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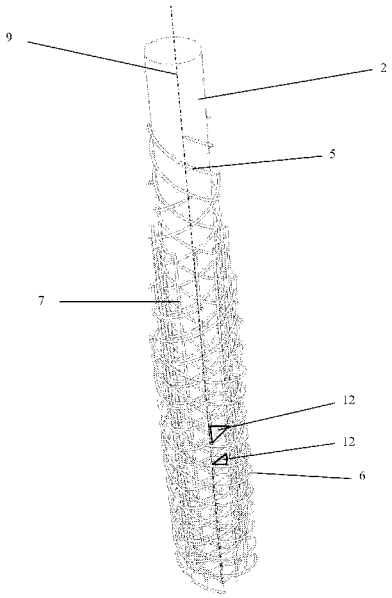


Fig. 1

(57) Abstract: The present invention relates to a pliable cable (1) having a high torsional rigidity and comprising a core (2) having a high tensile resistance and a core-surrounding sheath (3), wherein the core-surrounding sheath (3) comprises an elastomer which includes at least one fibre package, wherein each fibre package is arranged around the core (2) and wherein the cable (1) has been subjected to a vulcanisation or polymerisation process. On the other hand, it also relates to a method of producing such a cable (1).

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CABLE AND METHOD OF PRODUCING SUCH A CABLE

The present invention relates, on the one hand, to a pliable cable comprising a core and a core-surrounding sheath, wherein the core comprises one or more strand-like elements, wherein the core-surrounding sheath comprises an elastomer which includes at least one fibre package, and wherein each fibre package is arranged around the core and at least comprises

- a first group of fibres or strands which substantially extend along a first direction which forms a first angle with the longitudinal axis of the cable,
- a second group of fibres or strands which substantially extend along a second direction which forms a second angle with the longitudinal axis of the cable;

so that the fibres or strands of the respective first and second group cross one another.

The present invention relates in particular to such a cable which is provided for furling a sail or sailcloth, more specifically for furling a sail of a sailing boat.

On the other hand, the present invention relates to a method of producing a pliable cable, wherein the cable comprises a core and a core-surrounding sheath and wherein the core comprises one or more strand-like elements.

Both when a sailing boat is being sailed and when it is not being sailed, for example when the boat is moored, it has to be possible to furl one or more sails of a sailing boat. To this end, so-called furling systems are used. With relatively large sailing boats, furling systems are often used which are provided with an elongate hollow furling profile having a round or oval cross section, in which a groove which extends along the longitudinal axis is provided for attaching the sail. Such a furling profile is produced as a rigid unit made of metal or plastic and is connected in the furling system to a spool at one of its ends, as a result of which it is rotatable about its longitudinal axis, either by hand or with a motor. Along its edge, the sail is provided with a strand or border which forms a thickening of the sail. This thickening is

introduced into the abovementioned groove of the furling profile, so that the sail can be furled onto the furling profile or can be unfurled therefrom again by rotating the furling profile in one or the other direction of rotation.

The advantage of such a furling system is that, due to its stiffness, the furling profile is not or only to a limited degree, subject to torsion. As a result thereof, the sail can be furled and unfurled evenly along its entire length. However, the drawback is that this furling profile itself cannot be rolled up or folded up. Generally, the furling profile is releasably attached to the sailing boat. With relatively long sailing boats, the furling profile can then be placed on deck when a boat is not being sailed. However, this is unlikely to be possible with relatively small sailing boats, as the profile is longer than the length of the boat. Even with relatively long sailing boats, it may be desirable to store the profile below deck, but this is not always possible with a rigid profile.

In order to solve the above problem, furling systems provided with a more or less pliable furling cable having a relatively high tensile resistance are commonly used for furling the sail instead of the furling systems provided with a rigid furling profile. These cables comprise one or more fibres of great tensile strength, such as for example aramid fibres. The sail is then configured to have an edge which forms a tunnel into which the cable is introduced and the furling system then comprises a spool which is connected to the cable, as a result of which it is rotatable about its longitudinal axis. The cable is taut and by rotating the cable in one or the other direction of rotation about its longitudinal axis, the sail will be furled or unfurled again around the cable.

When a sailing boat is not being sailed, such a cable can be furled so that it takes up less space and can be stored in a relatively small space. The required storage space is in each case much smaller than the space which is required to store a rigid furling profile. Examples of such furling systems with furling cables are described in US 5463970 and EP 1580118.

However, this type of furling system has the drawback that the furling cables are subject to more torsional deformation/deformation by torsion than the rigid furling profiles. As a result thereof, the furling and unfurling of the sail occurs less evenly than with a rigid profile. If the edge of a sail is connected to such a furling cable and a moment of force is applied to the end of the cable in order to rotate the cable, then the cable will have rotated over a certain angle at said end after a certain period of time, but due to torsion the angular displacement of the cable during that same period of time will become progressively smaller with greater distance from this cable end. Due to the fact that such cables are relatively long, it has been found in practice that the end to which the moment of force is applied has to be rotated several turns (in strong wind even 10 to 30 turns) before the other end of the cable starts to rotate. Consequently, one end of the cable is rotated more than the other end, as a result of which one end of the sail is furled/unfurled to a greater degree than the other end of the sail. Thus, the furling and unfurling does not take place evenly. This causes problems, in particular when furling the sail in moderate or strong winds, since a portion of the sail remains behind at one end and forms a kind of balloon which catches the wind, thus making further furling even more difficult. In heavy winds, it becomes practically impossible to furl the sail completely.

In order to solve this problem of existing furling systems with furling cables, it has already been proposed, for example, to use two cables, in which case the sail is then provided with an edge forming a tunnel into which these two cables are introduced. In this way, the furling takes place more evenly compared to furling systems having only one cable, but still leaves something to be desired compared to furling systems provided with a rigid furling profile.

It is therefore an object of the invention to develop a cable by means of which the furling/unfurling of a sail can be carried out in a more even manner, that is, with the cable being subject to less torsional deformation/deformation by torsion and thus having a higher torsional rigidity.

This object is achieved by providing a pliable cable comprising a core and a core-surrounding sheath, wherein the core comprises one or more strand-like elements, wherein the core-surrounding sheath comprises an elastomer which includes at least one fibre package, wherein each fibre package is arranged around the core and at least comprises

- a first group of fibres or strands which substantially extend along a first direction which forms a first angle with the longitudinal axis of the cable,
- a second group of fibres or strands which substantially extend along a second direction which forms a second angle with the longitudinal axis of the cable,

so that the fibres or strands of the respective first and second group cross one another, wherein, in a said fibre package, the second group of fibres or strands is arranged around the first group of fibres or strands, and wherein the fibre package comprises a third group of fibres or strands, the fibres or strands of which extend substantially along the longitudinal axis of the cable, and wherein the pliable cable has undergone a vulcanisation or polymerisation process so that the elastomer is vulcanised or polymerised.

The expression first angle between the first direction and the longitudinal axis of the cable and the expression second angle between the second direction and the longitudinal axis of the cable are used to denote the smallest angle between said direction and the longitudinal axis of the cable.

The term elastomers is used to denote natural rubber and synthetic rubber, as well as all other polymers having rubber-like properties. Examples of synthetic rubber are isoprene rubber, polybutadiene rubber, ethylene propylene-diene monomer rubber (EPDM rubber) or neoprene rubber (polychloroprene). The core-surrounding sheath may also comprise a mixture of different types of elastomers. Thus, the core-surrounding sheath may comprise a mixture of natural rubber and synthetic rubber or a mixture of synthetic rubbers. The terms strands or fibres are used to denote textile

yarns or textile fibres, but may also be used to denote other fibres, such as for example natural fibres, or strands, such as for example metal strands.

Due to the fact that the entire cable has undergone a vulcanisation or polymerisation process and the elastomer is thus vulcanised or polymerised, the elastomer will not only bond to the fibres or strands of the fibre package and to the core mechanically, but also chemically. As a result thereof, the various components of the cable are securely connected to each other.

Moreover, this cable can be rolled up, folded up, is pliable and elongates only to a small degree. As a result thereof, this cable can be used as a furling cable in a furling system for a sailing boat, wherein the sail is provided with an edge which forms a tunnel into which the cable can be introduced and wherein the cable is rotatable around its longitudinal axis by means of, for example, a spool. This cable according to the invention is subject to less deformation by torsion than the existing cables which are being used for such furling systems, as the fibre package ensures that a moment of force which is applied to the end of the cable in order to rotate the cable is transmitted efficiently to the remainder of the cable. The transmission of said moment of force can take place efficiently, because the direction of both the first group and the second group of fibres or strands form an angle with the longitudinal axis/longitudinal direction of the cable and the fibres or strands of the first group cross the fibres or strands of the second group and because the third group of fibres or strands extend substantially along the longitudinal axis. The expression form an angle with the longitudinal axis/longitudinal direction of the cable is understood to mean that both the direction of the first group of fibres or strands and the direction of the second group of fibres or strands do not run parallel with the longitudinal axis of the cable. The term cross is used to denote the fact that the fibres or strands of the first group do not run parallel with the fibres or strands of the second group. Furthermore, in said fibre package, the second group of fibres or strands is arranged around the first group of fibres or strands. The one group of fibres or strands is arranged closer to the core than the other group of fibres. As a result thereof, this

group of fibres is able to efficiently counteract the deformation of the cable by torsion when a moment of force is applied to the cable in order to rotate the cable.

