March 2, 1965 P. E. BICKEL ETAL 3,171,674

WELL HEAD APPARATUS

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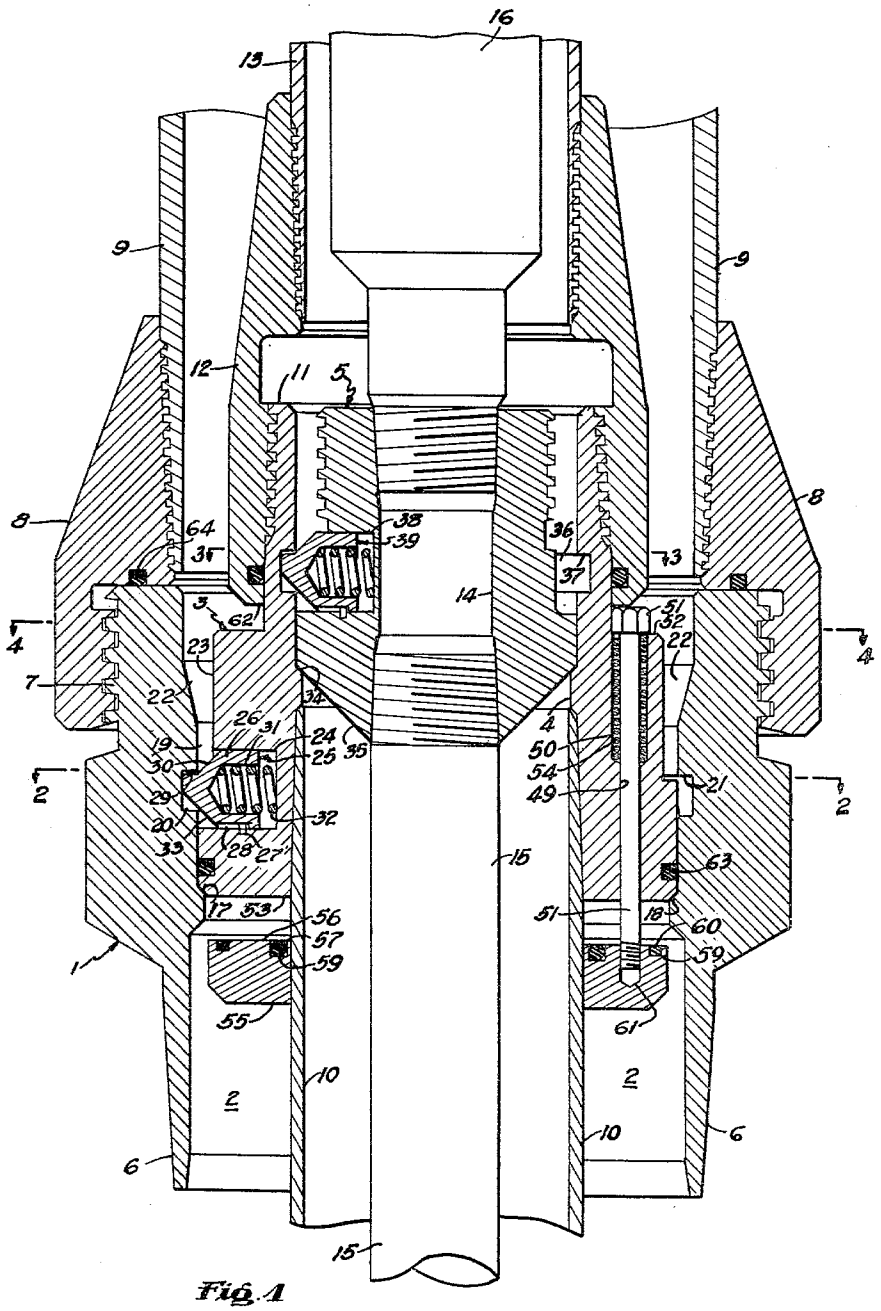


