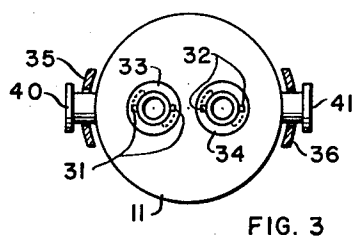
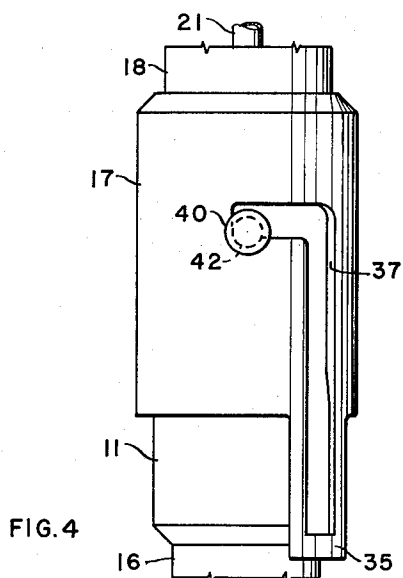
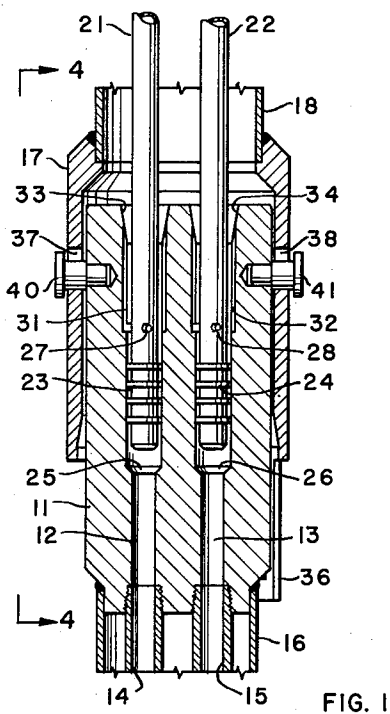
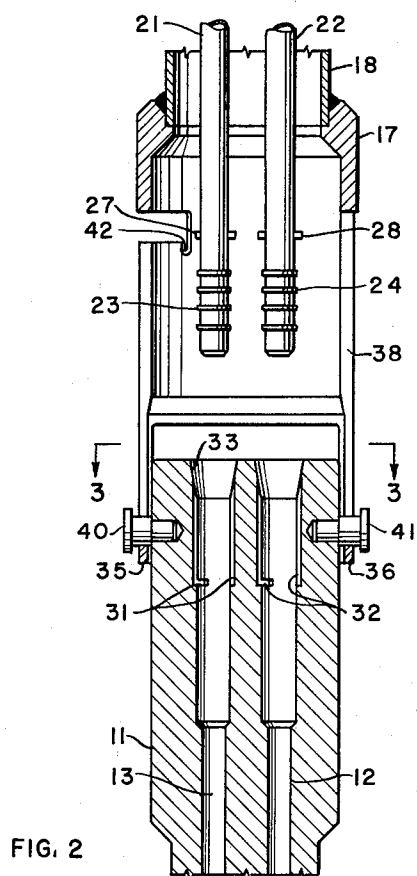


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PIVOTED TUBING WELL CONNECTION

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1

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PIVOTED TUBING WELL CONNECTION

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This invention relates to a means for connecting pipe or tubing and pertains more particularly to a flexible pipe joint by which temporarily disconnected pipe sections may be realigned and coupled together from a remote location.

The present pipe connection has particular application in oil well installations at offshore locations where the wellhead may be covered with substantial depths of water. Thus, after completing an offshore well with the wellhead positioned on the ocean floor, as described in co-pending application Serial No. 830,538, filed July 30, 1959, entitled "Underwater Well Completion Method," it is preferred that a string of pipe or casing remain connected to the wellhead and extend thereabove to a point above the surface of the water so as to facilitate re-entry to the well with tools, instruments, or other devices during work-over, testing, or logging operations. However, when a pipe or casing extends to a point above the surface of the water, it becomes a hazard to navigation and defeats the purpose of originally completing the well on the ocean floor.

After a well has been completed with the wellhead assembly on the ocean floor, the well can only be re-entered with tools with considerable difficulty if the pipe or casing extending from the wellhead to a point above the surface of the water is disconnected. In general, it is difficult to try and stab a pipe or casing onto the top of an underwater wellhead in water ranging from 50-1500 feet deep.