The combination of the abovementioned arrangement of strands or fibres in an elastomer and a vulcanisation or polymerisation process for the cables, results in a cable which has a very high resistance to torsion. Due to their mutual crossing arrangement resulting in an angle with the longitudinal direction of the cable, the first group and the second group of fibres or strands ensure a good resistance to torsion when the cable is being rotated about its longitudinal axis in both directions of rotation. In addition, as a result of the vulcanisation or polymerisation process, the elastomer is chemically and mechanically bonded to both the strands or fibres and the core of the cable. The core preferably has a high tensile resistance/high elastic modulus in order to absorb the tensile strain on the cable. One of the reasons why the core has this high tensile resistance/high elastic modulus is that the strand-like elements of the core have a high tensile resistance/high elastic modulus. The expression a high elastic modulus is understood to mean an elastic modulus of at least 2 GPa. Due to the core, the strong connection between the different components of the cable and to the fact that said fibres prevent torsion of the cable in both directions of rotation, this cable has a very high torsion resistance.

When a moment of force is applied to one end of such a cable, for example in order to furl a sail, the cable will experience little deformation by torsion, as a result of which the delay between the start of the rotation of the one cable end and the start of the rotation of the other cable end is much smaller than is the case with the existing furling cables.

If this cable is used in a furling system for furling the sail of a sailing boat, wherein the sail is provided, for example, with a tunnel-shaped edge into which the furling cable is introduced, and wherein a moment of force is applied to the one end of the cable in order to cause it to rotate, then the sail is furled and unfurled virtually

evenly, even at a high wind load. As a result, the furling and unfurling can be carried out more quickly, easily and efficiently.

In addition, the materials and properties of the cable are also such that the cable is pliable and/or can be rolled up, as a result of which the furling cable can be stored more easily and/or in a smaller space.

The cable may be provided with only one such fibre package which is arranged around the core along virtually the entire length of the cable, but may also be provided with additional fibre packages. In certain locations or over virtually its entire length, the cable may also be provided with several fibre packages on top of each other. Each fibre package is arranged around the core. This is understood to mean that each fibre package largely surrounds the core. However, this does not mean that the different strands or fibres themselves also run around the core, although this may of course be the case in a particular embodiment. The cable comprises one or more cores.

The selection of the elastomer or of the mixture of elastomers is preferably determined by the properties of the elastomer or the mixture of elastomers. Thus, it may be provided that the elastomer/elastomer mixture or at least the elastomer/elastomer mixture which is situated on the outer side of the cable, has a high coefficient of friction compared to the edge of the sail into which the cable is to be introduced. If there is a high coefficient of friction between the cable and the sail, the surface of the rotating furling cable will take the sail with in a reliable manner.

Preferably, the elastomer/elastomer mixture or at least the elastomer/elastomer mixture which is situated on the outer side of the cable, also has a high resistance to sunlight, ozone and other weather and environmental factors, so that the cable can be used for a very long time without losing its good properties.

In a very preferred embodiment, said first angle and said second angle are situated on either side of the longitudinal axis of the cable. That is to say that the smallest angle between the first direction and the longitudinal axis of the cable, read starting from the longitudinal axis of the cable, is read clockwise and that the smallest angle between the second direction and the longitudinal axis of the cable, read starting from the longitudinal axis of the cable, is read counterclockwise or vice versa. An angle is positive (+) if it is read counterclockwise. An angle is negative (-) if it is read clockwise. If they are both read from the longitudinal axis of the cable, the first and the second angle therefore have a different sign. The fibres or strands prevent torsion of the cable even better, as one group of fibres or strands then prevents torsion of the cable in one direction of rotation and the other group of fibres or strands then prevents torsion of the cable in the opposite direction of rotation, as a result of which the cable does not experience deformation by torsion, or only very little. The torsional rigidity of such a cable is therefore high if a moment of force is applied to the cable in order to rotate the cable.

Preferably, the fibres or strands of the first and the second group of fibres or strands extend around the core. This results in the moments of force which are applied to the cable in order to rotate the cable being passed on to the remainder of the cable even better, thus improving the torsional rigidity. This cable is therefore even more suitable for use in furling systems of sailing boats where the sail is provided with an edge which forms a tunnel, into which a cable is introduced, and where a moment of force is applied to the cable in order to rotate it.

In a very preferred embodiment, the successive fibres or strands of the first group of fibres or strands extend a certain intermediate distance apart and the successive fibres or strands of the second group of fibres or strands extend a certain intermediate distance apart.

Together, the mutually crossing fibres or strands thus form a matrix comprising a plurality of three-dimensional polygonal bodies (polygons), while the space inside

these polygons is moreover filled with the elastomer which is chemically and mechanically bonded to these strands or fibres. Said matrix ensures that the core-surrounding sheath experiences little deformation, more particularly little deformation by torsion, as a result of which the cable has a very high torsion resistance.

The third group of fibres or strands is preferably arranged around the first group of fibres or strands, and the second group of fibres or strands is then preferably arranged around the third group of fibres or strands. The first group of fibres or strands is thus closest to the core, with the third group of fibres or strands being further from the core and the second group of fibres or strands being furthest from the core. Due to this arrangement, the fibres or strands form a matrix comprising a plurality of three-dimensional triangular and polygonal bodies, with the space inside these bodies moreover being filled with the elastomer which is chemically and mechanically bonded to these strands or fibres. Triangular bodies are less deformable than bodies with more angles. This third layer leads to many three-dimensional triangular bodies which ensure a high torsional rigidity. Due to the fact that the third group of fibres or strands is arranged in between, as it were, the first group and the second group of fibres or strands, the first and the second group of fibres or strands are even more able to prevent deformation by torsion. As a result of said matrix and the arrangement of the fibres or strands, the cable thus has a very high torsion resistance.

In a highly preferred embodiment, viewed according to a cross section of the cable at right angles to the longitudinal axis of the cable, from the core outwards, there is an intermediate distance between the fibres or strands of the successive groups of fibres or strands. This intermediate distance is filled by the elastomer. Due to this intermediate distance and the fact that this intermediate distance is filled with the elastomer, the cable experiences even less deformation, as a result of which the cable does not experience deformation by torsion, or only very little.

The fibres or strands of a said fibre package preferably comprise textile fibres or textile strands. The fibres may be, for example, aramid fibres, such as Kevlar, polyamide fibres such as nylon 6,6 or other fibres or strands of great tensile strength, such as fibres or strands comprising high elastic modulus polyethylene (HMPE), polyester, polyethylene terephthalate. These are fibres having a relatively great tensile strength/high elastic modulus (Young's modulus). Nylon 6,6 has a high elastic modulus of between 2 and 4 GPa and has a tensile strength of between 70 and 90 MPa. Aramid fibres such as Kevlar have a very high elastic modulus of between 60 and 120 GPa. By using fibres having a relatively great tensile strength and therefore a high elastic modulus, the cable also acquires a high torsional rigidity.

Preferably, the angle between the first direction and the longitudinal axis of the cable is between 30° and 85°, more preferably between 35° and 55°. Highly preferably, this angle is virtually 45°. At this angle, the cable has a high torsional rigidity and a moment of force applied to rotate the cable is transmitted efficiently to the remainder of the cable.

Preferably, the angle between the second direction and the longitudinal axis of the cable is between 30° and 85°, more preferably between 35° and 55°. Highly preferably, it is virtually 45°. At this angle, the cable has a high torsional rigidity and a moment of force applied to rotate the cable is transmitted efficiently to the remainder of the cable.

In a particularly preferred embodiment, the angle between the first direction and the second direction is between 70° and 90°. If the angles between the first direction and the longitudinal axis of the cable and between the second direction and the longitudinal axis of the cable are then between 35° and 55°, respectively, this means that said first angle and said second angle are situated on either side of the longitudinal axis of the cable. Thus, the fibres or strands can prevent deformation of the cable by torsion very well if a moment of force is applied to rotate the cable about its longitudinal axis. Such a cable thus has a high torsional rigidity.

A very preferred embodiment is obtained if the angle between the first and the second direction is virtually 90°. If the first direction and the second direction are at right angles to each other, the cable has a high torsional rigidity If the angles between the first direction and the longitudinal axis of the cable and between the second direction and longitudinal axis of the cable are moreover virtually 45°, the torsional rigidity of the cable is very high.
In a preferred embodiment, the ratio between the largest transverse dimension and the smallest transverse dimension, viewed according to a cross section of the cable at right angles to the axis of the cable, is between 1 and 5. This cross section is, for example, square, rectangular, oval or triangular in shape or is in the shape of, for example, a circle or a wing etc. In case the cross section is circular, said ratio is 1.

In order not to compromise the ability of the cable to be rolled up or folded up, said ratio is preferably not greater than 5. If this cable is used in a furling system for a sail having an edge which is tunnel-shaped and surrounds the cable, it is not only the coefficient of friction between the cable and the sail which determines whether a rotation of the cable also results in an efficient rotation of the sail. The shape of said cross section also plays a part. Thus, cables having a wing-shaped or pear-shaped cross section take the sail with more readily upon rotation of the cable than cables having a circular cross section.