Fig. 1

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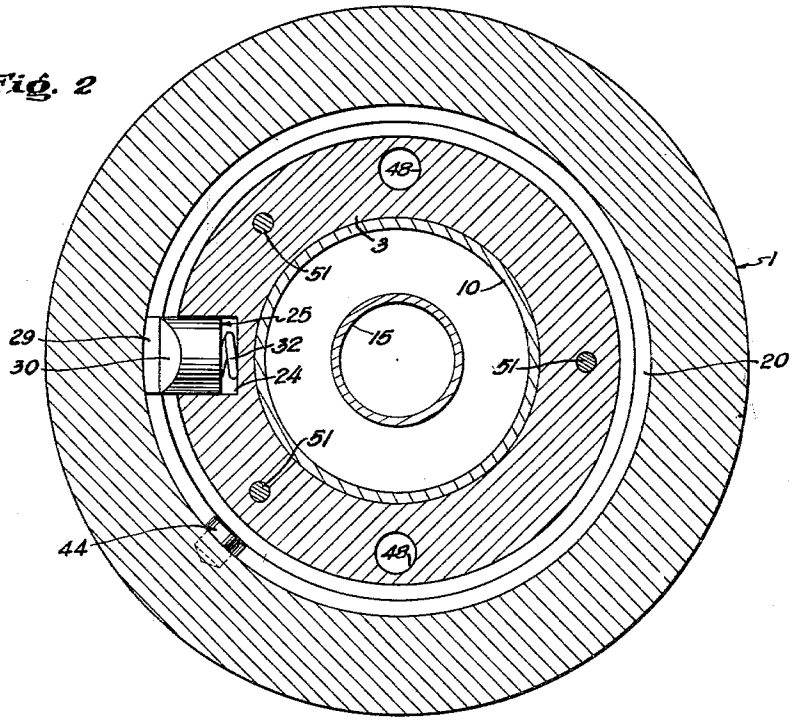
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WELL HEAD APPARATUS

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Fig. 2



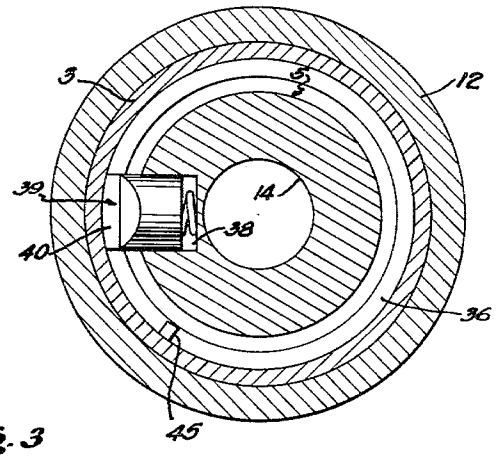


Fig. 3

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WELL HEAD APPARATUS

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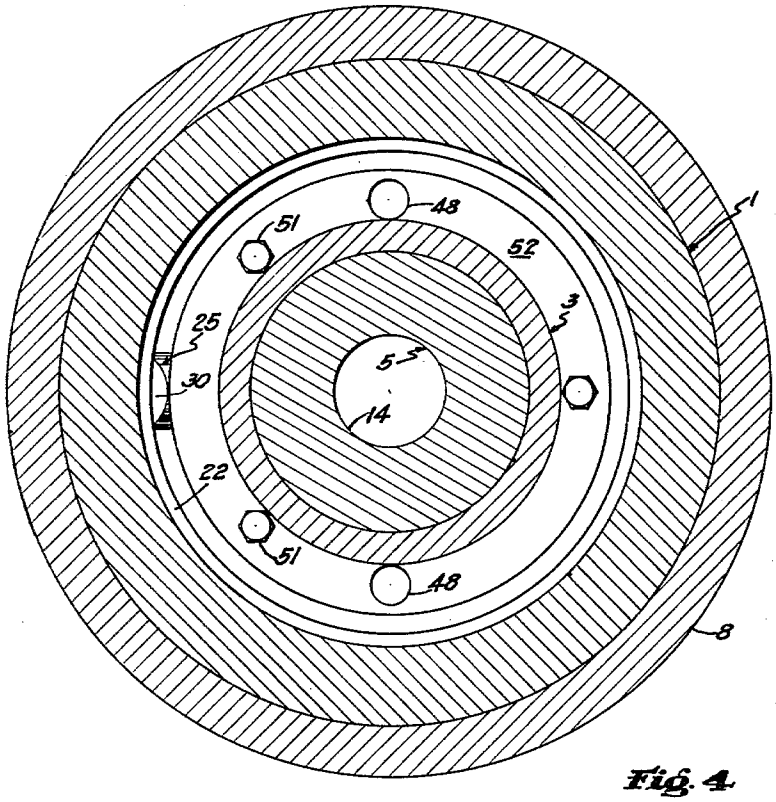