It is therefore a primary object of the present invention to provide apparatus by which a well pipe or casing extending from an underwater wellhead to a point above the surface of the water may be laid down on the ocean floor when not in use.

Another object of the present invention is to provide a pipe joint which permits a pipe to be uncoupled, with one section of the pipe moved with relation to the other at a sharp angle without being entirely disconnected therefrom, while at the same time being adapted to realign the two sections of pipe and recouple them.

A further object of the present invention is to provide apparatus whereby sections of a multiple number of parallel pipes may be uncoupled, altered in direction, realigned and subsequently recoupled in their original manner, all operations being carried out by an operator situated at a remote location.

These and other objects of this invention will be understood from the following description taken with reference to the drawing, wherein:

FIGURE 1 is a view taken in longitudinal cross-section of the present flexible pipe connection in its retracted telescopic position and inner tubing strings seated in fluid flow connection therewith;

FIGURE 2 is a view taken in longitudinal cross-section of the pipe connection of the present invention in its extended telescopic position with the tubing strings contained therein being withdrawn from their seating positions;

FIGURE 3 is a cross-sectional view taken along the line 3-3 of FIGURE 2; and,

FIGURE 4 is a view taken along the line 4-4 of FIGURE 1.

Referring to FIGURE 1 of the drawing, the apparatus of the present invention comprises a cylindrical element or housing 11 having one or more fluid flow conduits 12 and 13 therethrough. In the event that the housing has two conduits 12 and 13, as shown, a pair of pipes or tubes 14

2

and 15, respectively, would be connected to the outlets of the flow conduits 12 and 13. If desired, the tubes 14 and 15 may be surrounded by a large diameter protective pipe or casing 16 which is secured to the housing 11 in any suitable manner, as by welding. The tubes 14 and 15 are preferably connected to the housing 11 by screw threads, as shown.

Mounted for rotational and axial movement on the top of the housing 11 is a cylindrical cap 17, the top of which is connected, as by welding, to a protective pipe or casing 18 which surrounds one or more flow tubes 21 and 22. As illustrated, the lower ends of flow tubes 21 and 22 are adapted to be seated in the flow conduits 12 and 13, within the housing 11. Suitable packing means, such as rings or packing 23 and 24 are provided for closing the small space between the outer walls of the flow tubes 21 and 22 and the innerwalls of the flow conduits 12 and 13. For ease in installation, these packing rings are preferably mounted on the outside wall of the flow tubes 21 and 22. If desired, seats 25 and 26 may be formed within the fluid flow conduits 12 and 13 thereby allowing the lower ends of the flow tubes 21 and 22 to be seated within the housing 11 when no locking devices are employed.

The lower ends of the flow tubes 21 and 22 are preferably locked within the housing 11 in a quickly detachable manner. While screw threads could be used for this purpose, each tube 21 and 22 is preferably provided with one or more pins or keys 27 and 28 which are adapted to move within J-slots or L-shaped keyways 31 and 32. The L-shaped keyways are cut in the wall of the housing 11 forming the wall of the fluid flow conduit 12 and 13. The keyways 31 and 32 extend down from the top of the housing 11 with the bottom of the L-shaped groove extending circumferentially a short distance, thus forming the locking portion of the groove. If desired, the entrance to the fluid flow conduits 12 and 13 at the top of the housing 11 may be bevelled or flared as at 33 and 34 outwardly to facilitate inserting the ends of the tubes 21 and 22 into the housing 11.

Referring to FIGURE 2, it will be seen that the cap 17 is provided with a pair of downwardly extending arms 35 and 36. Formed or cut into the cylindrical cap 17, through the wall thereof are a pair of angular grooves or modified J-slots 37 and 38 with one portion of the grooves extending substantially the length of the downwardly extending arms 35 and 36. The grooves 37 and 38 may be cut in the inner surface of the cap 17 or may be cut entirely therethrough to form slots, as illustrated. The vertical sections of the modified J-slots 37 and 38 permit raising of the cap 17 above the housing 11 to the position shown in FIGURE 2, while the horizontal portion of the slots 37 and 38 permit rotation of the cylindrical cap 17 with respect to the housing 11 so as to lock the cap 17 and housing 11 together, thus preventing axial displacement.

Extending from the outer wall of the housing 11 and fixedly secured thereto are a pair of pivot pins 40 and 41 which extend into or through the modified J-slots 37 and 38 in the cylindrical cap 17, and are of a diameter so that they may readily move within the slots.

