

"Connector Assembly"

Field of the Invention

This present invention generally relates to a connector assembly for connecting one member to another

5 Background Art

When exploring or mining a reservoir below the seabed, machinery and componentry is required to be secured to the seabed to provide secure attachment to a well in order to drill and mine the reservoir. When the well is to be decommissioned, the equipment secured to the seabed must be removed such
10 that there is no equipment left upon or protruding above the seabed.

When establishing the well, casings are inserted into the well and cement poured into the void between the wall of the well and the casings to secure them in place. When decommissioning, a method employed to remove the casings above the seabed is to cut the casings using a milling tool. This cut is made at a level below
15 the seabed, allowing the casings above the cut to be removed from the well, such that no part of the remaining casing extends beyond the surface of the seabed. This process takes approximately eight hours to complete, representing a substantial cost.

The preceding discussion of the background to the invention is intended only to
20 facilitate an understanding of the present invention. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was part of the common general knowledge in Australia as at the priority date of the application.

It is an object of this invention to provide a connector assembly which will allow
25 the separation of two interconnected members with out the need for cutting either members.

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Disclosure of the Invention

The present invention provides a connector assembly comprising

a first hollow member having a first end adapted to releasably retain a second end of a second hollow member therein

5 a jacket secured around a first outer portion, adjacent the first end of the first hollow member, and a second outer portion, adjacent the second end of the second hollow member, whereby in use the jacket bears against or is adjacent to a wall of a bore of a well

10 a cavity between the jacket and the outer portions of the hollow members, the cavity being filled with a fluid and is in fluid communication with a vent

whereby during disconnection of the first hollow member from the second hollow member fluid is discharged from the cavity through the vent allowing the jacket to move inwardly away from the bore wall to assist removal of the first hollow member from the bore as it detaches from the second hollow member.

15 Preferably the first hollow member has a plurality of bores extending through its wall, such that when the first hollow member is connected to the second hollow member each bore is in fluid communication with an interface of the two members.

Each bore may be in fluid communication with a reservoir of fluid. When
20 detaching the first hollow member from the second hollow member, a pressurised fluid is pumped to the interface, causing the walls of the second hollow member to deflect inwardly, and the walls of the first hollow member to deflect outwardly. Whilst typically these deflections are small, they are sufficient to allow detachment of the first hollow member from the second hollow member when a suitable force
25 is applied to the first hollow member.

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The present invention further provides a connector assembly for connecting a first hollow member and a second hollow member, in operation the second hollow member and a portion of the first hollow member are located within a bore such as a well, the connector assembly characterised in that it has means to assist the
5 removal of the first hollow member from the bore, the connector assembly comprising

10 a first jacket having an outer surface which bears against or is adjacent to the inner surface of the bore of the well when in position; the first jacket spans between the first hollow member and second hollow member enclosing a cavity wall, defined by outer surfaces of the first hollow member and second hollow member, to provide a sealed cavity,

the sealed cavity is in fluid communication with a vent, and is filled with a fluid when assembled,

15 wherein during detachment of the first hollow member from the second hollow member the fluid is vented from the sealed cavity, permitting the first jacket to deflect inwardly away from the bore wall, reducing the outer diameter of the first jacket to permit easy removal of the first hollow member once detached from the second hollow member.

20 Preferably the venting of the fluid from the cavity also permits the end of the first hollow member to be moved outwardly away from the second hollow member to assist detachment of the first hollow member therefrom.

The fluid in the cavity ensures the first jacket does not deflect inwardly when the connector assembly is located in the well.

The first hollow member may be in the form of a first casing, cylindrical in shape.

25 The second hollow member may be in the form of a second casing, cylindrical in shape.

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The first casing may have one end adapted to releasably engage an end of the second casing.

Preferably the one end of the first casing provides a box.

- 5 Preferably the end of the second casing provides a pin which is adapted to be releasably secured in the box of the first casing such that when operably engaged the first casing is releasably secured to the second casing.

Preferably the pin and box connection is the type known as a Merlin connector.

A first annular shoulder may protrude from the first casing adjacent the box.

A second annular shoulder may protrude from the second casing adjacent the pin.

- 10 Preferably the first jacket is secured around the first casing and second casing, extending between the first annular shoulder and the second annular shoulder.

Preferably the cavity wall spans between the first annular shoulder and the second annular shoulder.

- 15 Preferably the second annular shoulder has a tapered leading edge, to assist the positioning of the connector assembly in the well.

Preferably the second annular shoulder also incorporates a projection projecting outwardly such that the projection protects the first jacket during insertion of the connector assembly into the well. The projection may be equal to or greater than the thickness of the first jacket.

- 20 The sealed cavity may be defined by the first annular shoulder, the second annular shoulder, the first jacket and the cavity wall.