Fig. 4

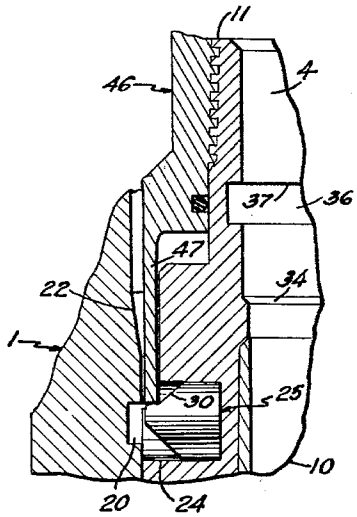


Fig. 5

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United States Patent Office

3,171,674
Patented Mar. 2, 1965

3,171,674

WELL HEAD APPARATUS

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Filed May 3, 1962, Ser. No. 192,172
8 Claims. (Cl. 285—39)

This invention relates to well head apparatus and, more particularly, to an improved well head construction adapted for use at points below the surface of a body of water.

While well heads have long been known in various forms, present underwater drilling practices have posed new problems which are not solved by use of prior-art apparatus. In underwater applications, it is necessary, for example, to install internal elements of the well head in their proper positions by manipulation from the deck of a vessel, for instance, which may be a substantial distance above the well. Once such elements have been installed, it is then frequently necessary to remove them for various purposes. In prior-art constructions designed for use on dry land, the internal elements are usually in sight of the operators during installation and, while capable of being properly handled with relative ease under dry land conditions, would at best be difficult to install properly when, as in underwater drilling, an operator can approach no closer to the well head than a point at least many feet thereabove. There is accordingly an active need for improved well head constructions which are better suited for remote installation.

A general object of the invention is to provide a simple and effective well head construction adapted for use in accordance with modern practices.

Another object is to provide such an apparatus which is especially adapted for underwater installation.

A further object is to devise a well head apparatus wherein internal elements, such as a hanger member, latch in place automatically when seated and can be readily unlatched, from a remote point above the well, for removal.

A further object is to provide such an apparatus wherein internal elements of the well head can be attached by screw-thread engagement to a handling joint or the like, landed by manipulation of the handling joint, and automatically latched in place, the internal element then being so retained in the well head as to permit ready detachment and withdrawal of the handling joint.

In order that the manner in which these and other objects are attained in accordance with the invention can be understood in detail, reference is had to the accompanying drawings, which form a part of this specification, and wherein:

FIG. 1 is a vertical sectional view of a well head apparatus in accordance with one embodiment of the invention;

FIGS. 2, 3 and 4 are transverse sectional views on lines 2—2, 3—3 and 4—4, FIG. 1, respectively; and

FIG. 5 is a fragmentary vertical sectional view of a portion of the apparatus of FIG. 1, illustrating the manner in which latch members employed therein are disengaged.

Turning now to the drawings in detail, it will be seen that the embodiment of the invention here illustrated comprises a casing head body member 1 provided with

an upright passage 2 which accommodates a hanger member 3. Hanger member 3 has an upright bore 4 in which is disposed a tubing string supporting element or mandrel 5. Lower end portion 6 of body member 1 is exteriorly threaded or otherwise suitably adapted for attachment to the top of the last piece of surface casing (not shown). Top portion 7 of body member 1 is connected, as by external threads as shown, to the sub 8 carried at the bottom end of conductor casing 9. Bore 4 of hanger member 3 is interiorly threaded at its lower end and there is secured therein the upper end of the last piece of production casing 10. Top portion 11 of hanger body 3 is externally threaded for attachment, by sub 12, to a handling joint 13. Supporting element 5 has a vertical through bore 14 which is threaded at both ends, the last joint 15 of the tubing string being secured in the lower threaded portion of bore 14 and any suitable flow device 16 being secured in the upper threaded portion of bore 14.

