

1 **CABLE ASSEMBLY WITH ANCHOR**

2
3 FIELD OF THE INVENTION

4
5 [0001] The present invention relates generally to a cable assembly with an anchor, and
6 more particularly to a cable assembly where the anchor is a flemish eye.

7
8 BACKGROUND OF THE INVENTION

9
10 [0002] Cable assemblies with anchors are used for a wide variety of applications,
11 including heavy duty offshore connecting and lifting. Cable assemblies used in such
12 applications are often constructed with what is referred to as a sling with a flemish eye.
13 With a flemish eye, a loop is formed at the end of a cable by dividing strands of the
14 cable and wrapping them over each other. The ends of the cable are secured together
15 using a sleeve. In some instances an adhesive may be applied in the sleeve to secure
16 the cable ends to a main body of the cable. Such known flemish eye cable assemblies
17 have found extensive use in nautical and offshore applications.

18
19 [0003] However, in some applications, as the adhesive is cured it has been found that
20 the adhesive does not provide sufficient bonding between the sleeve and the cable.
21 This can lead to several problems, including visible cracks appearing on a surface of the
22 adhesive. It would be desirable to provide a cable assembly where this is not a concern.

1
2 [0008] Fig. 3 is a cross section view of the sleeve taken through line 3-3 in Fig. 2.

3
4 [0009] Fig. 4 is a cross section view of the sleeve taken through line 4-4 in Fig. 2.

5
6 [0010] Fig. 5 is a cross section view of the sleeve taken through line 5-5 in Fig. 2.

7
8 [0011] Fig. 6 is an exploded isometric view of the sleeve, positioning ring, rope inserts
9 and end cap.

10
11 [0012] Fig. 7 shows three alternate cross section views of the sleeve with varying bore
12 geometries.

13
14 [0013] Fig. 8 is a side view of the rope insert.

15
16 [0014] It should be understood that the appended drawings are not necessarily to scale,
17 presenting a somewhat simplified representation of various preferred features
18 illustrative of the basic principles of the invention. The specific design features of the
19 cable assembly as disclosed here, including, for example, the specific dimensions of the
20 sleeve, will be determined in part by the particular intended application and use
21 environment. Certain features of the illustrated embodiments have been enlarged or
22 distorted relative to others to help provide clear understanding. In particular, thin
23 features may be thickened, for example, for clarity of illustration. All references to
24 direction and position, unless otherwise indicated, refer to the orientation illustrated in
25 the drawings.

26
27 DETAILED DESCRIPTION OF CERTAIN PREFERRED EMBODIMENTS

1

2 [0015] It will be apparent to those skilled in the art, that is, to those who have knowledge
3 or experience in this area of technology, that many uses and design variations are
4 possible for the cable assembly disclosed here. The following detailed discussion of
5 various alternative and preferred features and embodiments will illustrate the general
6 principles of the invention with reference to a cable assembly suitable for use in heavy
7 duty offshore applications. Other embodiments suitable for other applications will be
8 apparent to those skilled in the art given the benefit of this disclosure.

9

10 [0016] Turning now to the drawings, Fig. 1 shows a side view of a preferred
11 embodiment of the cable assembly 10. The cable assembly 10 includes a cable 12
12 having a main body 14. Preferably the cable 12 comprises a core rope 17 (shown in
13 Figs. 3-5) and outer ropes 19. Each rope preferably comprises a series of strands 16.
14 The construction of the core rope 17 and the outer ropes 19 is preferably in accordance
15 with the standards specified in ISO 10425:2003 API -9A. Each of the strands 16 can
16 comprise steel or another suitable high strength material. Preferably the cable
17 assembly 10 has an anchor 25. The anchor 25 can be formed as a flemish eye 24.
18 Rope 19 of the cable is split into portions at a tail 20 and wrapped over an opposite
19 portion of the rope. The portions are recombined with the main body 14 at a cable end
20 22 at a sleeve 30. Optionally an end cap 30 may be provided which is useful as an
21 anti-fouling member during use. In a similar manner, the anchor can also comprise a
22 second anchor 125 formed as a second flemish eye 124 at a second tail 120 may be

1 closed off at a second end 122 of the cable 12 using a second sleeve 130 and an
2 optional second end cap 170.