The flexible pipe joint of the present invention is shown in FIGURE 1 with the tubes 14 and 15 in open communication with flow tubes 21 and 22 which in turn are locked in a fluidtight manner within the flow conduits 12 and 13 within the housing 11. At the same time the protective sections of casings 16 and 18 are fixedly locked coaxially to each other by the cap 17 which fits down around the housing 11. The flow tubes 21 and 22 are in a locked position as they have been both rotated clockwise a part of a turn so that the pins or keys 27 and 28 are in the horizontal portion of the L-shaped keyways 31 and 32. At the same time the cap 17 is

3

locked on the housing 11, as shown in FIGURE 4, since the cap 17 has been rotated counter-clockwise a part of a turn so that the pin 41 has moved along the horizontal portion of the modified J-slot and now seats in the locking notch 42 at the end of groove 37, since the casing 18 is held in tension.

When it is desired to alter the direction of flow tubes 21 and 22, together with casing 18, so that they lie at, say a 90-degree angle or more to tubes 14 and 15 and their surrounding casing 16, (FIGURE 1), the casing 18 (FIGURE 4) is lowered slightly to get the pin 40 out of the locking notch 42, after which the casing 18 together with the cap 17 fixedly secured thereto is rotated in a clockwise manner to the end of the horizontal portion of the groove 37. At this time, or prior to the unlocking of the cap 17 with regard to the housing 11, the tubings 21 and 22 are unlocked from the housing 11 and withdrawn from the flow conduits 12 and 13 formed therein. Unlocking of the tubings 21 and 22 within the housing 11 is accomplished by rotating tubings 21 and 22 slightly in a counter-clockwise direction so that the pins 27 and 28 traverse the horizontal sections of the J-slots or angular grooves 37 and 38, after which both tubes 21 and 22 may be raised vertically with the pins 27 and 28 moving up the vertical sections of slots 31 and 32 until the tubings 21 and 22 are in a position shown in FIGURE 2.

With the ends of tubings 21 and 22 now raised out of housing 11, the casing 18 together with the cap 17 which has been rotated until pin 40 is at the top of groove 37, are now lifted vertically until pins 40 and 41 are stopped at the bottom of grooves 37 and 38, in a position as shown in FIGURE 2 of the drawing. At this time the tubings 21 and 22, casing 18 and cap 17 may be moved or pivoted sideways above pivot pins 40 and 41 in a plane parallel to the axis of the housing 11 and/or its attached casing 16, and normal to the line between the two pivot pins 40 and 41. The arc through which the casing 18 and tubes 21 and 22 can be moved relative to the vertical housing 11 depends upon the length of the grooves 37 and 38 within the downwardly extending arms 35 and 36 with respect to the radius of the housing 11, assuming that the arms 35 and 36 are considered to be all of that portion of the cap 17 that extends downwardly past the bottom of the cap 17. For purposes of definition, the bottom of the cap will be considered as the lowest point at which the cap is a complete cylinder. Thus, while the cap 17 is shown in FIGURE 4 as having a horizontal lower edge with arm 35 extending downwardly therefrom, it is realized that the lower edge of the cap 17 may slope upwardly away from the arms on one or both sides thereof thus permitting the casing 18 to be tilted at a greater angle to casing 16 when the pin 40 is in the other end of the slot. From this it may be seen that with the length of the groove 37 in the arm 35 equal to the diameter of the housing 11 plus half the thickness of the pin 40, the casing 18 could be tilted at an angle of only about 90 degrees to the casing 16. However, by lengthening the grooved arm 35 to about twice the diameter of the housing 11 then casing 18 could be moved down to form an angle of considerably more than 90 degrees with the casing 16.

When it is desired to reconnect the tubings 21 and 22 in the housing 11, the casing 18 and the tubings 21 and 22 would be tilted back until it was aligned axially with casing 16 at which time it could be lowered so that pins 40 and 41 moved up slots 37 and 38 to the top thereof. Then the casing 18 and cap 17 would be rotated in a counter-clockwise direction until the pin 40 slipped into the locking notch 42, in the position shown in FIGURE 4. Tubings 21 and 22 would then again be reinserted into the flow conduits 12 and 13 within the housing 11 by a procedure that was the reverse from that by which they were withdrawn. While the cap 17 has been shown

4

in the drawing as being mounted above the housing 11 it is realized that the position of these two elements could be reversed to form a joint that would still possess the unique features of the present invention. Additionally, while the present invention has been illustrated with regard to employing two tubings 21 and 22, it is realized that the same flexible joint may be employed while using one or any number of tubings within the protective casings 16 and 18.

