least one of the wires, cables and/or flexible strips or rods has an outer covering comprising a braided electrical alarm cable covered by an insulating sheath. The inclusion of such an alarm cable enables a warning to be sent in the event that an attack is made on the cover and the alarm cable is severed before the attacker has had time to cut through the whole of the cover and the structure it is protecting.

Preferably also, the inner sleeve or at least one of the inner sleeves is a tighter weave than the outer sleeve. This may be accomplished, for example by weaving the inner sleeve or at least one of the inner sleeves with between 30% and 70% more ends than the outer sleeve and/or by incorporating at least one additional ply into the warp yarns used for the inner sleeve or at least one of the inner sleeves over warp yarns used for the outer sleeve.

After weaving the woven structure of the cover may undergo further treatment to improve its cut-resistance. Preferably, for example, the outer sleeve may be covered by a latex or a gel material.

Other preferred but non-essential features of the invention are described in the dependent claims.

The present invention will now be described by way of example with reference to the accompanying drawings, in which:-

Fig. 1 is a schematic weave diagram of a conventional protective cover and shows a transverse cross-section through the cover;

Fig. 2 is a schematic weave diagram of the same conventional cover as Fig. 1 but shows a longitudinal section of the cover;

Fig. 3 is a schematic weave diagram of a transverse cross-section through a first embodiment of protective cover in accordance with the present invention;

Fig. 4 is a schematic weave diagram of a transverse cross-section through a second embodiment of protective cover in accordance with the present invention;

Fig. 5 is a schematic perspective view of the cover shown in Fig. 3;

Fig. 6 is a weave diagram of a longitudinal section of the cover shown in Figs. 3 and 5 but with the pull cord omitted; and

Fig. 7 is a weave diagram similar to Fig. 6, again omitting the pull cord, but showing a modified arrangement of stitcher yarns.

With reference to Figs. 3 and 5, the present invention comprises a protective cover 10 comprising a seamless woven structure that defines at least one inner sleeve 11 and an outer sleeve 12 that are substantially unconnected other than along one selvage 13 of the cover 10. The inner sleeve or sleeves 11 are therefore free to move relative to the outer sleeve 12. In the embodiment shown in Fig. 3, the cover 10 comprises a seamless, 4-ply woven structure woven from warp and weft yarns 14 and 15 respectively that are arranged to form four plies 16a, 16b 16c, 16d, as shown in Figs. 6 and 7. The first and fourth plies 16a and 16d join to form the outer sleeve 12 and the second and third plies 16b and 16c join to form the inner sleeve 11. There are no binder yarns, as in the prior art cover shown in Figs. 1 and 2, but the

inner and outer sleeves 11 and 12 are connected at the selvage 13. However, as described above, other embodiments of the invention are possible that comprise more than two sleeves and in these cases, the woven structure will comprise additional plies, at least two additional plies being required for each additional sleeve. These sleeves may all be connected by the same selvage 13 but preferably adjacent sleeves are connected by alternate selvages formed on opposite sides of the woven structure. Such an arrangement is shown in Fig. 4 where two additional plies are used to form a second inner sleeve so that there are two inner sleeves 11A and 11B. The outer sleeve and the first inner sleeve 11A are connected at selvage 13A but the two inners sleeves 11A and 11B are connected at the opposite side of the cover 10 by a selvage 13B.

The woven structure of the cover 10 may be produced from any tough, cut-resistant yarn suitable for the structure it is intended to protect. However, for use in the protection of wire ropes and cables the sleeves 11 and 12 are preferably woven from a cut-resistant, high-strength synthetic yarn such as DYNEEMA®, KEVLAR® or ZYLON®. Such a cover 10 can be made in appropriate dimensions as required. For use in the protection of wire ropes and cables, typically the cover 10 will be of the order of 100 mm wide. If the cover 10 is to be used in the open air, as will most likely be the case, the outer sleeve 12 is preferably woven from DYNEEMA® yarn as it is resistant to ultra-violet radiation.

In addition to the woven structure, the cover 10 comprises a plurality of wires, cables and/or flexible strips or rods 17 that are incorporated into the cover 10 along its length during weaving of the woven structure during weaving are woven into the cover 10 along its length. The wires, cables and/or flexible strips or rods 17 are spaced around the periphery of the inner sleeve 11 or one the inner sleeves 11A, 11B. In the embodiments shown in Figs. 3 and 4, there are twelve spaced wires, cables and/or flexible strips or rods 17 but any number can be used dependent on the dimensions of the cover 10. Preferably, as described above, these wires, cables and/or flexible

strips or rods 17 any or a combination of stranded steel cable, metal wire, flexible plastics rods and flexible strips incorporating ceramic blocks so that they significantly increase the cut-resistance of the cover 10. They may also comprise an outer textile wrapping as also described above.

