

1 "Apparatus and Method for Use in Handling a Load"

2

3 This invention relates to apparatus for use in
4 handling a load which is capable of raising and
5 lowering, or of towing, a load and also handling
6 service cables and/or hoses connected to the load.
7 The invention is particularly, but not exclusively,
8 applicable to the handling of subsea equipment such
9 as grabs.

10

11 Hitherto, providing services to underwater equipment
12 has required the provision of a specific bundle of
13 cable(s) and/or hose(s) dedicated to each
14 application. For some applications, it is known to
15 incorporate the service bundle within an armoured
16 hoist rope. This approach has a number of
17 deficiencies. The resulting rope is costly, gives
18 inferior hoisting properties, and by virtue of
19 limitations on the diameter of rope which can be
20 handled the services that can be incorporated are
21 limited. Further, in practice it is impossible with

1 this arrangement to add to the length of the rope or
2 to join different types of materials, for example
3 wire ropes with fibre ropes.

4
5 In accordance with an aspect of the present
6 invention, apparatus for use in handling a load
7 comprises a load-bearing rope, a mechanism for paying
8 out and recovering the rope, a mechanism for holding
9 a and paying out a service cable, and a wrapping
10 device for rotating said rope around the service
11 cable as the cable is payed out to wrap the rope
12 around the service cable, and to unwrap one from the
13 other as either of them is recovered

14
15 In accordance with another aspect of the present
16 invention, a method of handling a load comprises
17 paying out a service cable and wrapping a load-
18 bearing rope around the service cable as it is payed
19 out, and subsequently unwrapping one from the other
20 as either of them is recovered.

21
22 Winding the load-bearing rope around the cable as it
23 is paid off from a static cable winch allows use of
24 large diameter cables. When the wound cable and rope
25 leave the device, the higher tension on the rope
26 pulls that into an axial configuration with the
27 service cable helically coiled around it, ensuring
28 that the load is then borne by the rope and not the
29 cable.

30

1 The term "service cable" is used herein to denote a
2 flexible elongate member used for conveying power or
3 data, such as an electrical cable, a fibre optic
4 cable, or a pneumatic or hydraulic hose.

5
6 Preferably, the rope is wrapped helically around the
7 service cable as it is being paid out. The rope and
8 the service cable are preferably both tensioned when
9 being paid out, and the tension typically applied to
10 the load-bearing rope is typically higher than the
11 tension applied to the service cable.

12
13 As the rope and service cable leave the apparatus the
14 higher load on the rope wrapped around the service
15 cable straightens the service cable and wraps the
16 service cable helically around the rope. This allows
17 larger diameter service cables to be used with any
18 type of load-bearing rope without modifications to
19 the winding apparatus used for winding the rope
20 around the axial service cable. Therefore, the
21 service cable can be paid out from a large drum on a
22 static main winch of the device rather than needing
23 to be mounted on a drum of fixed size which is
24 arranged to rotate around an axis, thereby reducing
25 the limitations on the diameter and length of the
26 service cable to be paid out. Also, the service
27 cable on the main winch can be connected to the
28 services as it is being paid out, thereby allowing
29 services to be provided as the load is lowered or
30 raised, e.g. electricity can be supplied to an ROV
31 without disconnection of supply in order to change

1 reels of service cable. In contrast the rope can be
2 dispensed from the service cable and joined to
3 additional lengths of rope as required, again without
4 disrupting the provision of services to the load.

5
6 The drum for paying out the rope is typically
7 arranged such that the rope leaves the drum at or
8 close to the axis of the cable so that the rope does
9 not exert sideways force on the cable. Rollers or
10 other such devices can be used to deflect the cable
11 momentarily from the axis to allow the rope to be
12 paid out along or close to the axis.

13
14 Typically, the load-bearing rope will be a hoist rope
15 used for raising and lowering a load. Alternatively,
16 the load-bearing rope may be a towing rope used for
17 paying out, towing and recovering a load such as a
18 marine sensor array.

19
20 The apparatus may include a plurality of service
21 cables each extending from a respective drum.

22
23 The rope is preferably paid out from a drum arranged
24 to rotate around the axis of the service cable.

25
26 Preferably, the mechanism for paying out and
27 recovering the service cable comprises a cable winch,
28 from which the cable passes over a cable sheave and
29 thereafter may extend to the load along a
30 substantially straight axis.

31

1 The wrapping device may comprise the rope drum being
2 arranged for rotation about a drum axis which
3 coincides with the axis of the service cable, the
4 drum typically having a central aperture through
5 which the service cable passes, the rope preferably
6 passing over a rope sheave which is mounted for
7 movement in a circular path around said axis.

8
9 Alternatively, the rope drum may be rotatable on a
10 structural member that is arranged for movement in a
11 circular path about said axis.