Said elastomer is preferably a mixture of natural rubber and synthetic rubber. Examples of synthetic rubber are isoprene rubber, polybutadiene, styrene butadiene rubber, EPDM rubber or neoprene (polychloroprene). The advantage of working with different types of rubber is that each type of rubber has interesting and different properties. Thus, it is possible to obtain a mixture which is resistant to ozone and UV light and in which the coefficient of friction between the mixture and the sailcloth is high, as a result of which the furling and unfurling of the sailcloth runs smoothly. Natural rubber, for example, has a high elastic modulus, a low hysteresis and is wear-resistant, as a result of which a cable comprising an elastomer containing a high

percentage of natural rubber can readily be rolled up, is pliable and has improved durability. Styrene butadiene rubber, for example, ensures said high coefficient of friction. Neoprene and EPDM rubber, for example, are resistant to sunlight and ozone. Said elastomer does not have to be homogeneous. Thus, the elastomer which is closer to the core may have a different composition to the elastomer which is situated further from the core.

This object is also achieved by providing a method of producing a pliable cable wherein the cable comprises a core and a core-surrounding sheath and wherein the core comprises one or more strand-like elements, wherein the production of the cable comprises the following steps:

- wrapping the core with successively a first and a second layer of vulcanisable or polymerisable elastomer, which includes fibres or strands and in which the fibres or strands in the first and the second layer extend substantially along a first direction and a second direction, respectively, both directions forming an angle to the longitudinal axis of the cable and crossing, and
- in which the cable is subjected to a vulcanisation or polymerisation process so that the elastomer is vulcanised or polymerised.

The term elastomer may denote natural rubber, synthetic rubber and any other polymers having rubber-like properties or may also be used to denote a mixture of natural and synthetic rubber or a mixture of different types of synthetic rubber. Natural rubber and certain synthetic rubbers, such as styrene butadiene rubber, EPDM rubber and polychloroprene (neoprene) are vulcanisable or polymerisable. As a result, layers comprising one or more of these types of rubber may be applied in a non-vulcanised or partly polymerised state. This makes it possible to vulcanise or polymerise the cable at a later point in time. The terms strands and fibres may be used to denote textile strands or textile fibres, but may also denote metal strands. The layers of rubber may be formed by means of a calendaring process and the strands or fibres may be embedded in the rubber layer via this calendaring process.

Due to the fact that the entire cable has undergone a vulcanisation or polymerisation process, the elastomer will also have been vulcanised or polymerised, so that the elastomer is not only mechanically, but also chemically bonded to the fibres or strands of the fibre package and to the core and the different elastomer layers will also be chemically and mechanically bonded. As a result thereof, the different components of the cable are reliably bonded to each other. This cable can be rolled up, folded up and is pliable. This makes the cable suitable for use in furling systems for sailing boats wherein the sail is provided with an edge which forms a tunnel into which the cable can be introduced and wherein the cable is rotatable about its longitudinal axis.

The cable obtained using the above method suffers little deformation by torsion. This high torsional rigidity is achieved as a result of the construction of the cable and by the fact that the elastomer is bonded, both chemically and mechanically, to said strands or fibres and is also chemically and mechanically bonded to the core. In this case, the core preferably has a high tensile resistance/high elastic modulus in order to absorb tensile strain on the cable. The core could have such a high tensile resistance/high elastic modulus inter alia, because the strand-like elements of the core have a high tensile resistance/high elastic modulus. The expression a high elastic modulus is understood to mean a modulus of elasticity of at least 2 GPa. A moment of force applied to rotate the cable is transmitted efficiently because the fibres or strands from the first elastomer layer and the second elastomer layer offer resistance to torsion, as a result of which the one end of the cable does not rotate more than the other end if a moment of force is applied to one end in order to rotate the cable. The reason for this is that both the direction of the fibres or strands of the first elastomer layer and the second elastomer layer form an angle with, and thus do not run parallel to the longitudinal axis of the cable, due to the fact that the fibres or strands of the first elastomer layer cross, and thus do not run parallel with, the fibres or strands of the second elastomer layer, since there is a certain intermediate distance between the fibres or strands of the first elastomer layer and the fibres or strands of the second elastomer layer, and that the elastomer layers extend around the core.

In addition, the mutually crossing fibres or strands together form a matrix comprising a plurality of three-dimensional polygonal bodies while the space inside these bodies is moreover filled with the elastomer which is chemically and mechanically bonded to these strands or fibres. These bodies are not very deformable. Said matrix thus has the additional effect that the cable has a very high torsion resistance. This prevents the one end of the cable from rotating more or less than the other end if a moment of force is applied to rotate the cable about its longitudinal axis. The cable thus experiences little deformation by torsion and can transmit said moment of force efficiently.

Due to this high torsional rigidity and the ability to be rolled up, the cable obtained according abovementioned method is very suitable to be used in a furling system for sailing boats, in which the sail is provided with an edge which forms a tunnel, into which said cable is introduced and in which a moment of force is applied to the cable to rotate it about its longitudinal axis. By rotating the cable, the sail is furled/unfurled virtually evenly, as the cable is rotated evenly along its entire length.

By using a certain type of elastomer or a mixture of different types of elastomer, it is possible to ensure that there is a relatively high coefficient of friction between the sail and the cable, as a result of which the sail which is attached to the cable is taken by the cable efficiently upon rotation of this cable about its longitudinal axis.

The successive fibres or strands of the first group of fibres or strands preferably extend a certain intermediate distance apart and the successive fibres or strands of the second group of fibres or strands also preferably extend a certain intermediate distance apart. Together, the mutually crossing fibres or strands thus form a matrix comprising a plurality of three-dimensional polygonal bodies (polygons), while the space inside these polygons is moreover filled with the elastomer which is chemically and mechanically bonded to these strands or fibres. Said matrix ensures

that the cable experiences little deformation, more specifically little deformation by torsion, as a result of which the cable has a very high torsion resistance.

In a preferred embodiment, the core is wrapped with a third layer of vulcanisable or polymerisable elastomer, which includes fibres or strands and in which these fibres or strands of the third layer extend virtually along the longitudinal axis of the cable. This third layer may be situated between the first layer and the second layer. It may also be at a different position compared to the first layer and the second layer.

In a highly preferred embodiment, after the first elastomer layer has been wrapped around the core and before the second elastomer layer is wrapped around it, the third elastomer layer is wrapped around the core. Due to the presence of these fibres or strands oriented along the longitudinal axis, all of the fibres or strands form a matrix comprising a plurality of three-dimensional triangular and polygonal bodies, whereas the space inside these bodies is moreover filled with the elastomer which is chemically and mechanically bonded to these strands or fibres. Due to the presence of triangular bodies, which are less deformable than bodies having 4 or more corners, the torsional rigidity is high. Due to said matrix and the arrangement of the fibres or strands, the cable thus has a very high torsional rigidity.

Highly preferably, an additional elastomer layer is wrapped around the second elastomer layer. This additional elastomer layer is then not provided with strands or fibres, as a result of which the strands or fibres which are present are well embedded in the elastomer and are thus not exposed to weather and other environmental factors. In addition, the elastomer in this additional layer may be such that this elastomer or elastomer mixture has a high coefficient of friction with respect to the sailcloth and also has a good resistance to the effects of the sunlight, ozone and other weather and environmental factors. When choosing the layers of elastomer which are situated underneath, the friction properties and the resistance to weather and environmental factors are less of a consideration and it is thus possible to choose the elastomer first

and foremost on the basis of the elasticity and torsional rigidity of the cable which can be achieved therewith.

In a specific embodiment, a said elastomer layer at least partly overlaps itself. This is understood to mean that, that around which the said elastomer layer is wrapped, is wrapped more than once by said elastomer layer. The elastomer layer then forms more than one complete wrapping, so that at least the two end edges of the elastomer layer overlap one another. In this way, it is possible to ensure that the wrapping is completely, that is to say not less than once. The overlapping may be 10 percent, but may also be more than 10 percent, for example 75 percent or even 100 percent. If the overlapping is 100 percent, the elastomer layer is wrapped around twice. By means of overlapping, it is also readily possible to obtain cables having a cross section at right angles to the longitudinal axis of the cable, wherein this cross section is not circular when a circular core is being covered, and wherein the ratio between the largest transverse dimension and the smallest transverse dimension of this cross section is larger than 1. In that case, the cross section is, for example, oval or triangular. A large part of the fibres or strands is then at a greater distance from the core, as a result of which the torsional rigidity is greater. In order not to compromise the ability of the cable to be rolled up and folded up, the ratio is preferably not greater than 5.

In a very preferred embodiment, the fibres or strands which are present in said fibre- or strand-comprising elastomer layers are covered with an adhesion-improving cover layer. The core is preferably also covered with an adhesion-improving cover layer. By means of adhesion-improving cover layers, the chemical bond between the elastomer and the components comprising an adhesion-improving cover layer is improved, as a result of which the elastomer is also more strongly bonded to these components, thus increasing the torsional rigidity of the cable produced according to this method. For example, if the fibres or strands are nylon fibres, for example nylon 6,6, the adhesion-improving cover layer may comprise resorcinol formaldehyde. The core may be provided with an adhesion-improving cover layer by immersing it in a

solution comprising rubber and a solvent, this rubber being provided specifically in order to increase the adhesion to the core. Here, the adhesion-improving cover layer then comprises rubber.

Preferably, the cable is placed in a mould for said vulcanisation or polymerisation process, this mould is heated to a temperature of between 110°C and 170°C and this mould is subjected to a surface pressure of between 5MPa and 80MPa. These are the ideal reaction conditions to ensure said process runs efficiently, to obtain a good chemical and mechanical bond between the elastomer and the fibres or strands, to obtain a good chemical and mechanical bond between the elastomer and the core and to obtain a good bond between the elastomer layers themselves.
The elastomer layers preferably comprise one or more elastomer strips. This/these elastomer strip/strips are preferably wrapped around the core parallel to the longitudinal axis of the core.