3
4 [0017] Fig. 2 is a cross section view of an end of flemish eye 24 at the sleeve 30 of Fig.
5 1 where the strands are recombined with the main body 14. As noted above the flemish
6 eye 24 is formed by dividing strands of the cable at the tail 20, and wrapping or laying
7 the strands over each other. A first end 22 of the cable is secured around the main
8 body of the cable inside a bore 32 of the sleeve 30. Preferably the sleeve 30
9 circumferentially surrounds a portion of the main body 14 of the cable 12 and a portion
10 of the tail 20. The sleeve 30 has a first end 34 generally adjacent the 25 and a second
11 end 36 positioned more remote from the 25. The tail 20 is preferably distributed or
12 wrapped evenly around the main body 14 of the cable to ensure a uniform load
13 distribution. The sleeve 30 and adhesive 40 cooperate to lock the strands 16 of the
14 cable 12 in place. A positioning ring 60 may be provided which is preferably positioned
15 in the bore 32. The ring 60 may extend circumferentially around the cable 12. The ring
16 60 acts an alignment agent, centering the cable within the bore 32. The ring 60 also
17 allows the tail and main body 14 to set in the adhesive in a controlled manner during
18 assembly. Preferably the ring is positioned near a second end 36 of the sleeve 30. Both
19 the sleeve and the positioning ring may be made of steel or other suitable high strength
20 material.

21
22 [0018] The adhesive 40 which is used to help hold the flemish eye 24 in place is
23 preferably a composite resin or a thermosetting resin. A suitable example of an

1 acceptable resin is sold under the name Maklock. During assembly, the adhesive is
2 introduced into the sleeve after the flemish eye is formed and the sleeve is fitted around
3 the cable. The second end 36 of the sleeve is preferably sealed using plasticine or a
4 similar material to prevent leakage. As a further advantageous step, a quantity of the
5 resin, such as between 5 and 10% of the total volume, is preferably mixed and poured
6 into the sleeve after the sleeve is sealed. The adhesive is preferably allowed to harden
7 before a main pour is made to complete and strengthen the seal ensuring that there will
8 be no leakage of the main pour. Once the resin is mixed to a preferred consistency, the
9 resin should be poured immediately into the sleeve to ensure good penetration into
10 interstices (gaps) of the cable. Immediate pouring will ensure that the gelling stage
11 occurs in the sleeve and not in the mixing container. Preferably, the adhesive is
12 poured down the side of the sleeve to allow air to escape.

13
14 [0019] The cap 70 may preferably be attached to the second end 36 of the sleeve 30
15 remote from the flemish eye by in any of a number of ways, for example, welded
16 together, with the cable 12 extending through the cap bore 72. The cap may comprise
17 steel or other suitable high strength material. As shown in Fig. 2, the shape of the cap
18 70 is preferably conical. That is, the first end 74 of the cap has a cross section width 78
19 greater than a cross section width 79 of the second end 76 of the cap 70. The purpose
20 of the cap is two fold: to provide some extra support for the sleeve to restrict relative
21 movement, and to act as an anti-fouling member when in use. That is, the cap helps
22 guide external elements away from the sleeve, preventing them from catching on the
23 sleeve. This helps to ensure smooth maneuvering of the cable assembly when in use.

1
2 [0020] In accordance with a highly advantageous feature, rope inserts 50 are positioned
3 within the bore 32 of the sleeve 30. The rope inserts 50 preferably comprise a short
4 length of a cable similar to the material used for cable 12. However, the rope inserts 50
5 may use strands smaller in diameter than the strands 16 of cable 12. The rope inserts
6 are shown in Fig. 2 as positioned within the bore circumferentially around the cable 12
7 and can preferably have a stem 52 and broom 54. Most preferably, the at least one
8 rope insert extends partially out of the adhesive and even out of the bore of the sleeve.
9 That is, the broom 54 is exposed by a small amount (for example 1 to 2 mm) above the
10 adhesive as shown in Fig 2. The broom 54 can comprise part of the rope insert which is
11 separated or unwound to increase surface area for the adhesive 40 to bind to.
12 Preferably, the broom 54 is closer to the first end 34 of the sleeve 30 than the stem 52.
13 The broom can comprise part of the rope insert which is separated or unwound to
14 increase surface area for the adhesive 40 to bind to. This increased surface area is
15 highly advantageous, especially with large cable assemblies in that the adhesive has
16 more material to bind to, increasing strength of the cable assembly and helping to
17 reduce surface cracking of the adhesive. Fig. 8 shows an isolated example of a rope
18 insert 50. In accordance with a highly advantageous feature, the sleeve has a length 38
19 (shown in Figs. 2 & 6), the rope insert has a length 56 (shown in Fig. 8) which is 35% to
20 70% of the sleeve length. The ratio of lengths has been found to be a suitable
21 compromise between increased binding area for the adhesive and cost of the
22 components. Also, preferably the broom has a length 55 and the stem has a length 53
23 and the stem length is two to three times the broom length.

1
2 [0021] As noted above, the sleeve has a length 38. In accordance with another highly
3 advantageous feature, it has been determined that a preferred length of sleeve needed
4 to provided proper bond strength to secure the flemish eye is a function of the cable
5 diameter. More particularly, the length of the sleeve preferably at least 3.75 times the
6 cable diameter 13 (shown in Fig. 5.