While the present invention has been described with regard to the pins 40 and 41 being secured to the housing 11 while the slots or grooves 37 and 38 are formed in the cap 17 it is realized that the position of these elements may be reversed with the pins being secured so as to extend inwardly from the bottoms of the downwardly extending arms while the cooperating slots are formed in the outer surface of the housing 11.

We claim as our invention:

1. A flexible pipe joint comprising a housing having fluid passage means extending longitudinally therethrough, pipe means fixedly secured to one end of said housing and in fluid communication with said fluid passage means, a cap surrounding the upper part of said housing and in telescoping sliding engagement therewith, movable pipe means adapted to be positioned longitudinally within said housing and extending through said cap, the end of said movable pipe means being adapted to engage the fluid passage means of said housing, seal means closing the space around said movable pipe means when said movable pipe means are within said housing, a pair of longitudinally extending arms carried by said cap and extending therefrom along opposite sides of said housing, and longitudinally extensible and pivotally aligning means carried in cooperative engagement between said housing and said cap including the arms thereof.

2. A flexible pipe joint comprising a housing having fluid passage means extending longitudinally therethrough, pipe means fixedly secured to one end of said housing and in fluid communication with said fluid passage means, a cap surrounding the upper part of said housing and in telescoping sliding engagement therewith, movable pipe means adapted to be positioned longitudinally within said housing and extending through said cap, the end of said movable pipe means being adapted to engage the fluid passage means of said housing, seal means closing the space around said movable pipe means when said movable pipe means are within said housing, a pair of longitudinally extending arms carried by said cap and extending therefrom along opposite sides of said housing, each of said arms having a longitudinal slot therein extending substantially the length of said arm and continuing into said cap, and pin means extending from said housing in the upper part thereof and extending through said slots.

3. A flexible pipe joint comprising a housing having fluid passage means extending longitudinally therethrough, pipe means fixedly secured to one end of said housing and in fluid communication with said fluid passage means, a cap surrounding the upper part of said housing and in telescoping sliding engagement therewith, movable pipe means adapted to be positioned longitudinally within said housing and extending through said cap, the end of said movable pipe means being adapted to enter the fluid passage means of said housing, releasable locking means in engagement between said movable pipe means and said housing, seal means closing in a fluidtight manner the space around said movable pipe means when said movable pipe means are within said housing, a pair of longitudinally extending arms carried by said cap and extending therefrom along opposite sides of said housing, each of said arms having a longitudinal slot therein extending substantially the length of said arm and continuing into said cap, and pin means extending from said

5

housing in the upper part thereof and extending through said slots.

4. A flexible pipe joint comprising a cylindrical housing having a plurality of fluid passage means extending longitudinally therethrough, a plurality of pipe means fixedly secured to one end of said housing and in fluid communication with said fluid passage means, a cylindrical cap surrounding the upper part of said housing and in telescoping sliding engagement therewith, a plurality of movable pipe means adapted to be positioned longitudinally within said housing and extending through said cap, the end of said movable pipe means being adapted to enter the fluid passage means of said housing, releasable locking means in engagement between said movable pipe means and said housing, seal means closing in a fluidtight manner the space around said movable pipe means when said movable pipe means are within said housing, a pair of longitudinally extending arms carried by said cap and extending therefrom along opposite sides of said housing, each of said arms having a longitudinal slot therein extending substantially the length of said arm and continuing into said cap, releasable locking means formed at the end of said slots in said cap for locking said cap on said housing, and pin means extending from said housing in the upper part thereof and extending through said slots.

5. A flexible pipe joint comprising a cylindrical housing having a plurality of fluid passage means extending longitudinally therethrough, a plurality of pipe means fixedly secured to one end of said housing and in fluid communication with said fluid passage means, a cylindrical cap surrounding the upper part of said housing and

6

in telescoping sliding engagement therewith, a plurality of movable pipe means adapted to be positioned longitudinally within said cap, the end of said pipe means being of a diameter adapted to enter the fluid passage means of said housing, a large-diameter conduit surrounding said movable pipe means and having one end fixedly secured to the top of said cap, releasable locking means in engagement between said movable pipe means and said housing, seal means closing in a fluidtight manner the space around said movable pipe means when said movable pipe means are within said housing, a pair of longitudinally extending arms carried by said cap and extending therefrom along opposite sides of said housing, each of said arms having a longitudinal slot therein extending substantially the length of said arm and continuing into said cap, releasable locking means formed at the end of said slots in said cap for locking said cap on said housing, and pin means extending from said housing in the upper part thereof and extending through said slots.

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