In order to prevent bunching of the wires, cables and/or flexible strips or rods 17 between the sleeves 11, 12 or 11A, 11B they are individually retained in position by stitcher yarns 18 that connect the sleeves between which they are located together at predetermined spaced intervals along the length of the cover 10. The stitcher yarns 18 tack the sleeves 11 and 12 together in Fig. 3 and the sleeves 11A and 11B together in Fig. 4 with tacks 19a or 19b (see Figs. 6 and 7) located at predetermined intervals down each side of the wires, cables or flexible strips or rods 17. However, the tacks 19a, 19b on each side of each wire, cable or flexible strip or rod 17 are staggered down the length of the wire, cable or flexible strip or rod 17. This holds the wire, cable or flexible strip or rod 17 in position between the sleeves 11, 12 or 11A, 11B but also allows some degree of movement of the wire, cable or flexible strip or rod 17 relative to the sleeves. In addition, the tacks 19a, 19b used for adjacent wires, cables or flexible strips or rods 17 are also staggered with respect to one another to ensure that the wires, cables and/or flexible strips or rods 17 are not all tacked along the same transverse cross-section of the cover 10. It will be appreciated that there are double the number of stitcher yarns 18 as wires, cables or flexible strips or rods 17 as each of the latter is tacked into position on both sides.

In a modification as outlined above, bunches of wires, cable and/or flexible strips or rods may replace the single wire, cable or flexible rod 17 shown in the drawings.

The tacks 19a, 19b of each stitcher yarn 18 only connect the sleeves 11, 12 or 11A, 11B together at predetermined intervals. While this interval can be substantially varied from cover to cover, it is expected that in most practical applications of the cover 10 the predetermined spaced interval will be at least

150 mm. This ensures that the inner and outer sleeves are all capable of sliding relative to one another and that the wires, cables and/or flexible strips or rods 17 are capable of slippage relative to the sleeves.

The stitcher yarns 18 are preferably one of two different types, namely stuffer warp yarns or warp yarns that cross-over between the sleeves 11 and 12. These alternatives are shown in Figs. 6 and 7 respectively, which use the 4-ply cover shown in Fig. 3 as an example but it will be appreciated that the same would apply with reference to the inner sleeves 11A and 11B shown in Fig. 4.

Referring firstly to Fig. 6, here pairs of stitcher yarns 18a, 18b are included as floating stuffer warp yarns in the woven structure of the cover 10. These stitcher yarns 18a, 18b are not woven into the structure but are allowed to float within the plies 16a, 16b and the plies 16c, 16d respectively. At the predetermined intervals, one yarn 18a is woven into the weave between the first and second plies 16a, 16b to form a tack 19a that connects uppermost parts of the sleeves 11 and 12 together adjacent one of the wires, cables or flexible strips or rods 17a located between these uppermost parts of the sleeves 11 and 12. Similarly, the other yarn 18b of the pair of yarns is woven into the weave between the third and fourth plies 16c, 16d to form a tack 19b that connects lowermost parts of the sleeves 11 and 12 together adjacent another of the wires, cables or flexible strips or rods 17b located between these lowermost parts of the sleeves 11 and 12.

Turning now to Fig. 7, here the stitcher yarns 18 are formed by warp yarns 18a, 18b that cross over between the sleeves 11 and 12 at the aforesaid predetermined intervals to form the tacks 19a, 19b. Each pair of yarns 18a, 18b crosses over between either the first and second plies 16a, 16b or the third and fourth plies 16c, 16d adjacent one of the wires, cables or flexible strips or rods 17. In order not to weaken the woven structure of the cover 10, the cross-over warp yarns 18a, 18b are additional warp yarns that are

inserted into the woven structure purely for the purpose of retaining the wires, cables and/or flexible strips or rods 17.

In a further development of the invention, an electrical alarm cable is incorporated into the woven structure of the cover 10. In some embodiments a single cable 20 but preferably a plurality of such cables 20 may be woven into the structure of the cover 10 as one or more of the warp yarns 14 so that it or they run along the complete length of the cover 10, as shown in Fig. 6. In order for the cable or cables 20 to provide the earliest possible warning of the cover 10 coming under attack, they are preferably woven into the structure of the outer sleeve 12 and preferably a plurality of such alarm cables 20 is used spaced around its circumference. Such alarm cables 20 are typically made from fine insulated wire and can be readily included in the weave structure adjacent one or more of the regular warp yarns 14.

Alternatively or in addition, at least one of the wires, cables and/or flexible strips or rods 17 has an outer covering comprising a braided electrical alarm cable covered by an insulating sheath. In particular, one or more of the wires, cables and/or flexible strips or rods 17 comprises a steel cable covered with an insulating sheath around which an electrical alarm cable is braided, the alarm cable being covered by a second insulating sheath.

In use, the alarm cable or cables 20 are connected to an alarm system so that if an attacker attempts to cut through the cover 10, it is likely that fairly quickly one of these cables 20 will be breached as the wires comprising the cable 20 can be readily severed. This will set off an alarm well before the attacker is able to sever the cover 10, if at all, to get to the underlying protected structure.

In a further modification, loose, cut-resistant fibres (not shown) may be incorporated into the spaces 21 between adjacent stitcher yarns 18 between the inner and outer layers 11 and 12 or between any two inner layers 11A, 11B. These fibres preferably comprise long fibres of ballistic nylon or an

aramid which, as indicated above, both tend to jam cutting tools such as chain saws, loppers and the like. These fibres are preferably incorporated into the spaces 21 during weaving of cover 10.