The present invention will now be explained in more detail by means of the following detailed description of a preferred embodiment of a cable and a method of producing a cable according to the present invention. The sole aim of this description is to give illustrative examples and to indicate further advantages and particulars of this cable and this method, and can therefore by no means be interpreted as a limitation of the area of application of the invention or of the patent rights defined in the claims.

Reference numerals are used in this detailed description to refer to the attached drawings, in which

- ***Fig. 1*** shows a cable according to the invention in perspective in which only the fibre package of the core-surrounding sheath is illustrated;
- ***Fig. 2*** shows how a first rubber layer is wrapped around a core, according to a cross section at right angles to the longitudinal axis of the core and shows a front view of this first rubber layer;

- ***Fig. 3*** shows how a third rubber layer is wrapped around the first rubber layer and the core, as illustrated in Fig. 2, according to a cross section at right angles to the longitudinal axis of the core and shows a front view of this third rubber layer;

-***Fig. 4*** shows how a second rubber layer is wrapped around the rubber layers and the core, as illustrated in Fig. 3, according to a cross section at right angles to the longitudinal axis of the core and shows a front view of this second rubber layer;

-***Fig. 5*** shows how a fourth rubber layer is wrapped around the rubber layers and the core, as illustrated in Fig. 4, according to a cross section at right angles to the longitudinal axis of the core and shows a front view of this fourth rubber layer;

-***Fig. 6*** shows a cross section of a cable and the edge of a sail, at right angles to the longitudinal axis of the cable according to the prior art, in which this cable is situated in a tunnel formed by the edge of the sail;

-***Fig. 7*** shows a cross section of a cable according to the invention, at right angles to the longitudinal axis of the cable, in which this cable is situated in a tunnel formed by the edge of the sail and in which this cable has a virtually circular cross section;

-***Fig. 8*** shows a cross section of a cable according to the invention, at right angles to the longitudinal axis of the cable, in which this cable is situated in a tunnel formed by the edge of the sail and in which this cable has a virtually oval cross section;

-***Fig. 9*** shows a cross section of a cable according to the invention, at right angles to the longitudinal axis of the cable, in which this cable is situated in a tunnel formed by the edge of the sail and in which this cable has a virtually wing-shaped cross section;

-***Fig. 10*** shows a cross section of a cable according to the invention, at right angles to the longitudinal axis of the cable, in which this cable is situated in a tunnel formed by the edge of the sail and in which this cable has a virtually pear-shaped cross section;

-***Fig. 11*** shows a cross section of a cable according to the invention, at right angles to the longitudinal axis of the cable, in which this cable is situated in a tunnel formed by the edge of the sail and in which this cable has a virtually circular cross section with projections;

-***Fig. 12*** shows a cross section of a cable according to the invention, at right angles to the longitudinal axis of the cable, in which this cable is situated in a tunnel formed by the edge of the sail and in which this cable has a cross section, one half of which is in the shape of half a circle and the other half of which is in the shape of half a square;

-***Fig. 13*** shows a perspective view of a furling system with a sail, in which the furling system comprises a spool and a cable according to the invention and this cable is situated in a tunnel formed by the edge of the sail.

The cable (1) according to the invention as illustrated in Figs. 1, 7 to 13 comprises a core (2) having a high tensile resistance and a core-surrounding sheath (3). As illustrated in Figs. 2 to 5 and 7 to 13, this core (2) comprises several strand-like elements (4). These strand-like elements (4) are textile fibres having a certain tensile strength/tensile resistance so that the core (2) which is composed of these strand-like elements (4) also has a certain tensile strength/tensile resistance. Obviously, other embodiments in which the strand-like elements (4) are steel cables or steel strands are also possible. The strand-like elements (4) are aramid fibres. Other possible textile fibres are polyamide fibres, such as nylon 6,6 or high elastic modulus polyethylene (HMPE) fibres, polyester fibres, Dyneema fibres (UHMWPE or ultra-high-molecular-weight polyethylene) or polyethylene terephthalate fibres. Aramid fibres such as Kevlar are fibres having a very high tensile resistance, since the modulus of elasticity is very high, being between 60 and 120 GPa. Nylon fibres have a high modulus of elasticity of between 2 and 4 GPa. In Figs. 2 to 5, the plurality of strand-like elements (4) have virtually the same cross section. In Figs. 7 to 13, the core (2) comprises one central strand-like element (4), surrounded by several strand-like elements (4) having a smaller cross-section than the central strand-like element (4).

The cables (1) are pliable, flexible, bendable, resistant to sunlight and ozone and are hard-wearing.

The core-surrounding sheath (3) comprises a rubber mixture which includes one fibre package. Each fibre package surrounds the core (2) and comprises

- a first group of fibres or strands (5) which substantially extend along a first direction which forms an angle (α) of virtually 45° with the longitudinal axis (9) of the cable (1);
- a second group of fibres or strands (6) which substantially extend along a second direction which forms an angle (β) of virtually 45° with the longitudinal axis (9) of the cable (1), so that the fibres or strands of the respective first and second group (5, 6) cross each other at an angle of virtually 90°;
- a third group of fibres or strands (7) which substantially extend along the longitudinal axis (9) of the cable (1);

and in which the pliable cable (1) has undergone a vulcanisation or polymerisation process so that the elastomer is vulcanised or polymerised.

Here, the angles (α, β) between the first direction and the longitudinal axis (9) of the cable (1) and between the second direction and the longitudinal axis (9) of the cable (1) are given without indicating the sign, positive (+) or negative (-), as the direction in which they are to be read is not being taken into account. However, if the angles (α, β) are read starting from the longitudinal axis (9), the angle (α) between the first direction and the longitudinal axis (9) is + 45°, since this is read counterclockwise, and the angle (β) between the second direction and the longitudinal axis (9) is -45°, since this is read clockwise. Both angles (α, β) are thus on either side of the longitudinal axis (9).

All these fibres or strands (5, 6, 7) extend around the core (2) and the successive fibres or strands of the first group of fibres or strands (5), as well as the successive fibres or strands of the second group of fibres or strands (6), and the successive fibres

or strands of the third group of fibres or strands (7) extend at a certain intermediate distance apart. Thus, the fibres or strands within a group (5, 6, 7) do not bear against each other, as rubber is provided between the fibres or strands within a group (5, 6, 7). The first group of fibres or strands (5) extends around the core (2). The third group of fibres or strands (7) extends around the first group of fibres or strands (5) and the second group of fibres or strands (6) is arranged around the third group of fibres or strands (7). In a cross-section at right angles to the cable (1), starting from the core (2) outwards, the first group of fibres or strands (5), the third group of fibres or strands (7) and the second group of fibres or strands (6) can be seen. In said cross-section, starting from the core (2) outwards, it can also be seen that that there is an intermediate distance between the fibres or strands of the successive groups of fibres or strands (5, 6, 7). The fibres or strands of the first group of fibres or strands (5) therefore do not touch the fibres or strands of the third group of fibres or strands (7) and the fibres or strands of the second group of fibres or strands (6) do not touch the fibres or strands of the third group of fibres or strands (7) either.

The cables (1) illustrated here in Figs. 1, 7 to 14 comprise only one fibre package. However, the cables (1) may also comprise several fibre packages along their entire length. At certain locations, the cable (1) may also be provided with several fibre packages on top of each other. In order to facilitate furling of the cable (1), the ends of the cable (1) may be provided with several fibre packages above one another, for example, while the remainder of the cable (1) is only provided with one fibre package. The cable (1) may also be provided with two or more fibre packages at certain intermediate distances apart. With very long cables (1), this benefits the torsional rigidity of the cable (1). The cable (1) may also be provided with several cores (2), in which case a core-surrounding sheath (3) comprising rubber which contains a fibre package is arranged around these cores (2).

The ends or one end of cable (1) may be provided with an eye splice made from the core (2), in which case the eye splice is also provided with a surrounding sheath (3) comprising rubber which includes at least one of said fibre packages. If such a cable

(1) is then used in furling systems of sailing boats, in which case the cable (1) is arranged in a tunnel (13) on the edge of the sail (10), a moment of force applied to an end of the cable (1) by means of, for example, a spool (11) to rotate the cable (1) is efficiently transmitted to the remainder of the cable (1).

The cables (1) according to the invention are subjected to a vulcanisation process in their entirety. Thus, the rubber mixture of the core-surrounding sheath (3) is bonded both chemically and mechanically with the fibres or strands of the groups of fibres or strands (5, 6, 7) and the core (2). Partly due to this good bond and to the composition of the cables (1), the cables (1) have a high torsional rigidity. This high torsional rigidity is achieved by the fact that the fibres or strands of the first group of fibres or strands (5) and the fibres or strands of the second group of fibres or strands (6) prevent torsion of the cable (1) if a moment of force is applied to rotate the cable (1). As a result thereof, the cable (1) experiences little deformation and the moment of force applied to the cable (1) in order to rotate the cable (1) can be transmitted entirely to the remainder of the cable (1). The fibres of the third group of fibres or strands (7) together with the other fibres or strands (5, 6) form a matrix comprising a plurality of three-dimensional triangular bodies (12). These triangular bodies (12) are filled with the rubber mixture which is chemically and mechanically bonded to these strands or fibres (5, 6, 7). These triangular bodies (12) experience little deformation/torsion, as a result of which said matrix also experiences little deformation/torsion and the cable (1) has a very high torsion resistance.