Preferably the first jacket has an outer surface tapered inwardly from the first casing to the second casing.

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Preferably the first jacket is constructed from a material which does not adhere to concrete, such as polyurethane.

Preferably the first jacket breaks into two portions when the first casing is detached and removed from the second casing.

- 5 Preferably the box of the first casing has a plurality of bores extending through its wall, such that when the first casing is connected to the second casing each bore is in fluid communication with an interface between the box and the pin.

Each bore may be in fluid communication with a reservoir of fluid. When detaching the first casing from the second casing, a pressurised fluid is pumped to
10 the interface between the box and pin, causing the walls of the pin to deflect inwardly, and the walls of the box to deflect outwardly. Whilst typically these deflections are small, they are sufficient to allow detachment of the first casing from the second casing when a suitable force is applied to the first casing.

Preferably each bore in the box is connected to the reservoir by a conduit passing
15 through the sealed cavity.

Preferably a second jacket encases part of the first casing. Preferably the second jacket is constructed from a material which does not adhere to concrete, such as polyurethane.

The second jacket may extend from the first annular shoulder away from the box.
20 Preferably the second jacket tapers outwardly away from the first annular shoulder.

Preferably the first jacket and second jacket provide a substantially continuous outer surface when the first casing is connected to the second casing.

The present invention still further provides a connector assembly comprising:

- 25 a first casing having an end adapted to releasably retain an end of a second casing, a sheath which, when the first casing retains the second

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casing, surrounds an outer region of the first casing and second casing adjacent each end;

a sealed cavity between the sheath and the outer region, which is in fluid communication with a vent;

- 5 whereby upon assembly the cavity is filled with a fluid to prevent inward deflection of the sheath.

Preferably when the cavity is filled with fluid the end of the first casing is prevented from outward movement.

Brief Description of the Drawings

- 10 The invention will be better understood by reference to the following description of a specific embodiment thereof as shown in the accompanying drawings in which:

Figure 1 is a cross sectional view of a connector assembly between a first casing and a second casing;

- 15 Figure 2 is an exploded cross sectional view of the connecting region between a first casing and a second casing;

Figure 3 is a cross sectional view of an upper portion of the first casing;

Figure 4 is a schematic of the fluid flow system relating to the connector assembly.

Best Mode(s) for Carrying Out the Invention

- 20 Referring to the drawings, the connector assembly 11 according to an embodiment of the invention has a first hollow member in the form of a first casing 13, and a second hollow member in the form of a second casing 15. When assembled the second casing 15 has a second end 21 releasably retained within a first end 17 of the first casing 13. Both casings being cylindrical in shape.

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The first end 17 of the first casing 13 provides a box 19.

The second end 21 of the second casing 15 provides a pin 23.

The box 19 is adapted to releasably retain the pin 23 therein such that when operably engaged, the first casing 13 and second casing 15 are coupled together.

- 5 Adjacent the box 19 a first annular shoulder 25 extends outwardly from the first casing 13.

Adjacent the pin 23 a second annular shoulder 27 extends outwardly from the second casing 15. The second annular shoulder 27 has a tapered leading edge 29 to assist in positioning the connector assembly in a bore of a well (not shown).

- 10 The second annular shoulder 27 also has a projection 31, the purpose of which is explained below.

- When the first casing 13 is connected to the second casing 15 a first jacket 33 extends around the box 19 and pin 23 assembly between the first annular shoulder 25 and second annular shoulder 27. As shown in figure 2, the first jacket 15 33 is flush with projection 31 such that when the connector assembly 11 is positioned in the bore of the well the first jacket 33 is protected by the projection 31.

- The connector assembly 11 also comprises a sealed cavity 35 defined by the first jacket 33, the first annular shoulder 25, the second annular shoulder 27 and an 20 outer surface 37a, 37b of the first casing 13 and second casing 15. The outer surface 37a, 37b extends either side of an interface 39 between the first casing 13 and second casing 15.

- The sealed cavity 35 is in fluid communication with a vent 41 as shown in figure 1. When assembled the sealed cavity 35 is filled with a fluid. This prevents the first 25 jacket 33 deflecting inwardly, and assists in maintaining the integrity of the connection between the first casing 13 and second casing 15 by ensuring the wall 43 of the box 19 does not deflect outwardly.

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The first jacket 33 has an outer surface which tapers inwardly from the first annular shoulder 25 to the second annular shoulder 27.

The first casing 13 also comprises a second jacket 45 extending from the first annular shoulder 25 away from the box 19. The outer surface of the second
5 jacket 45 tapers outwardly away from the box 19.