In order to facilitate location of the cover 10 over an elongate structure to be protected, the cover 10 preferably comprises a pull cord 22 that is incorporated into the cover 20 during weaving. The cord 22 is located within the innermost sleeve 11, 11B along the full length of the cover. It is formed by the provision of a warp yarn that is not woven into the structure so it remains loose and is preferably made of a strong material such as DYNEEMA® so that, in use, it can be attached to the elongate structure to be protected by the cover 10 and then withdrawn from the cover 10, thereby pulling the elongate structure into the cover 10.

Although the cover 10 is primarily designed to provide cut-resistant protection to an elongate structure by preventing the structure from being severed, it is also advantageous if the cover 10 prevents any damage occurring to the structure. Some scissor-action severing tools have sharp-tipped blades and while the tool may be incapable of severing the cover 10 are capable of being stabbed through the sleeves of the cover 10 with the potential to damage the structure being protected. Any damage to some forms of elongate structure, for example crane cables, requires a replacement to be used. It is therefore advantageous if the cover 10 is also stab-resistant. To this end, the inner sleeve 11 or at least one of the inner sleeves 11A, 11B is preferably made a tighter weave than the outer sleeve 12 so that it is harder to penetrate by sharp tools. The weave of the inner sleeve 11 or at least one of the inner sleeves 11A, 11B can be tightened over that of the outer sleeve 12 in two different ways, namely by increasing the number of ends per decimetre (that is the number of warp yarns per decimetre) or by bulking the size of each warp yarn by increasing the number of strands or plies from which it is made. It will be appreciated that both of these options can be employed in the same sleeve.

In the first option, the inner sleeve 11, 11A, 11B is preferably woven with between 30% and 70% more ends than the outer sleeve and may also be woven from a different material, such as KEVLAR®. Advantageously, the inner sleeve 11, 11A, 11B is woven with at least 50% more ends that the outer sleeve, for example with 384 ends per decimetre as opposed to 246 ends per decimetre for the outer sleeve 12.

In the second option, the inner sleeve 11, 11A, 11B is woven with a warp yarn that has at least one additional ply over the warp yarns used for the outer sleeve 12. In particular, the additional ply may be of a different material to the other plies, for example an aramid (KEVLAR®) ply if the other plies are made of ultra-high molecular weight polyethylene (DYNEEMA®). In one example, the warp yarns for the inner sleeve 11 or sleeves 11A, 11B may comprise 7 plies to the outer sleeves 6.

After weaving, the cover 10 as described above may be further treated to enhance its cut-resistance. For example, the outer surface of the outer sleeve 12 of the cover 10 may be coated with latex or gel materials intended to snag cutting tools and to make the cover 10 slippery and harder to grip. Gel-coated yarns may also be included in the weave of the outer sleeve 12 for a similar purpose.

CLAIMS

1. A protective cover for ropes, cables and similar elongate structures comprising a seamless woven structure that defines an outer sleeve and at least one inner sleeve, which sleeves are substantially unconnected by binder yarns other than along a selvage edge of the cover, and a plurality of wires, cables and/or flexible strips or rods that are incorporated into the cover along its length during weaving of the woven structure and spaced around the periphery of the inner sleeve or one of the inner sleeves.

2. A cover as claimed in Claim 1, comprising a 4-ply woven structure without binder yarns other than along the aforesaid selvage edge, the first and fourth plies forming the outer sleeve and the second and third plies forming a single inner sleeve.

3. A cover as claimed in Claim 1, comprising two or more inner sleeves, adjacent sleeves being connected either along the aforesaid selvage edge or along an opposite selvage edge.

4. A cover as claimed in any of Claims 1 to 3, wherein the wires, cables and/or flexible strips or rods are retained in position between adjacent sleeves by stitcher yarns that tack the sleeves together at predetermined spaced intervals along the length of the cover.

5. A cover as claimed in Claim 4, wherein the predetermined spaced intervals between the tacks are at least 150 mm.

6. A cover as claimed in Claim 4 or Claim 5, wherein the wires, cables and/or flexible strips or rods are either individually retained in position between the sleeves by stitcher yarns located on each side of each individual wire, cable or flexible strip or rod or bunches of wires, cables and/or flexible strips or rods are retained in position between

the sleeves by stitcher yarns located on each side of each of the bunches of wires, cables and/or flexible strips or rods.

7. A cover as claimed in any of Claims 4 to 6, wherein the tacks formed by the stitcher yarns that retain the individual wire, cable or flexible strip or rod or each bunch of wires, cables and/or flexible strips or rods are located on each side thereof and are staggered with respect to one another down the length of said individual wire, cable or flexible rod or sad bunch of wires, cable or flexible rods.

8. A cover as claimed in any of Claims 4 to 7, wherein the stitcher yarns are either stuffer warp yarns or warp yarns that form a cross-over between the sleeves.

9. A cover as claimed in Claim 8, wherein the stuffer warp yarns float between plies of the woven structure and are woven into the weave between adjacent plies at predetermined intervals to form the tacks and the cross-over warp yarns are additional warp yarns inserted into the woven structure that cross over between the sleeves at predetermined intervals to form the tacks.