The cross-section of the cable (1) at right angles to the longitudinal axis (9) of the cable (1) may have different forms. This form is particularly important for the ability of the cable (1) to be rolled up and for the suitability of the cable (1) for use in furling systems of sails (10), in which the edge of the sail (10) is provided with a tunnel (13) into which the cable (1) can be introduced and in which the sail (10) can be furled and unfurled by applying a moment of force to an end of the cable (1) in order to rotate the cable (1). For the sake of simplicity, use is generally made of a core (2) having a virtually circular cross-section. Such cores (2) are easy to produce.

The way in which the core-surrounding sheath (3) surrounds the core (2) will thus determine the shape of the cable (1).

Fig. 6 illustrates the prior art of the existing furling system for sailing boats, in which the cable (1a) is situated in a tunnel (13a) of the edge of the sail (10a). This cable (1a) comprises several strand-like elements (4a) and may be the core (2) of the cable (1) according to the invention. The torsional rigidity of the prior-art cable (1a) is not as high as that of the cable (1) according to the invention since it not only lacks crossing fibres, but also rubber-filled three-dimensional polygonal and triangular bodies. As a result thereof, a sail (10a) cannot be furled and unfurled evenly by means of such cable (1a). In addition, the coefficient of friction between the sail (10a) and the prior-art cable (1a) is low, as a result of which rotation of the cable (1a) does not always result in a rotation of the sail (10a).
The coefficient of friction between a cable (1) according to the invention and the sail (10) is determined by the rubber/rubber mixture which is used. This is taken into account by providing a rubber/rubber mixture on the outer side of the cable (1) which has a high coefficient of friction with the sail (10). The outer side of the cable (1) is also subject to external factors, such as wind, sunlight, salt water or freshwater, ozone, etc. as a result of which the rubber/rubber mixture provided on the outer side of the cable (1) also needs to have a certain resistance with respect to these external factors.

In addition to this coefficient of friction, the shape of the cross section of the cable (1) at right angles to the longitudinal axis (9) of the cable (1) also partly determines whether rotation of the cable (1) also efficiently rotates the sail (10), the edge of the sail (10) being arranged around said cable (1). Thus, the shapes in Figs. 9 to 12 are very suitable to ensure that a rotation of the cable (1) is also followed by a rotation of the sail (10). These shapes take the sail (10) with, as it were, when the cable (1) rotates. The cable (1) having a wing-shaped cross section, as illustrated in Fig. 9, or the cable (1) having the pear-shaped cross section, as illustrated in Fig. 10, due to their shape always take the sail (10) with when the cable (1) rotates. The sail (10) has

no other option but to co-rotate. The projecting components of the cable (1) as illustrated in Fig. 11 ensure a better contact between the cable (1) and the sail (10) than for example a cable (1) having a smooth surface. Due to the fact that the cable (1) as illustrated in Fig. 12 comprises two angles, the sail (10) is taken by the cable (1) efficiently. In order not to compromise the ability of the cable (1) to be rolled up, the ratio of the largest transverse dimension and the smallest transverse dimension of the cross section of the cable (1) at right angles to the axis of the cable (1) must not be greater than 5. The radius of the rolled-up cable (1) is then between 5 to 25 times, half the sum of the largest dimension and the smallest dimension of the cross section of the cable (1). These specific shapes are obtained during manufacture of the cable (1). Below, an embodiment of a method is described for producing a pliable cable (1) having high torsional rigidity according to the invention. The above-described cable (1) is manufacture by means of this embodiment.

The method comprises the following steps:

- Providing a core (2) having great tensile strength comprising several strand-like elements (4);
- Wrapping the core (2) with a first layer of non-vulcanised rubber (50) which includes fibres or strands (5) and in which the fibres or strands (5) extend substantially along a first direction, this first direction being at an angle (α) of virtually 45° to the longitudinal axis (9) of the cable (1);
- Wrapping the core (2) and the first layer of non-vulcanised rubber (50) with a third layer of non-vulcanised rubber (70) which includes fibres or strands (7) and in which the fibres or strands (7) extend substantially along the longitudinal axis (9) of the cable (1);
- Wrapping the core (2), the first layer of non-vulcanised rubber (50) and the third layer of non-vulcanised rubber (70) with a second layer of non-vulcanised rubber (60) which includes fibres or strands (6) and in which the fibres or strands (6) extend substantially along a second direction, this second direction being at an angle (β) of virtually 45° to the longitudinal axis (9) of

the cable (1) and said first direction and said second direction making an angle of virtually 90°;

- Wrapping the core (2), the first layer of non-vulcanised rubber (50), the third layer of non-vulcanised rubber (70), the second layer of non-vulcanised rubber (60), with a fourth layer of non-vulcanised rubber (80) which does not include fibres or strands, and
- Subjecting the cable (1), comprising a core (2) and 4 layers of non-vulcanised rubber (50, 60, 70, 80) to a vulcanisation process.

In Figs. 2 to 5, an arrow indicates how these non-vulcanised rubber layers (50, 60, 70, 80) are applied. These rubber layers (50, 60, 70, 80) are mouldable at room temperature and are vulcanisable. The rubber layers (50, 60, 70, 80) comprise one or more adjoining rubber strips. Wrapping these one or more rubber strips around the core is carried out parallel to the longitudinal axis (9) of the core (2). The rubber strips may, for example, be produced by means of calendaring. If the rubber layer (50, 60, 70) then comprises fibres or strands (5, 6, 7), these fibres or strands (5, 6, 7) are embedded into the rubber layer (50, 60, 70) by means of calendaring. The rubber layers (50, 60, 70, 80) comprise natural rubber, synthetic rubber, a mixture of natural rubber and synthetic rubber(s) or a mixture of synthetic rubber types. Each rubber layer (50, 60, 70, 80) may also have a different composition. It is important, for example, that the rubber of the fourth rubber layer (80) is resistant to ozone, sunlight etc. and that the coefficient of friction between the sail (10) and this rubber is high. For this reason, the fourth rubber layer (80) has a greater content of neoprene rubber and/or EPDM rubber. For the layers (50, 60, 70) situated underneath, it is of prime importance that they contribute to the torsional rigidity and the capability of the cable (1) to be rolled up. It is also important that the composition of the rubber layers (50, 60, 70) situated underneath provides a good bond between the different rubber layers (50, 60, 70, 80) after vulcanisation. To this end, the rubber layers (50, 60, 70) situated underneath comprise a mixture of natural rubber and styrene butadiene rubber.

By using a fourth rubber layer (80) without fibres or strands here, no fibres or strands (5, 6, 7) are directly exposed to external factors, as a result of which the fibres or strands (5, 6, 7) do not have to possess a good resistance to these external factors. Due to the fact that the fibres or strands (5, 6, 7) are situated in different rubber layers (50, 60, 70), the fibres or strands (5, 6, 7) of successive rubber layers (50, 60, 70) cannot touch each other. Of course, in other embodiments more than 4 rubber layers or fewer than 4 rubber layers may be wrapped around the core (2).

By means of the vulcanisation step, improved properties are achieved, the different rubber layers (50, 60, 70, 80) are bonded well to each other and the rubber is also bonded well to the fibres or strands (5, 6, 7) of the rubber layers (50, 60, 70) and the core (2). In addition, the cable (1) thus becomes resistant to wear.

When wrapping the different rubber layers (50, 60, 70, 80) around the core, the rubber layers (50, 60, 70, 80) may optionally partly overlap. Figs. 2 to 5 show that these rubber layers (50, 60, 70, 80) do not overlap. Both the core (2) and the fibres or strands (5, 6, 7) of the first, second or third rubber layer (50, 60, 70) are covered with an adhesion-improving cover layer. By means of this adhesion-improving cover layer, a strong chemical bond is produced between the rubber and the core (2) and between the rubber and said fibres or strands (5, 6, 7) during the vulcanisation process, as a result of which the bond between the rubber and the other components of the cable (1) is very strong. The vulcanisation process takes place in a prefabricated mould at temperatures of between 110°C and 170°C and at a surface pressure of between 5MPa and 80 MPa.

The cable (1) produced by this method and/or the above-described cable (1) is highly suitable for use in furling systems for sails (10) of sailing boats, in which the edge of the sail (10) extends around the cable (1). Here, the cable (1) then has a length of between 5 and 150 metres, depending on the size of the sailing boat. The ratio of the largest transverse dimension and the smallest transverse dimension of the cross section of the cable (1) at right angles to the axis of the cable (1) is not greater than 5.

The ratio of the length of the cable (1) and half the sum of the largest transverse dimension and the smallest transverse dimension of the cross section of the cable (1) at right angles to the axis of the cable (1) is greater than 100 and is preferably between 500 and 5000. Half the sum of the largest transverse dimension and the smallest transverse dimension of the cross section of the cable (1) at right angles to the axis of the cable (1) thus varies between 10 and 30 mm.