When assembled the first jacket 33 and second jacket 45 provide a substantially continuous surface as best shown in figure 1. The first jacket 33 and second jacket 45 are made from polyurethane such that concrete does not adhere thereto.

10 As shown in figure 2, the box 19 has a plurality of bores 47 (only one shown) extending through the wall 43, such that when the first casing 13 is connected to the second casing 15 a pathway is provided through wall 43 to an internal interface 49 between the box 19 and pin 23. Referring to figure 4, each bore 47 is in fluid communication with a reservoir 70 for purposes which are described
15 below.

Once the well is complete, the final casings to be placed in the bore are the first casing 13 and second casing 15. Before being positioned the first casing 13 and second casing 15 are assembled according to the connector assembly 11 of the present embodiment.

20 In an assembled condition, the connector assembly 11 is positioned within the bore of the well before the void between the well and the outer surface of the first and second casings 13, 15 is filled with a suitable material, such as concrete.

When placed in the bore of the well, the connector assembly 11 is positioned such that when the first casing 13 is removed from the second casing 15, the second
25 casing 15 is below the seabed.

At the end of the life of the well, the well must be decommissioned. When decommissioning a well, a remote operated vehicle (ROV) is used to disassemble

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and remove equipment from within and around the wellhead. This includes removing the first casing 13. According to the present embodiment and referring to figure 4, the ROV activates a first valve 72 to allow fluid to be discharged from the cavity 35 through vent 41. This permits the first jacket 33 to deflect inwardly
5 as well as permitting the wall 43 of the box 19 to be deflected outwardly.

The ROV then activates a second valve 74 causing pressurised fluid, such as oil, to pass from the reservoir 70, through bores 47 to the internal interface 49 between the box 19 and pin 21. As the pressure builds up at this internal interface 49, the wall 43 of the box 19 deflects outwardly whilst the wall of the pin
10 23 deflects inwardly. This deflection is sufficient to allow the first casing 13 to detach from the second casing 15 when a suitable force is applied to the first casing 13.

As you will note from figure 4, the release system also has component 76 which allows the ROV to activate the detachment process should the delivery of
15 pressurised oil fail.

As the first casing 13 detaches from the second casing 15, the first jacket 33 splits, breaking into two portions, one portion remaining with the second casing 15 and the other portion being removed from the well with the first casing 13.

As the first jacket 33 and second jacket 45 do not adhere to the concrete the first
20 casing 13 may be easily removed. The removal of the first casing 13 is further enhanced by the tapered outer surface of each jacket.

Whilst the above invention and the embodiment discussed above relates to a well in the seabed, the current invention is not to be limited to such an application. For instance this invention may also be applied to structures secured to the seabed.
25 The connection assembly of the current invention can be employed within the legs securing the structure to the seabed. When the structure is to be decommissioned the first hollow member may easily be removed from the second hollow member, negating the need to cut the casing below the seabed.

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Throughout the specification, unless the context requires otherwise, the word “comprise” or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

The Claims Defining the Invention are as Follows

1. A connector assembly comprising

a first hollow member having a first end adapted to releasably retain
a second end of a second hollow member therein

5 a jacket secured around a first outer portion, adjacent the first end of
the first hollow member, and a second outer portion, adjacent the
second end of the second hollow member, whereby in use the jacket
bears against or is adjacent to a wall of a bore of a well;

10 a sealed cavity between the jacket and the outer portions of the
hollow members, the cavity being filled with a fluid and is in fluid
communication with a vent;

15 whereby during disconnection of the first hollow member from the second
hollow member fluid is discharged from the cavity through the vent allowing
the jacket to move inwardly away from the bore wall to assist removal of
the first hollow member from the bore as it detaches from the second
hollow member.

20 2. The connector assembly according to claim 1 wherein the first hollow
member has a plurality of bores extending through its wall, such that when
the first hollow member is connected to the second hollow member each
bore is in fluid communication with an interface of the two members.

25 3. The connector assembly according to claim 2 wherein each bore is in fluid
communication with a reservoir of fluid from which a pressurised fluid may
be pumped to the interface, causing the walls of the second hollow
member to deflect inwardly, and the walls of the first hollow member to
deflect outwardly.