10. A cover as claimed in any of Claims 1 to 9, wherein at least one electrical alarm cable is incorporated into the woven structure.

11. A cover as claimed in any of Claims 1 to 10, wherein at least one alarm cable is woven into the outer sleeve and/or at least one of the wires, cables and/or flexible strips or rods incorporates an electrical alarm cable.

12. A cover as claimed in Claim 11, wherein at least one of the wires, cables and/or flexible strips or rods has an outer covering comprising a braided electrical alarm cable covered by an insulating sheath.

13. A cover as claimed in any of Claims 1 to 12, comprising a pull cord that has been is incorporated into the cover during weaving and that is located along the length of cover within but not connected to the inner sleeve or the innermost sleeve.

14. A cover as claimed in any of Claims 1 to 13, wherein the inner sleeve or at least one of the inner sleeves is a tighter weave than the outer sleeve.

15. A cover as claimed in Claim 14, wherein the inner sleeve or at least one of the inner sleeves is woven with between 30% and 70% more ends than the outer sleeve.

16. A cover as claimed in Claim 14 or Claim 15, wherein the inner sleeve or at least one of the inner sleeves has warp yarns comprising at least one additional ply over warp yarns used for the outer sleeve.

17. A cover as claimed in any of Claims 1 to 17, wherein the cover is woven from any or a combination of yarns made from ultra-high molecular weight polyethylene, aramid, fibres of thermoset liquid crystalline polyoxazole, metal and yarns comprising plies made from any combination of the aforementioned substances.

18. A cover as claimed in any of Claims 1 to 17, wherein the plurality of wires, cables and/or flexible strips or rods comprise any or a combination of stranded steel cable, metal wire, flexible plastics rods and flexible strips incorporating ceramic blocks.

19. A cover as claimed in Claim 18, wherein each or a majority of the wires, cables and/or flexible strips or rods comprises an outer textile wrapping.