12
13 Alternatively the rope drum may be static and a
14 winding device can rotate around it to pay out the
15 rope.

16
17 The service cable winch, the rope drum, and the
18 wrapping device may conveniently each have a
19 respective driving motor; they could however be
20 driven by a single source through appropriate
21 mechanical linkages.

22
23 Certain embodiments are likely to be useful when a
24 large diameter or heavy signal/power is used and it
25 is more convenient to store the cable on a large
26 winch cable bin, or flaked out in lengths and
27 subsequently joined. Smaller load bearing ropes can
28 be stored on the mechanism, and can also be used for
29 hoses and telecommunications cables.

30

1 The hoist rope winch is rotated around the central
2 signal/power cable in order to twist the cable and
3 the rope together as they are paid out and rotated in
4 the opposite direction to untwist them as the load is
5 hoisted. Because the weight is on the hoist rope the
6 result will have the appearance of the signal/power
7 cable being wound around the hoist rope.

8
9 The hoist rope winch drum may be placed near the
10 centre in order that the rope is paid out close to
11 the centre line and double tapered rollers may be
12 used to deflect the signal/power cable to one side in
13 order to assist in maintaining the hoist rope near
14 the centre.

15
16 In other embodiments the hoist rope winch is turned
17 in combination with a rotating arm which may support
18 spooling gear. This arm rotates around the central
19 signal/power cable in order to twist the two cables
20 together as they are paid out and rotated in the
21 opposite direction to untwist the cables as they are
22 hoisted.

23
24 The rotating arm may have guide sheaves to position
25 the hoist rope near the centre and attached to these
26 may be double tapered rollers to deflect the
27 signal/power cable to one side in order to assist in
28 maintaining the hoist rope in the centre.

29
30 One or more additional ropes can be provided, each
31 with a respective rope drum and sheave arranged to

1 rotate around the axis of the service cable if
2 desired. Alternatively, other service cables can be
3 wound around the main service cable in a similar
4 manner to the hoist rope sheave.

5
6 Examples of apparatus and a method for use in
7 handling a load in accordance with the invention will
8 now be described with reference to the drawings, in
9 which:-

10

11 Fig. 1 is a schematic perspective view
12 illustrating the principle of operation of a
13 first example of the invention;

14 Fig. 2 is a more detailed side view, partly in
15 section, of an apparatus used in the example of
16 Fig. 1;

17 Fig. 3 is a view similar to Fig. 1 illustrating
18 a modification of the arrangement of Fig. 1;

19 Fig. 4 is a schematic perspective view
20 illustrating a second example of the invention;

21 Fig. 5 is a side view of an apparatus used in
22 the example of Fig. 4;

23 Fig. 6 is a schematic perspective view
24 illustrating a third example similar to that of
25 Fig. 1 but modified for towing rather than
26 lifting;

27 Fig. 7 illustrates a fourth example similar to
28 that of Fig. 4 but modified for towing rather
29 than lifting; and

30 Figs 8 and 9 show further embodiments.

31

1 Referring to Fig. 1, an electrical power or cable 1
2 extends from a cable winch 13 over a cable sheave 4
3 to supply power to e.g. an ROV etc (not shown). A
4 hoist rope 2 is reeled on a rope drum 3 and extends
5 to the load via a rope sheave 5. The hoist rope 1
6 may be any suitable form of hoist rope such as
7 flexible steel wire rope or synthetic fibre rope, for
8 example of "Kevlar".

9
10 The service cable 1 passes through a central aperture
11 of the hoist rope drum 3, and the rope sheave 5 is
12 arranged to be driven circumferentially around the
13 axis of the service cable 1. By co-ordinating the
14 movements of the cable winch 13, the rope drum 3 and
15 the rope sheave 5, the hoist rope 2 can be wrapped
16 helically around the cable 1 to lower the load, and
17 unwrapped as the load is raised. In this way, a
18 hoist rope of any desired properties can be used in
19 combination with any required service connection.

20
21 Fig. 2 shows the rope drum 3 and associated parts in
22 greater detail. The cable sheave 4 is journaled to
23 a fixed frame 20 that is secured to any suitable
24 supporting structure (not shown). The rope drum 3 is
25 rotatably mounted on the lower part of the frame 20
26 and driven in rotation by a motor 6.

27
28 The inner end of the rope 2 can be connected to any
29 appropriate service if needed by any convenient means
30 (not shown) but is otherwise connected to the winch
31 drum 3.

1 The rope sheave 5 is journaled on a mounting frame 9
2 that is rotatable about the fixed frame 20 by means
3 of a motor 7.

4
5 The motors 6 and 7 are driven at speeds related to
6 the axial speed of payout of the cable 1. The speed
7 correlation may be fixed. Preferably, however, this
8 correlation will be controllable to alter both the
9 length of twist (pitch) of the lay of the rope 2 on
10 the cable 1, and the tension in each.