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4. A connector assembly for connecting a first hollow member and a second hollow member, in operation the second hollow member and a portion of the first hollow member are located within a bore such as a well, the connector assembly characterised in that it has means to assist the removal of the first hollow member from the bore, the connector assembly comprising :
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- 10 a first jacket having an outer surface which bears against or is adjacent to the inner surface of the bore of the well when in position; the first jacket spanning between the first hollow member and second hollow member enclosing a cavity wall, defined by outer surfaces of the first hollow member and second hollow member, to provide a sealed cavity,
- the sealed cavity is in fluid communication with a vent, and is filled with a fluid when assembled,
- 15 wherein during detachment of the first hollow member from the second hollow member the fluid is vented from the sealed cavity, permitting the first jacket to deflect inwardly away from the bore wall, reducing the outer diameter of the first jacket to permit easy removal of the first hollow member once detached from the second hollow member.
- 20 5. The connector assembly according to claim 4 wherein the venting of the fluid from the cavity also permits the end of the first hollow member to be moved outwardly away from the second hollow member to assist detachment of the first hollow member therefrom.
- 25 6. The connector assembly according to claim 4 or 5 wherein the first hollow member is in the form of a first casing, cylindrical in shape.
7. The connector assembly according to claim 4, 5 or 6 wherein the second hollow member is in the form of a second casing, cylindrical in shape.

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8. The connector assembly according to claim 7 wherein the first casing has one end adapted to releasably engage an end of the second casing.
9. The connector assembly according to claim 8 wherein the one end of the first casing provides a box.
- 5 10. The connector assembly according to claim 9 wherein the end of the second casing provides a pin which is adapted to be releasably secured in the box of the first casing such that when operably engaged the first casing is releasably secured to the second casing.
- 10 11. The connector assembly according to claim 10 wherein the pin and box connection is the type known as a Merlin connector.
12. The connector assembly according to claim 9, 10 or 11 wherein a first annular shoulder protrudes from the first casing adjacent the box.
13. The connector assembly according to claim 10, 11 or 12 wherein a second annular shoulder does protrude from the second casing adjacent the pin.
- 15 14. The connector assembly according to claim 13 wherein the first jacket is secured around the first casing and second casing, extending between the first annular shoulder and the second annular shoulder.
- 20 15. The connector assembly according to claim 13 or 14 wherein the cavity wall spans between the first annular shoulder and the second annular shoulder.
16. The connector assembly according to claim 13, 14 or 15 wherein the second annular shoulder has a tapered leading edge, to assist the positioning of the connector assembly in the bore of the well.
- 25 17. The connector assembly according to any one of claims 13 to 16 wherein the second annular shoulder incorporates a projection projecting outwardly

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such that the projection protects the first jacket during insertion of the connector assembly into the well.

18. The connector assembly according to claim 17 wherein the projection is equal to or greater than the thickness of the first jacket.
- 5 19. The connector assembly according to any one of claims 13 to 18 wherein the sealed cavity is defined by the first annular shoulder, the second annular shoulder, the first jacket and the cavity wall.
- 10 20. The connector assembly according to any one of claims 7 to 19 wherein the first jacket has an outer surface tapered inwardly from the first casing to the second casing.
21. The connector assembly according to any one of claims 3 to 20 wherein the first jacket is constructed from a material which does not adhere to concrete, such as polyurethane.
- 15 22. The connector assembly according to any one of claims 7 to 21 wherein the first jacket breaks into two portions when the first casing is detached and removed from the second casing.
- 20 23. The connector assembly according to any one of claim 10 to 22 wherein the box of the first casing has a plurality of bores extending through its wall, such that when the first casing is connected to the second casing each bore is in fluid communication with an interface between the box and the pin.
- 25 24. The connector assembly according to claim 23 wherein each bore is in fluid communication with a reservoir of fluid from which a pressurised fluid may be pumped to the interface between the box and pin, to cause the walls of the pin to deflect inwardly, and the walls of the box to deflect outwardly.

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25. The connector assembly according to claim 23 or 24 wherein each bore in the box is connected to the reservoir by a conduit passing through the sealed cavity.
- 5 26. The connector assembly according to any one of claims 6 to 25 wherein a second jacket encases part of the first casing.
27. The connector assembly according to claim 26 wherein the second jacket is constructed from a material which does not adhere to concrete, such as polyurethane.
- 10 28. The connector assembly according to claim 26 or 27 wherein the second jacket extends from the first annular shoulder away from the box.
29. The connector assembly according to claim 26, 27 or 28 wherein the second jacket tapers outwardly away from the first annular shoulder.
- 15 30. The connector assembly according to any one of claims 26 to 29 wherein the first jacket and second jacket provide a substantially continuous outer surface when the first casing is connected to the second casing.
31. A connector assembly comprising:
- 20 a first casing having an end adapted to releasably retain an end of a second casing, a sheath which, when the first casing retains the second casing, surrounds an outer region of the first casing and second casing adjacent each end;
- a sealed cavity between the sheath and the outer region, which is in fluid communication with a vent;
- whereby upon assembly the cavity is filled with a fluid to prevent inward deflection of the sheath.

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32. The connector assembly according to claim 31 whereby when the cavity is filled with fluid the end of the first casing is prevented from outward movement.

5 33. A connector assembly as substantially herein described with reference to the drawings.