CLAIMS

1. Pliable cable (1) comprising a core (2) and a core-surrounding sheath (3), wherein the core (2) comprises one or more strand-like elements (4), wherein the core-surrounding sheath (3) comprises an elastomer which includes at least one fibre package, and wherein each fibre package is arranged around the core (2) and at least comprises
   - a first group of fibres or strands (5) which substantially extend along a first direction which forms a first angle (α) with the longitudinal axis (9) of the cable (1),
   - a second group of fibres or strands (6) which substantially extend along a second direction which forms a second angle (β) with the longitudinal axis (9) of the cable (1);

   so that the fibres or strands of the respective first and second group (5, 6) cross one another,

   characterized in that in a said fibre package, the second group of fibres or strands (6) is arranged around the first group of fibres or strands (5) and in that the fibre package comprises a third group of fibres or strands (7), the fibres or strands (7) of which extend substantially along the longitudinal axis (9) of the cable (1), and wherein the pliable cable (1) has undergone a vulcanisation or polymerisation process so that the elastomer is vulcanised or polymerised.

2. Cable (1) according to Claim 1, characterized in that said first angle (α) and said second angle (β) are situated on either side of the longitudinal axis (9) of the cable (1).

3. Cable (1) according to Claim 1 of 2, characterized in that the fibres or strands of the first and the second group of fibres or strands (5, 6) extend around the core (2).
4. Cable (1) according to one of the preceding claims, characterized in that the successive fibres or strands of the first group of fibres or strands (5) extend a certain intermediate distance apart and the successive fibres or strands of the second group of fibres or strands (6) extend a certain intermediate distance apart.

5. Cable (1) according to one of the preceding claims, characterized in that the third group of fibres or strands (7) is arranged around the first group of fibres or strands (5), and the second group of fibres or strands (6) is arranged around the third group of fibres or strands (7).

6. Cable (1) according to one of the preceding claims, characterized in that viewed according to a cross section of the cable (1) at right angles to the longitudinal axis (9) of the cable (1), from the core (2) outwards, there is an intermediate distance between the fibres or strands of the successive groups of fibres or strands (5, 6, 7),.

7. Cable (1) according to one of the preceding claims, characterized in that the fibres or strands (5, 6, 7) of a said fibre package, comprise textile fibres or textile strands.

8. Cable (1) according to one of the preceding claims, characterized in that the angle (α) between the first direction and the longitudinal axis (9) of the cable (1) is between 30° and 85°, preferably between 35° and 55°.

9. Cable (1) according to one of the preceding claims, characterized in that the angle (β) between the second direction and the longitudinal axis (9) is between 30° and 85°, preferably between 35° and 55°.

10. Cable (1) according to one of the preceding claims, characterized in that the angle between the first direction and the second direction is between 70° and 90°.

11. Cable (1) according to one of the preceding claims, characterized in that the ratio between the largest transverse dimension and the smallest transverse dimension, viewed according to a cross section of the cable (1) at right angles to the axis of the cable (1), is between 1 and 5.

12. Cable (1) according to one of the preceding claims, characterized in that said elastomer is a mixture of natural rubber and synthetic rubber.

13. Method of producing a pliable cable (1), wherein the cable (1) comprises a core (2) and a core-surrounding sheath (3) and wherein the core (2) comprises one or more strand-like elements (4), **characterized in that** the production of the cable (1) comprises the following steps:
    - wrapping the core (2) with successively a first and a second layer of vulcanisable or polymerisable elastomer (50, 60), which includes fibres or strands (5, 6) and in which the fibres or strands (5, 6) in the first and the second layer (50, 60) extend substantially along a first direction and a second direction, respectively, both directions forming an angle (α, β) to the longitudinal axis (9) of the cable (1) and crossing each other, and
    - in which the cable (1) is subjected to a vulcanisation or polymerisation process so that the elastomer is vulcanised or polymerised.

14. Method according to Claim 13, characterized in that the core (2) is wrapped with a third layer of vulcanisable or polymerisable elastomer (70), which includes fibres or strands (7) and in which these fibres or strands (7) of the

third layer (70) extend substantially along the longitudinal axis of the cable (1).

15. Method according to Claim 14, characterized in that after the first elastomer layer (50) has been wrapped around the core (2) and before the second elastomer layer (60) is wrapped around it, the third elastomer layer (70) is wrapped around the core (2).

16. Method according to one of Claims 13 to 15, characterized in that an additional elastomer layer (80) is wrapped around the second elastomer layer (60).

17. Method according to one of Claims 13 to 6, characterized in that a said elastomer layer (50, 60, 70, 80) at least partly overlaps itself.

18. Method according to one of Claims 13 to 17, characterized in that the fibres or strands (5, 6, 7) which are present in the said fibre- or strand-comprising elastomer layers (50, 60, 70), are covered with an adhesion-improving cover layer.

19. Method according to one of Claims 13 to 18, characterized in that the cable (1) is placed in a mould for said vulcanisation or polymerisation process, said mould is heated to a temperature of between 110°C and 170°C and said mould is subjected to a surface pressure of between 5MPa and 80MPa.

20. Method according to one of Claims 13 to 19, characterized in that the cable (1) is a cable (1) according to one or more of Claims 1 to 12.

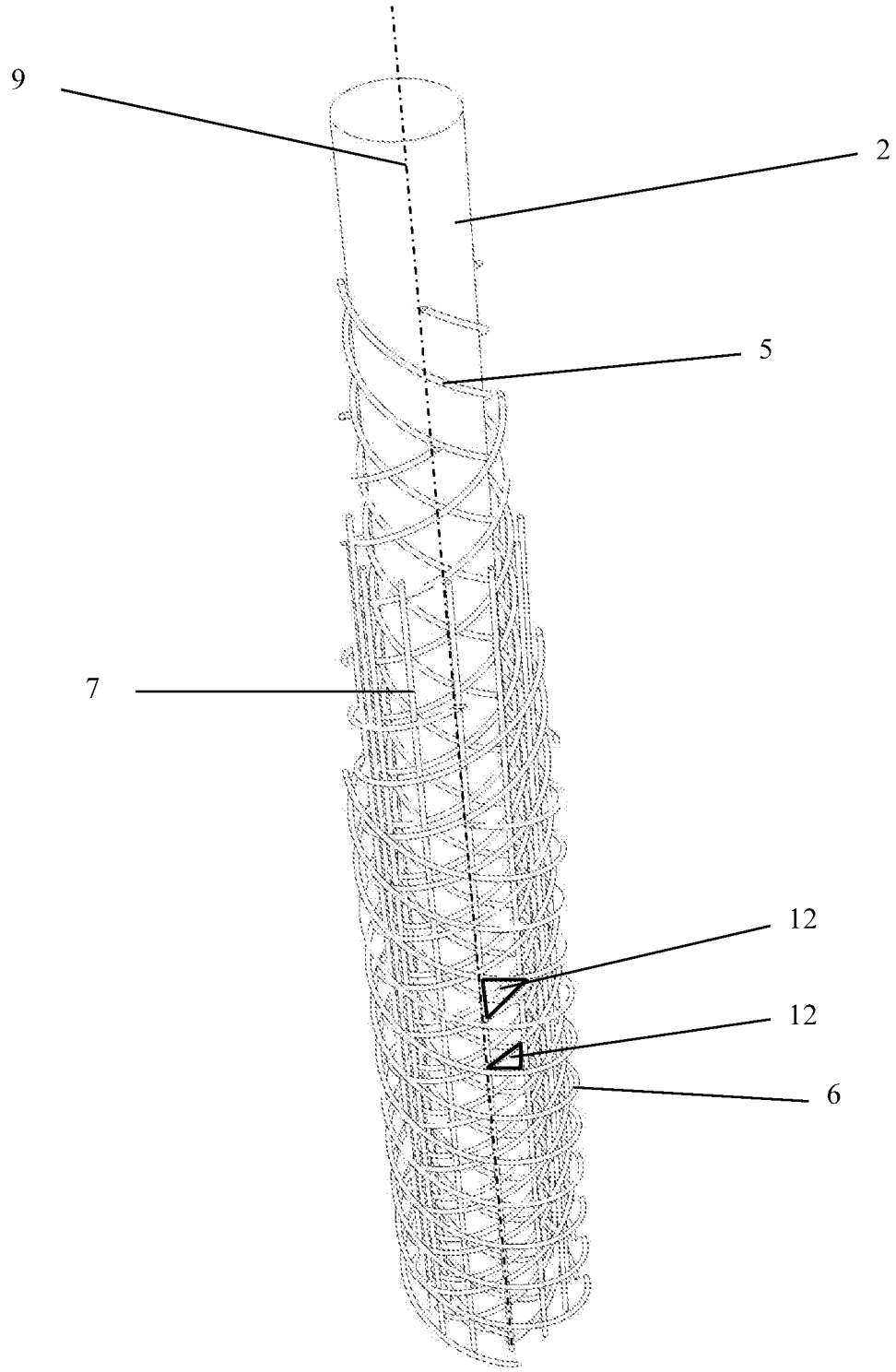
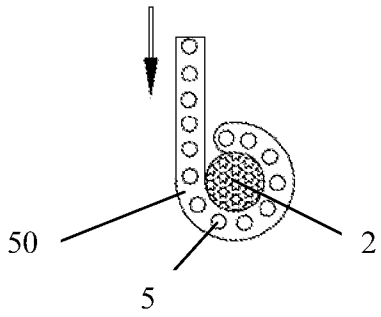