7
8 [0022] Figs. 3-5 show cross section views of the cable in the sleeve 30, taken through
9 Fig. 2. Fig. 3 is taken through the broom 54 of the rope insert 50, Fig. 4 is taken
10 through the stem 52 of the rope insert, and Fig. 5 is taken where the rope insert is not
11 present. In Figs. 3 and 4, the rope inserts 50 are shown positioned spaced evenly and
12 circumferentially around both the main body 14 of the cable 12 and part of the tail 20, in
13 the adhesive 40. Fig. 4 also shows an option where the tail 20 is partially unwound.
14 Fig. 5 shows the main body 14 having a cable diameter 13 which is used to calculate a
15 preferred length 38 of the sleeve 30, as noted above. In the preferred embodiment
16 shown in the Figs., the cable 12 comprises a core rope 17 having the outer ropes 19
17 wrapped around the core. Various numbers of outer ropes may be used, depending
18 upon the intended application.

19
20 [0023] Fig. 6 shows isometric views of the sleeve 30, positioning ring 60 and cap 70
21 (and rope inserts 50). In accordance with a preferred embodiment, the sleeve has a
22 pair of flats 39 positioned opposite one another such that the bore 32 has a non-circular
23 cross section. The non-circular bore advantageously helps to resist relative movement

1 of the cable with respect to the sleeve. Also, the flats provide a convenient place for
2 part identification and other markings.

3
4 [0024] Fig. 7 shows three different preferred cross section widths of the bore 32 of the
5 sleeve 30, depending upon intended use or design preference. The bore may have a
6 uniform cross section width 33 from the first end 34 to the second end 36, a cross
7 section width 35 which narrows from the first end 34 to the second end 36, or a cross
8 section width 37 which widens from the first end 34 to the second end 36.

9
10 [0025] From the foregoing disclosure and detailed description of certain preferred
11 embodiments, it will be apparent that various modifications, additions and other
12 alternative embodiments are possible. The embodiments discussed were chosen and
13 described to provide the best illustration of the principles of the invention and its
14 practical application to thereby enable one of ordinary skill in the art to use the invention
15 in various embodiments and with various modifications as are suited to the particular
16 use contemplated. All such modifications and variations are within the scope of the
17 invention as determined by the appended claims when interpreted in accordance with
18 the breadth to which they are fairly, legally, and equitably entitled.

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

1
2 5. The cable assembly of any claims 1 to 4 further comprising a positioning ring
3 positioned in the bore and extending circumferentially around the cable.
4

5 6. The cable assembly of any of claims 1-5 further comprising a cap having a cap
6 bore with the cable extending through the cap bore, a first end positioned generally
7 adjacent the second end of the sleeve and a second end, wherein the first end of the
8 cap has a cross section width greater than a cross section width of the second end of
9 the cap.
10

11 7. The cable assembly of any of claims 1-6 wherein the at least one rope insert
12 comprises a stem and a broom, wherein the broom is closer to the first end of the
13 sleeve than the stem.
14

15 8. The cable assembly of claim 7 wherein the sleeve has a length and the at least
16 one rope insert has a length which is 35% to 70% the sleeve length.
17

18 9. The cable assembly of claim 7 wherein the broom has a broom length and the
19 stem has a stem length which is two to three times the broom length.
20

21 10. The cable assembly of claim 1 wherein the at least one rope insert comprises a
22 plurality of rope inserts positioned circumferentially around the cable.
23

1 11. The cable assembly of claim 1 wherein the adhesive comprises one of a
2 composite resin and a thermosetting resin.

3
4 12. The cable assembly of any of claims 1-11 wherein the bore has one of:
5 a uniform cross section width from the first end to the second end;
6 a cross section width which narrows from the first end to the second end; and
7 a cross section width which widens from the first end to the second.

8
9 13. The cable assembly of any of claims 1-12 wherein the main body of the cable
10 has a diameter, and the sleeve has a length which is at least 3.75 times the diameter of
11 the cable.

12
13 14. The cable assembly of claim 1 wherein the sleeve has a pair of flats positioned
14 opposite one another such that the bore has a non-circular cross section.

15
16 15. The cable assembly of claim 2 wherein
17 the cable further comprises a second tail and a second cable end opposite the
18 first cable end wherein strands of the cable at the second tail are divided and laid over
19 one another to form a second flemish eye and the anchor further comprises the second
20 flemish eye;
21 a second sleeve having a second bore, a first end and a second end, wherein the
22 first end of the second sleeve is positioned generally adjacent the second flemish eye,

1 and the second end of the second sleeve is positioned remote from the second flemish
2 eye, and the second cable end is positioned in the bore;
3 cured adhesive positioned in the bore, binding the second sleeve to the cable;
4 at least one rope insert, wherein the cured adhesive holds the at least one rope
5 insert in a fixed position with respect to the second sleeve; and
6 a second cap having a cap bore with the main body of the cable extending
7 through the cap bore, a first end positioned generally adjacent the second end of the
8 sleeve and a second end.