20. A cover as claimed in any of Claims 1 to 19, wherein the outer sleeve is covered by a latex or a gel material.

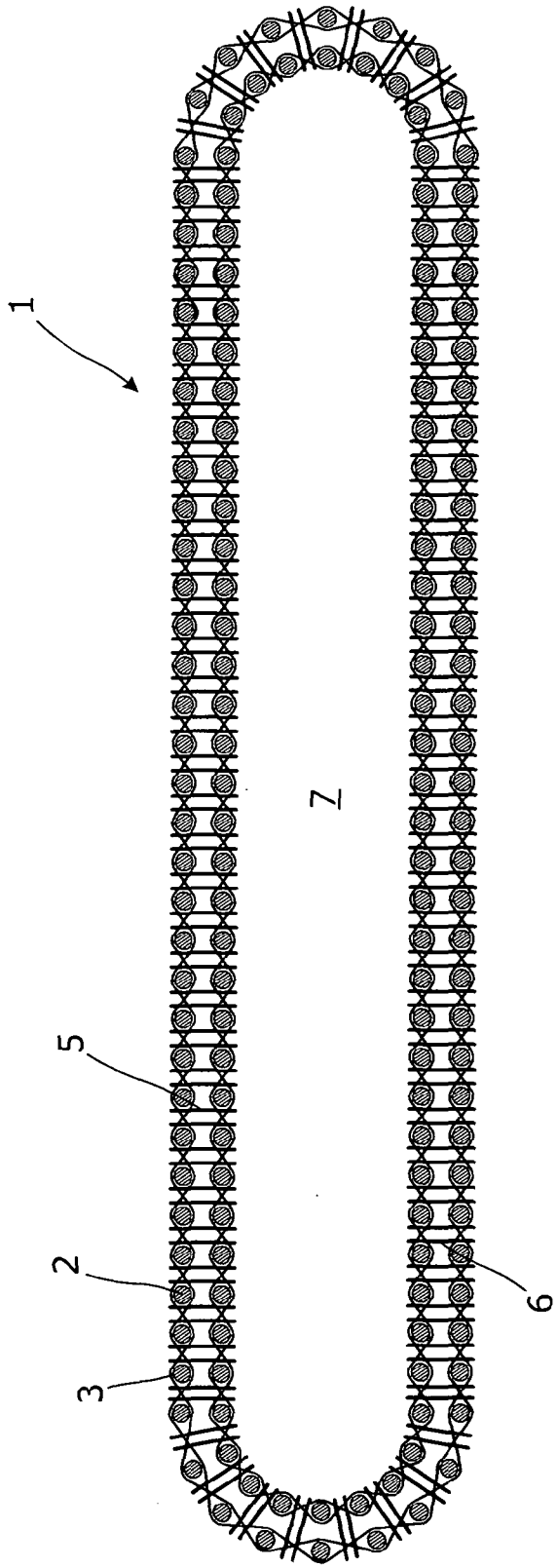


Fig. 1
Prior Art

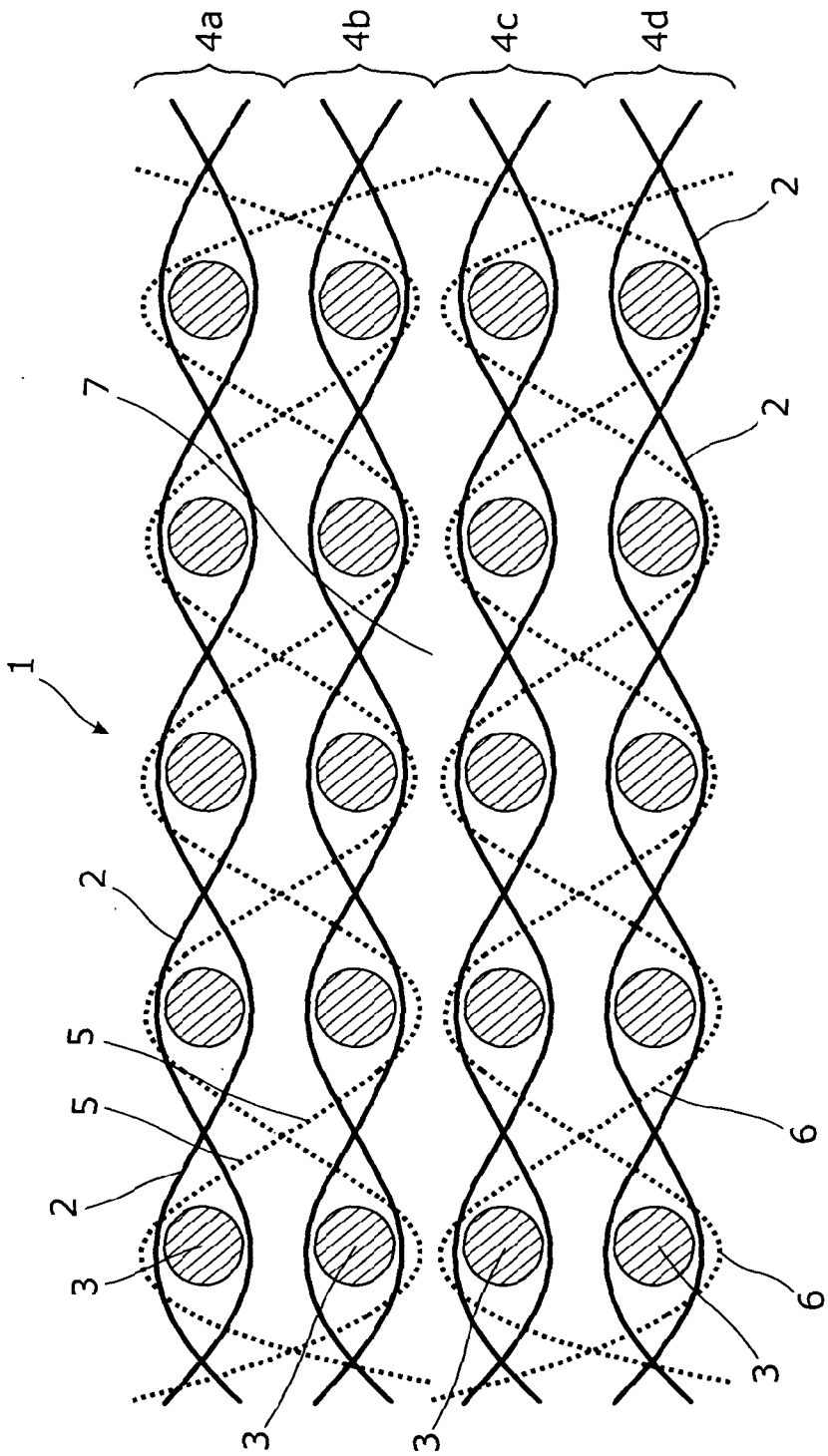


Fig. 2
Prior Art

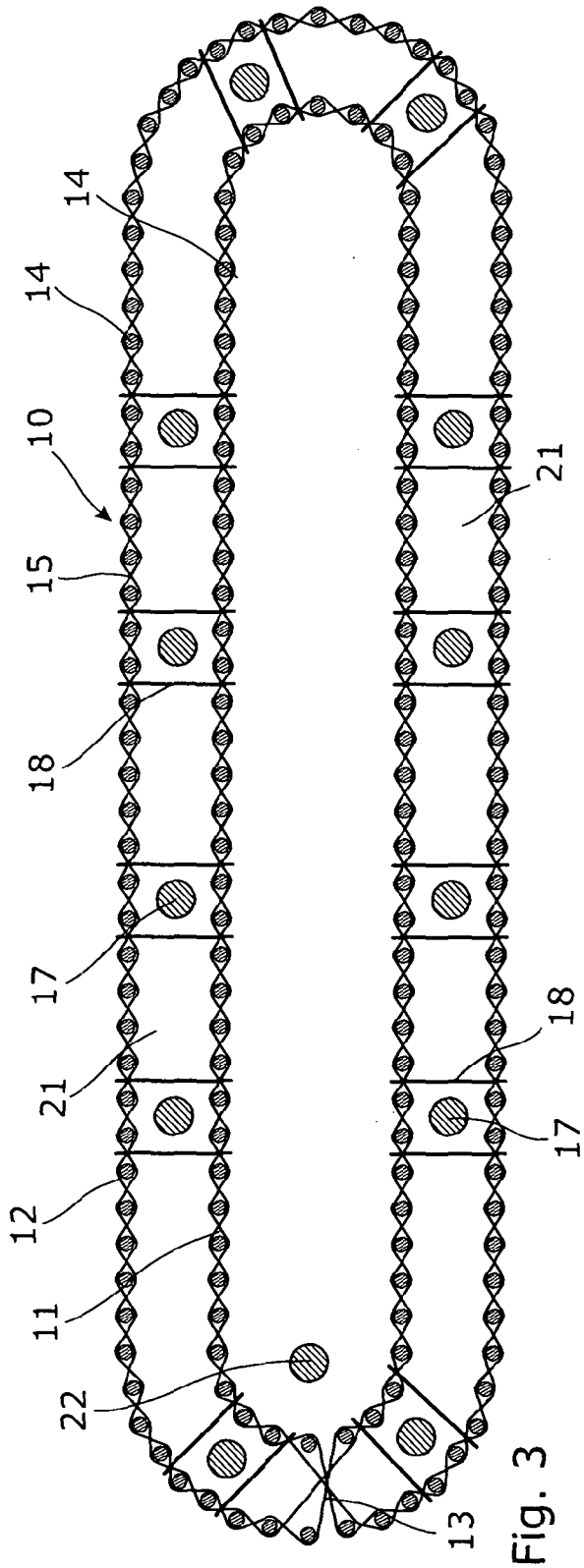

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Fig. 3

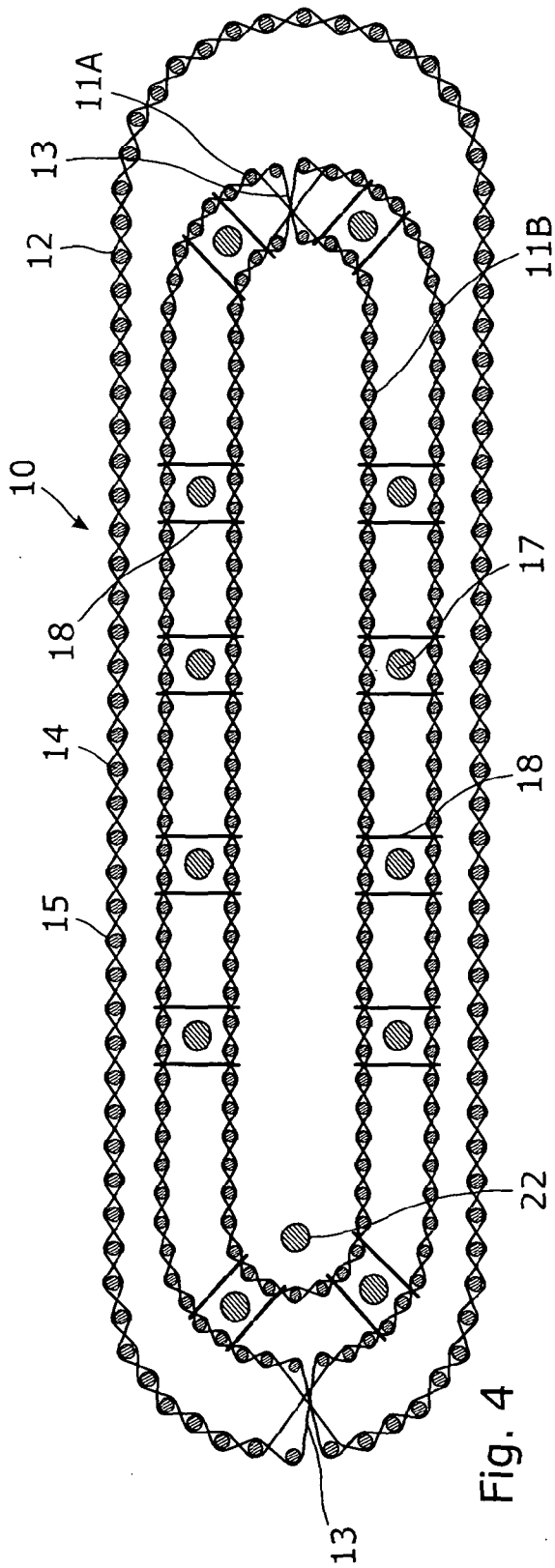