Fig. 1



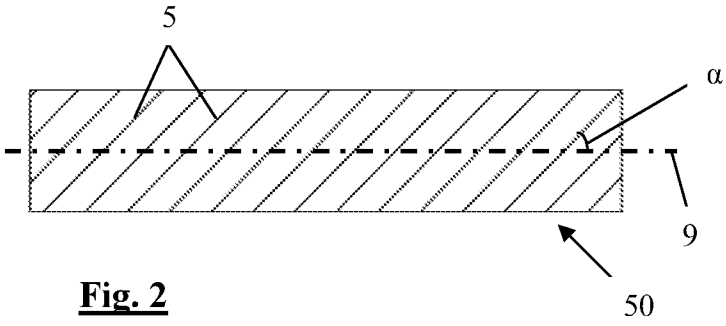
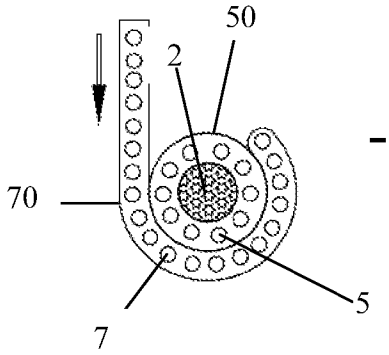


Fig. 2



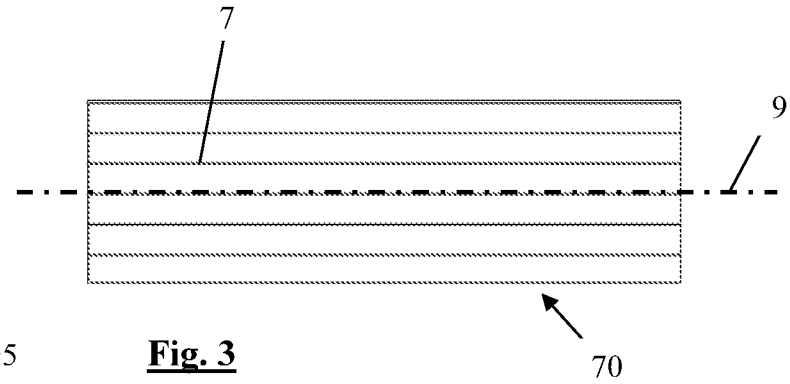
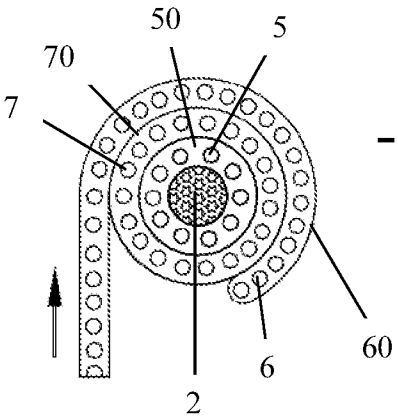


Fig. 3



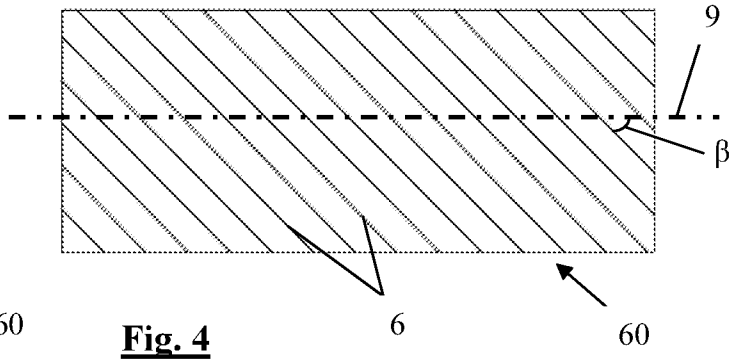
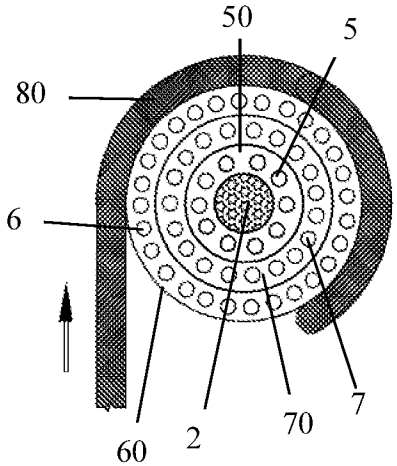


Fig. 4



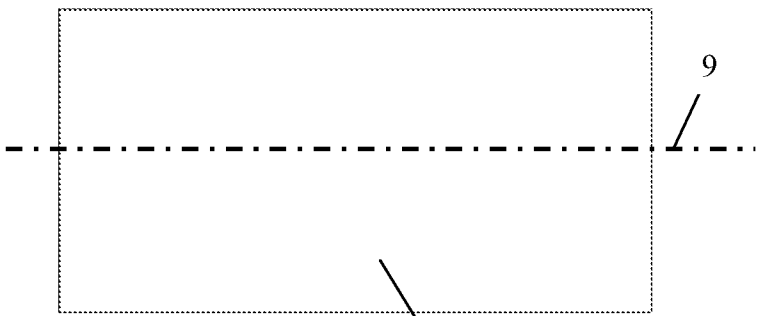
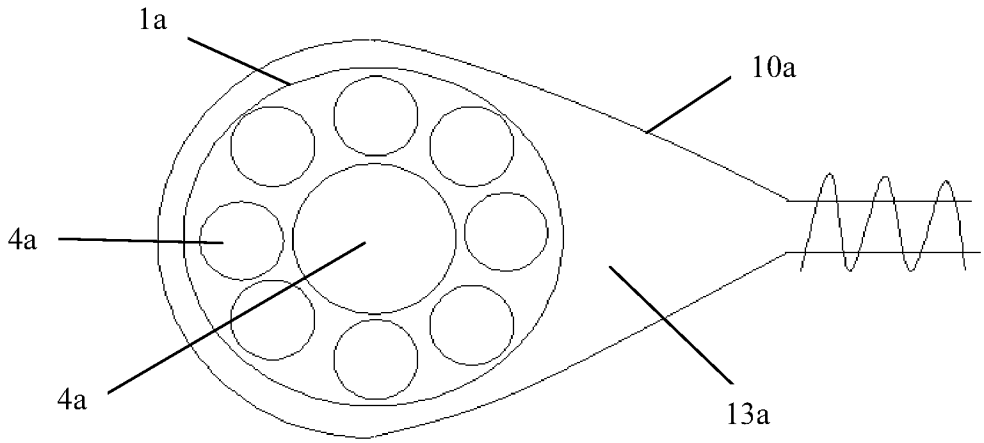