11
12 Fig. 3 shows a modification in which a second service
13 cable 17 is wrapped on the first cable 1 along with
14 the hoist rope 2. In this modification, the service
15 cable 17 is provided with a cable storage drum 16 and
16 a cable sheave 14 which may suitably be carried on a
17 common supporting frame for rotation in unison with
18 the hoist rope sheave 5 around the rope drum 15.

19
20 The apparatus may be further modified by adding
21 further drums and sheaves to handle more services or
22 hoist ropes.

23
24 Fig. 4 illustrates a second example in which the rope
25 2 is reeled on a drum 3 and the drum 3 is itself
26 rotated about the service cable 1 to achieve a
27 helical wrap and unwrap. As shown in more detail in
28 Fig. 5, the rope drum 3 may be constituted by a drum
29 12 removably mounted on a hub motor 11 which is
30 carried on the end of an arm 18 rotatably mounted on
31 the fixed frame 20 and driven by a motor 10.

1 As with the first example, the example shown in Figs.
2 4 and 5 could be modified by adding further service
3 cable drums to be rotated by the motor 10.

4
5 Fig. 6 illustrates the example of Fig. 1 modified for
6 use in a marine towing application, for example in
7 paying out, towing and recovering a sensor array such
8 as a sonar sensor or seismographic surveying sensor,
9 the sensor array being towed underwater or on the
10 surface. The rope drum 3 is hinged to the main
11 structure of the towing vessel (not shown) and can be
12 tilted to a desired towing angle by hydraulic or
13 other mechanisms. Likewise, Fig. 7 illustrates the
14 modification of the example of Fig. 4 for the same
15 use, the frame carrying the mounting arm for the rope
16 drum 3 being hinged to the vessel and tilted to the
17 desired angle by hydraulic or other mechanisms.

18
19 The invention may be applied to a system in which one
20 or more service cables is applied to a load-bearing
21 rope which itself carries a service channel in
22 addition to fulfilling its load-bearing function.
23 For example, the load-bearing rope could be a steel
24 wire rope carrying electrical signals, or a rope
25 comprising "Kevlar" load-bearing strands in
26 combination with optical fibre cable.

27
28 Fig.8 shows another embodiment having a signal/power
29 cable 1 passing over a cable sheave 4 on an axial
30 path to a load (not shown). The rope 2 is held on a
31 rope drum 12a that is mounted in a hub motor 11a and

1 carried on an arm 18a rotatably mounted on a frame
2 20a and driven by a motor 10a. The rope 2 spools
3 over the top of the drum 12a so that it is paid out
4 close to the axis of the cable 1.

5
6 The arm 18a has a pair of double tapered rollers 25,
7 which deflect the path of the cable 1 from its axis
8 to make way for the rope 2 to extend axially
9 downwards to the load. The greater tension is
10 applied to the rope 2 and although before convergence
11 of the cable 1 and the rope 2 the rope 2 is wrapped
12 around the cable 1, after the rope leaves the drum
13 12a the high load pulls it axially straight down and
14 this forces the cable 1 into a helical wrap around
15 the outer surface of the rope 2.

16
17 In the Fig 9 embodiment the rope 2 is held on a drum
18 12b having an axial aperture through which the cable
19 1 extends from the cable sheave 4. The rope drum 12b
20 is held stationary and a winch in the form of a
21 rotating arm 18b spools off the rope 1 in one
22 direction from the drum 12b. The arm 18b has
23 spooling rollers, pulleys or guide sheaves 26 which
24 guide the path of the rope 2 around the lip of the
25 drum 12b and over the axis of its rotation above the
26 load. The rope 2 is thereby twisted around the cable
27 1 as it is paid out and the arm 18b rotates in the
28 opposite direction to wind it back in. The apparatus
29 may have double tapered rollers 25 to deflect the
30 path of the cable 1 as previously described. In

- 1 various modifications the drum 12b may wind in or
- 2 out.
- 3
- 4 Other modifications may be made within the scope of
- 5 the invention.

1 Claims

2

3 1. A method of handling a load comprising paying
4 out a service cable and wrapping a load-bearing
5 rope around the service cable as it is paid
6 out, and subsequently unwrapping one from the
7 other as either of them is recovered.

8

9 2. A method as claimed in claim 1, wherein the
10 service cable comprises an electrical cable, a
11 fibre optic cable, a pneumatic hose or a
12 hydraulic hose.

13

14 3. A method as claimed in claim 1 or claim 2,
15 wherein the rope is helically wrapped around the
16 axis of the service cable as it is being paid
17 out.

18

19 4. A method as claimed in any preceding claim,
20 wherein the rope and the service cable are each
21 tensioned when being paid out.