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Fig. 4

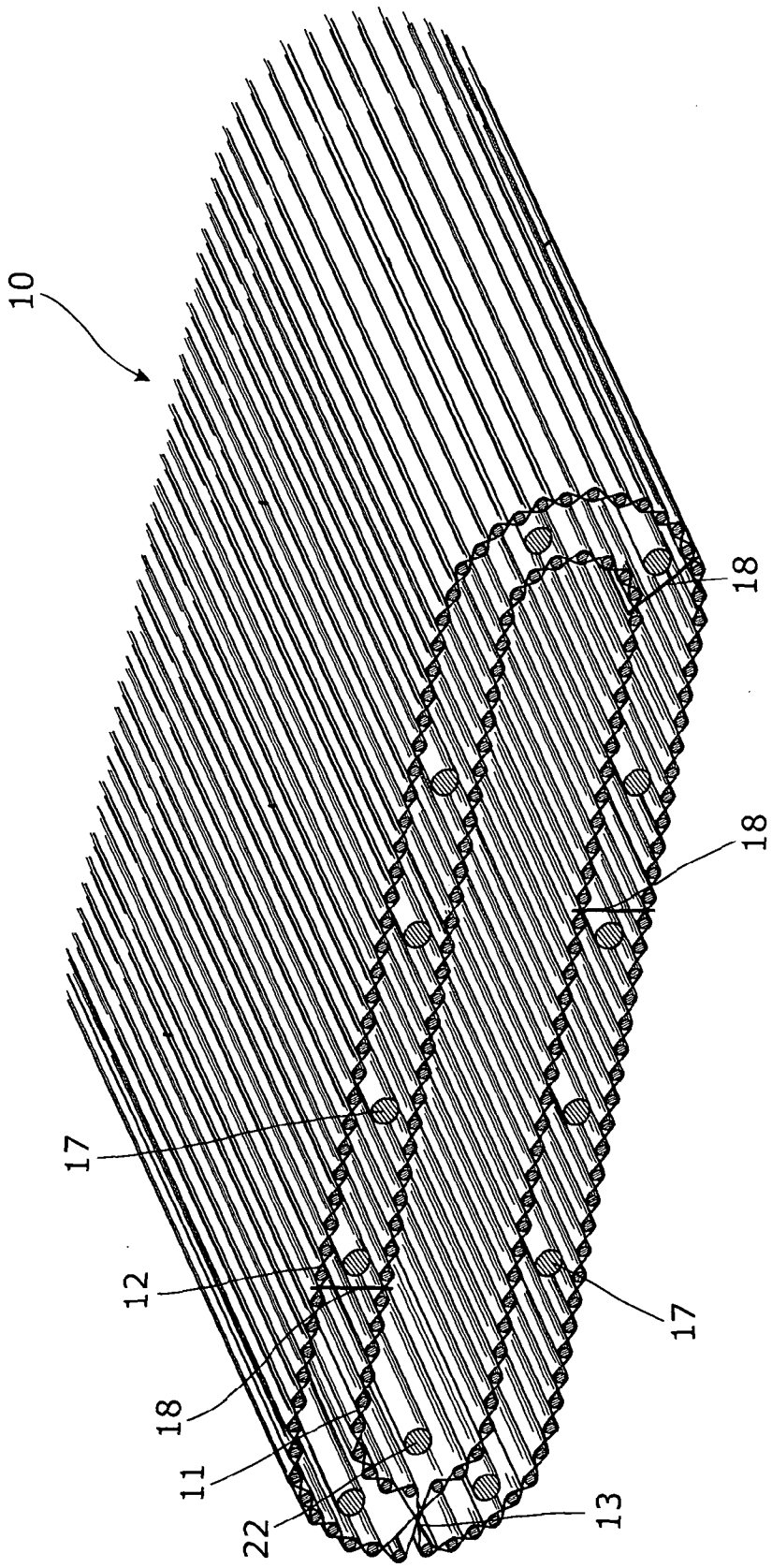


Fig. 5

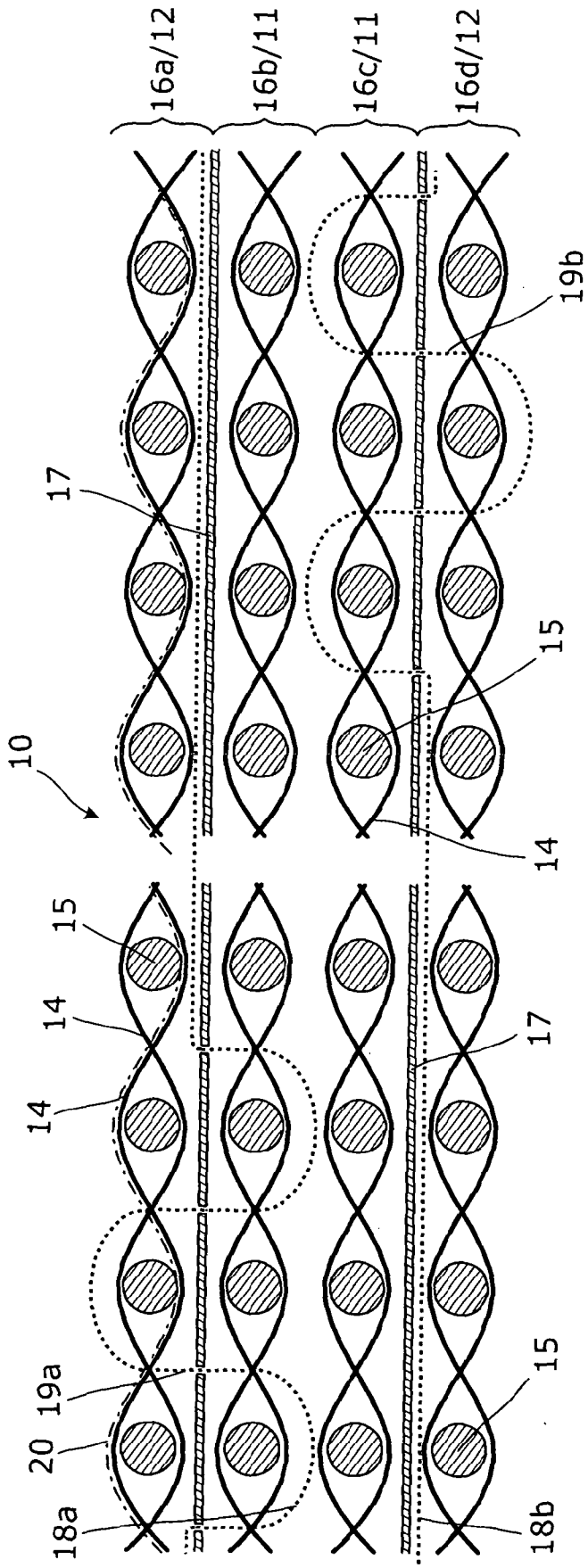

16a/12
16b/11
16c/11
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Fig. 6

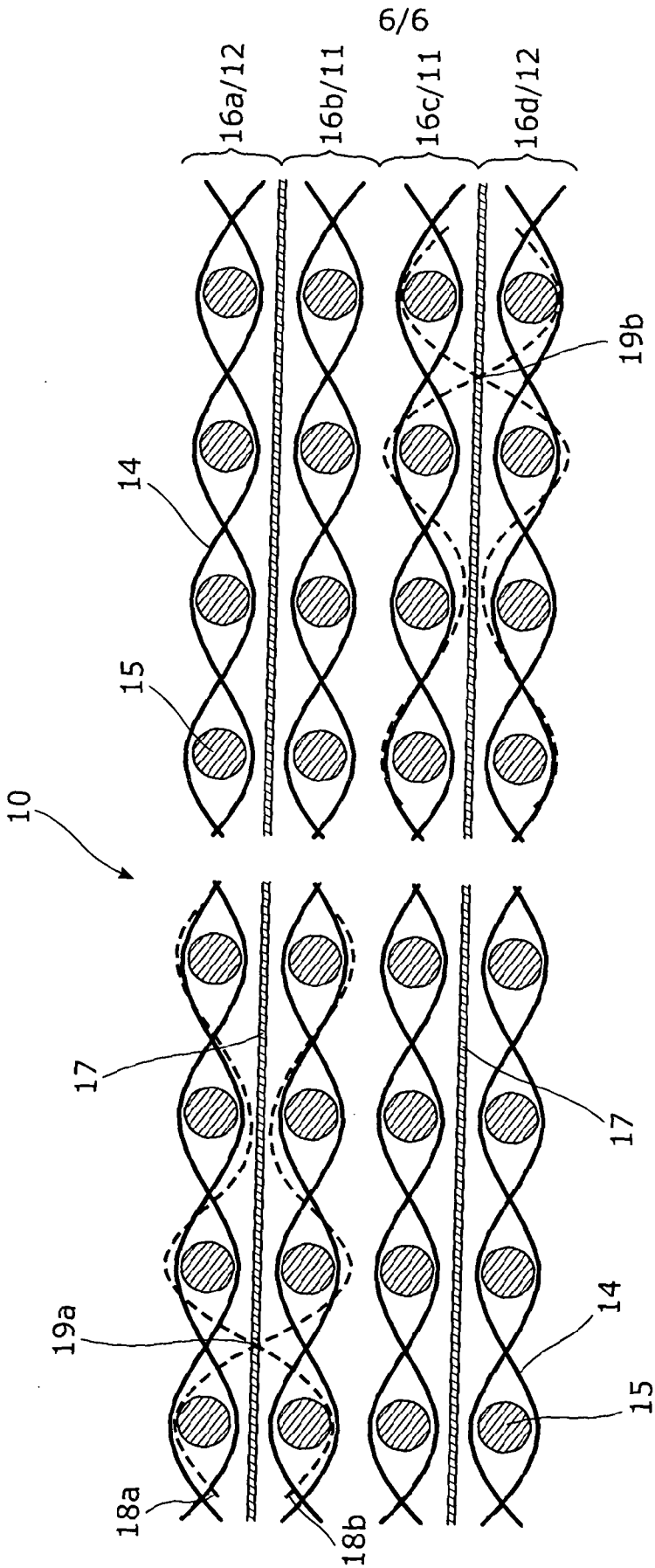


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2013/000187

A. CLASSIFICATION OF SUBJECT MATTER
INV. D03D1/00 B32B27/12 D03D3/02 D03D11/02 F16L11/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D03D B32B F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 2011 0096665 A (KIM JUNG SOK [KR]) 31 August 2011 (2011-08-31) figures 1,2	1-20
A	JP 2009 270236 A (ASHIMORI IND CO LTD) 19 November 2009 (2009-11-19) abstract; figure 1	1-20
A	US 268 366 A (.) 28 November 1882 (1882-11-28) figures 1,2	1-20
A	JP S64 53777 U (.) 3 April 1989 (1989-04-03) figures 2,3	1-20
A	GB 1 489 952 A (MECONDOR SPA) 26 October 1977 (1977-10-26) figure 2	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 June 2013	27/06/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Iamandi, Daniela

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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