Fig. 5



Prior art

Fig. 6

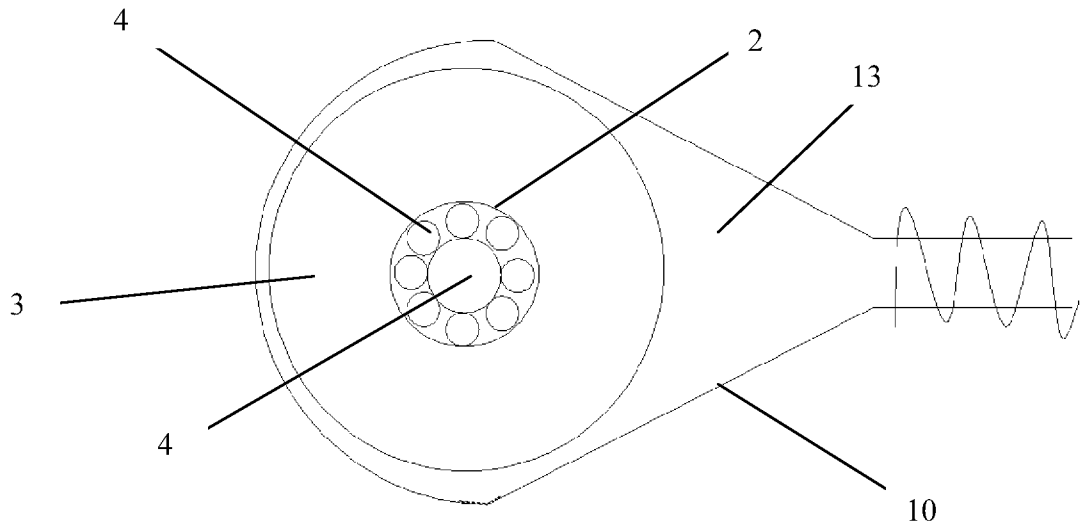


Fig. 7

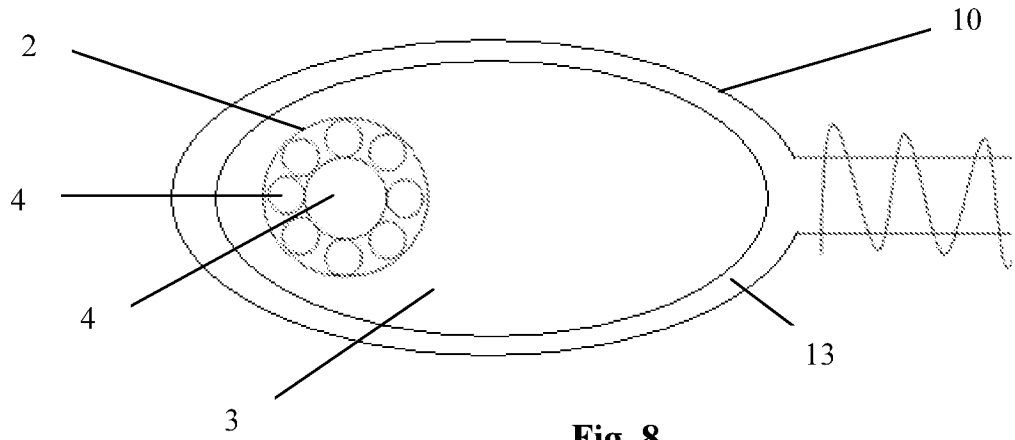


Fig. 8

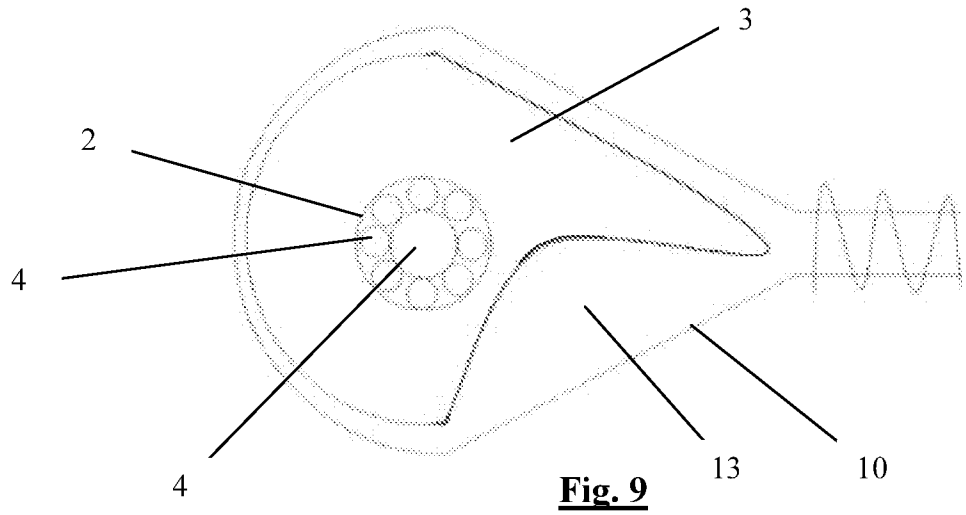


Fig. 9

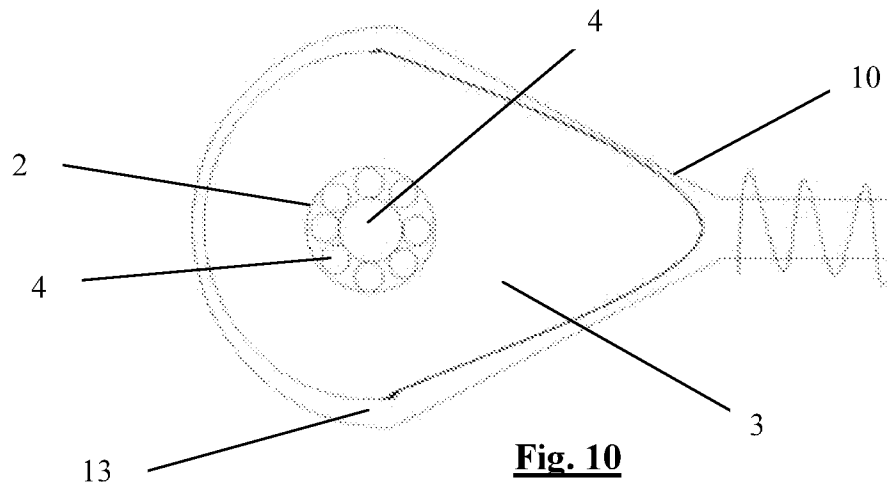


Fig. 10

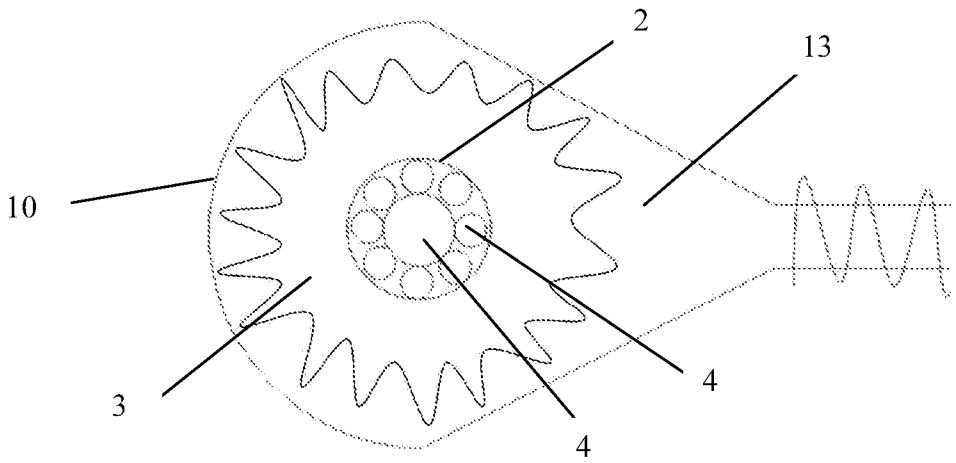


Fig. 11

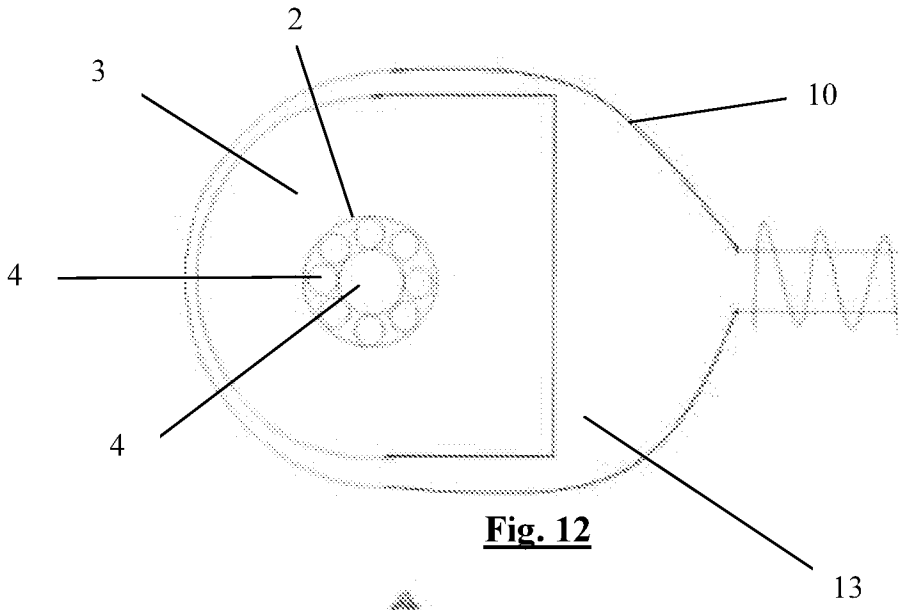


Fig. 12

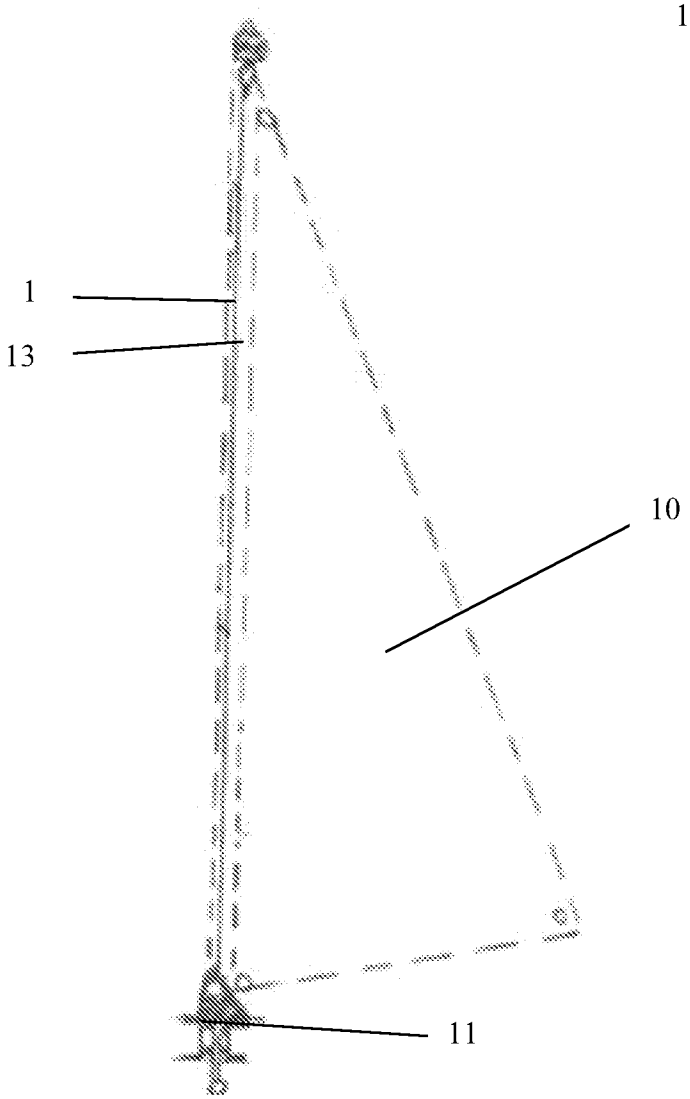


Fig. 13