22

23 5. A method as claimed in any preceding claim,
24 wherein the tension applied to the load-bearing
25 rope is higher than the tension applied to the
26 service cable.

27

28 6. A method as claimed in any preceding claim,
29 wherein the service cable is paid out from a
30 static winch.

31



* C L H S *

- 1 7. A method as claimed in any preceding claim,
2 wherein the drum for paying out the rope is
3 arranged such that the rope leaves the drum at
4 or close to the axis of the cable.
5
- 6 8. A method as claimed in any preceding claim,
7 wherein the service cable is deflected from its
8 axis to allow the rope to be paid out along or
9 close to the axis.
10
- 11 9. A method as claimed in any preceding claim,
12 wherein the load-bearing rope is a hoist rope
13 used for raising and lowering a load.
14
- 15 10. A method as claimed in any one of claims 1-8,
16 wherein the load-bearing rope is a towing rope
17 used for paying out, towing and recovering a
18 load.
19
- 20 11. A method as claimed in any preceding claim,
21 wherein more than one service cable is provided.
22
- 23 12. A method as claimed in any preceding claim,
24 wherein the rope is paid out from a member that
25 can move in a circular path about the service
26 cable.
27
- 28 13. A method as claimed in any one of claims 1-12,
29 wherein the rope is paid out from a winding
30 device rotating around a static rope drum.
31



- 1 14. A method as claimed in any one of claims 1-12,
2 wherein the rope is paid out from a drum capable
3 of rotating around the axis of the service
4 cable.
5
- 6 15. A method as claimed in any preceding claim,
7 wherein the mechanism for paying out and
8 recovering the service cable comprises a cable
9 winch, from which the cable passes over a cable
10 sheave and thereafter extends to the load along
11 a substantially straight axis.
12
- 13 16. Apparatus for use in handling a load comprising
14 a load-bearing rope, a mechanism for paying out
15 and recovering the rope, a mechanism for holding
16 and paying out a service cable, and a wrapping
17 device for rotating said rope around the service
18 cable as the cable is payed out to wrap the rope
19 around the service cable, and to unwrap one from
20 the other as either of them is recovered.
21
- 22 17. Apparatus as claimed in claim 16, wherein the
23 mechanism for paying out and recovering the rope
24 comprises a rope drum.
25
- 26 18. Apparatus as claimed in claim 16 or claim 17,
27 wherein the rope drum is arranged for movement
28 in a circular path about the axis of the service
29 cable.
30



- 1 19. Apparatus as claimed in claim 16 or claim 17,
2 wherein the rope drum is static and a winding
3 device rotates around it to pay out the rope.
4
- 5 20. Apparatus as claimed in claim 16, 17 or 18,
6 wherein the rope drum can rotate about its axis.
7
- 8 21. Apparatus as claimed in claim 16, wherein the
9 rope drum has an axis which coincides with the
10 axis of the service cable, the drum typically
11 having a central aperture through which the
12 service cable passes, the rope passing over a
13 rope sheave which is mounted for movement in a
14 circular path around the axis of the service
15 cable.
16
- 17 22. Apparatus as claimed in any one of claims 16-21,
18 wherein the service cable winch, the rope drum,
19 and the wrapping device each have a respective
20 driving motor.
21
- 22 23. Apparatus as claimed in any one of claims 16-22,
23 wherein the rope is paid out close to the axis
24 of the service cable.
25
- 26 24. Apparatus as claimed in any one of claims 16-23,
27 wherein the service cable is deflected from its
28 axis by rollers.
29



- 1 25. Apparatus as claimed in any one of claims 16-24,
2 wherein the load-bearing rope is paid out by a
3 rotating arm.
4
- 5 26. Apparatus as claimed in claim 25, having
6 spooling gear on the arm.
7
- 8 27. Apparatus as claimed in claim 25 or 26 wherein
9 the arm rotates around the service cable.
10
- 11 28. Apparatus as claimed in claim 25, 26 or 27,
12 wherein the rotating arm has a guide sheave to
13 position the hoist rope near the axis of the
14 service cable.
15
- 16 29. Apparatus as claimed in any one of claims 16-28,
17 wherein the service cable comprises an
18 electrical cable, a fibre optic cable, a
19 pneumatic cable or a hydraulic hose.
20
- 21 30. Apparatus as claimed in any one of claims 16-29,
22 wherein the load-bearing rope is a hoist rope
23 used for raising and lowering a load.
24
- 25 31. Apparatus as claimed in any one of claims 16-29,
26 wherein the load-bearing rope is a towing rope
27 used for paying out, towing and recovering a
28 load.
29
- 30 32. Apparatus as claimed in any preceding claim,
31 wherein more than one service cable is provided.

