The state-of-the-art ships rely on the interaction between – and synchronization of – multiple tensioners in a tower in order to control the laying process. Operations at larger sea depths require more tensioner holding power, which in turn requires larger and taller towers on the laying vessels.

The present applicant has devised and embodied this invention to overcome the shortcomings of the prior art and to obtain further advantages.

Summary of the invention

The invention is set forth and characterized in the main claims, while the dependent claims describe other characteristics of the invention.

It is thus provided an apparatus for feeding an elongate article from a floating vessel and suspending a first portion of the elongate article in a body of water below the vessel, wherein the apparatus comprises~~characterized by~~ a cylindrical body rotatably supported on the vessel and comprising driving means for controlling the rotation of the cylindrical body; the cylindrical body further comprising a spooling-on region and a spooling-off region for the elongate article, and a cylindrical contacting surface for interaction with at least a portion of the elongate article either directly or via a plurality of support elements ; the contacting surface~~being configured so as to~~ supporting the first portion during use, and first tensioner means for the elongate article to be spooled onto the cylindrical body, arranged on the vessel between the spooling-on region and a storage area for the elongate article. The apparatus further comprises a guiding apparatus arranged on the vessel proximate to at least a part of the contacting surface, arranged and configured for controlling the movement of the elongate article between the spooling-on region and the spooling-off region in a cylindrical body axial direction, wherein the guiding apparatus comprises individual guiding means for each turn of the elongate article around the contacting surface.

In one embodiment, the contacting surface extends a distance in the axial direction of the cylindrical body of a magnitude which allows multiple turns of the elongate article to be wound around the contacting surface.

In one embodiment, the apparatus further comprises second tensioner means for the elongate article to be spooled off of the cylindrical body, arranged on the vessel proximate to the spooling-off region. The second tensioner means may be movable in the cylindrical body axial direction.

The contacting surface may comprise a friction-enhancing material. In one embodiment, the axis of rotation of the cylindrical body is substantially horizontal. As mentioned above~~In one embodiment~~, a guiding apparatus is arranged on the vessel proximate to at least a part of the contacting surface, arranged and configured for controlling the movement of the elongate article between the spooling-on region and the spooling-off region in a cylindrical body axial direction.

As mentioned above, t~~T~~he guiding apparatus ~~may~~ comprise~~s~~ individual guiding means for each turn of the elongate article around the contacting surface.

direction of the cylindrical body, and brought back to the surface. Rotatable guiding means are arranged in relation to the surface and configured for pushing a portion of the belt in said axial direction when the cylindrical body is rotating; and the guiding means are arranged in the region of the take-off section.

In one embodiment, each support element comprises a v-shaped profile for supporting at least a part of the elongated article.

In one embodiment, wherein the spooling-on region and the spooling-off region are one the same side of the cylindrical body's axis of rotation.

It is also provided a vessel for laying an elongate article, comprising the apparatus as described herein, a hull and a deck, the~~and further characterized by a~~ cylindrical body being rotatably supported on the vessel and comprising driving means for controlling the rotation of the cylindrical body~~; the cylindrical body further comprising a spooling-on region and a spooling-off region for the elongate article, and a cylindrical contacting surface for interaction with at least a portion of the elongate article; the contacting surface being configured so as to support the first portion~~.

The vessel comprises in one embodiment a deck opening through which a first portion is passed, said first portion being suspended by the cylindrical body.~~ The vessel advantageously comprises the apparatus according to the invention.~~

In one embodiment, the vessel comprises an alignment-and-radius-control unit arranged proximate to a first tensioner.

The vessel advantageously comprises a storage area for a plurality of storage spools for portions of the elongate article, upstream of the spooling-on region.

It is also provided a method of laying an elongate article from a vessel, comprising the steps of:

a) arranging a section of the elongate article around a cylindrical body rotatably supported on the vessel;

b) feeding a first portion of the elongate article into a body of water below the vessel and suspending said first portion by the cylindrical body and a tensioner; and

c) rotating the cylindrical body and operate the tensioner so as to lower the elongate article into the water. The method further comprises the use of a guiding apparatus to effect a controlled movement of the portion of the elongate article which is wound onto the contacting surface, said movement being in the axial direction of the cylinder and at increments per rotation of the cylindrical body which corresponds to the transverse dimension, such as the outer diameter, of the elongate article.

In one embodiment, step a comprises the winding of the elongate article a number of turns around a cylindrical contacting surface on the cylindrical body.

In one embodiment of the method, the elongate article is spooled off of one of a plurality of storage spools on a deck area on the vessel and onto the cylindrical body, without intermediate storage.

In one embodiment, an endless belt of cradles is wound a number of turns around the cylindrical body, providing support for the elongate article. The method comprises in one embodiment a temporary removal of the belt off of the cylindrical boy at a take-off section.

As mentioned above~~In one embodiment~~, the method further comprises the use of a guiding apparatus to effect a controlled movement of the portion of the elongate article which is wound onto the contacting surface, said movement being in the axial direction of the cylinder and at increments per rotation of the cylindrical body which corresponds to the transverse dimension, such as the outer diameter, of the elongate article.

A greater flexibility is achieved with the invention, compared to the prior art, in that the pipe storage spools may be used directly; there is no need to transfer the flexible pipe onto an on-board reel or spool before deployment. The cylinder according to the invention also eliminates the need for the tall tower which is necessary in the prior art laying vessels. The single-unit cylinder arrangement is advantageous, compared to the tall tower with its plurality of tensioners of the prior art.

The cylinder and guiding apparatus according to the invention also facilitates a hoisting of elongate articles, from the water and into the laying ship, i.e. a process which is reverse of the laying procedure.

Brief description of the drawings

These and other characteristics of the invention will be clear from the following description of a preferential form of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

Figures 1 and 2 are a side view and a plan view, respectively, of an embodiment of the installation ship according to the invention;

Figures 3 and 4 are perspective views of an embodiment of the cylinder according to the invention;

Figure 5 is a front view of the embodiment of the cylinder illustrated in figures 3 and 4;

Figure 6 is a perspective view of an embodiment of the cylinder support structure and the guiding unit according to the invention;

Figure 7 is a perspective view of the guiding unit according to the invention;

Figures 8 and 9 are a perspective view and a plan view, respectively of a portion of the guiding unit illustrated in figure 7;