Near its mid-point, passage 2 has a portion of reduced diameter, providing an upwardly facing, downwardly and inwardly tapering, frusto-conical seat 17. At its bottom end, hanger member 3 is formed with a downwardly facing, downwardly and inwardly tapering, frusto-conical surface 18 adapted to engage seat 17 in face-to-face contact, so that the hanger member can be securely supported by body member 1. Above seat 17, portion 19 of passage 2 extends as a right cylindrical surface interrupted only by a transverse annular groove 20. Opening inwardly of the body member 1, groove 20 has a flat top wall 21 lying in a plane at right angles to the axis of passage 2. The upper end portion of passage 2 is enlarged, tapering upwardly and outwardly at 22.

Above surface 18, hanger member 3 has a right cylindrical outer surface which is of such length that, when the hanger member is engaged with seat 17, the body of the hanger member substantially completely fills the space enclosed by cylindrical portion 19 of passage 2, as will be evident from FIG. 1. Hanger member 3 also has an intermediate portion presenting an outer surface of right cylindrical configuration indicated at 23, the diameter of surface 23 being materially smaller than the diameter of cylindrical portion 18 of passage 2, so as to provide an annular space between hanger member 3 and portion 19 of passage 2 when the hanger member is seated as shown in FIG. 1. At a point which is aligned with groove 20 when surface 18 of hanger member 3 engages seat 17, the hanger member is provided with an outwardly opening, radially extending, cylindrical bore 24. A latch pin 25 is slidably disposed in bore 24.

Latch pin 25 has a cylindrical body 26 which is shorter than the depth of bore 24 and which has an outer diameter of such size that the latch pin slidably engages the wall of bore 24. A guide pin 27 projects upwardly into bore 24, being fixed to hanger member 3 and extending radially with respect to the bore. Latch pin 25 is provided with a longitudinally extending guide slot 28 which opens outwardly and receives guide pin 27, so that the latch pin 25 is retained in a predetermined orientation. In an area which, as a result of cooperation of guide pin 27 and slot 28, is maintained as an upper portion of latch pin 25, the latch pin is cut away to provide a horizontal flat surface 29 and an upwardly and inwardly slanting cam surface 30. Body 26 of the latch pin is provided with an axially extending bore 31 which accommodates a helical compression spring 32, the effect of the spring being to

bias the latch pin outwardly relative to hanger member 3. The bottom of the outer end portion of the latch pin is chamfered or cut away to provide a downwardly and inwardly slanting surface, as indicated at 33, so that the tip of the latch member is of such dimension, axially of hanger member 3, as to be accommodated within groove 20. The location of bore 24, and the position of flat surface 29, is such that when surface 18 of hanger member 3 is engaged with seat 17, surface 29 of the guide pin is aligned in a plane just below the plane occupied by top wall 21 of the groove, so that the tip portion of the latch pin can move outwardly into the groove.

When hanger member 3 is inserted downwardly into passage 2, it will be understood that the tip of latch pin 25 projects radially outwardly from the hanger member to such an extent that, as the hanger member is lowered, the tip of the latch pin will ride along frusto-conical portion 22 of the passage, so that the latch pin is cammed inwardly. Further lowering of the hanger member causes the tip of the latch pin to ride along cylindrical portion 19 of passage 2. As the hanger member is seated, the tip of the latch pin passes below top wall 21 of groove 20, and the latch pin snaps outwardly into the groove, so that surface 29 is engaged below wall 21 and the hanger member is latched in its seated position.

Bore 4 of hanger member 3 is also provided with a portion of reduced diameter presenting an upwardly facing, downwardly and inwardly slanting, frusto-conical seat 34. Above seat 34, the wall of bore 4 extends as a plain cylinder. The lower portion of mandrel 5 is of such diameter as to substantially completely fill that portion of bore 4 above seat 34. At its lower end, mandrel 5 is provided with a downwardly and inwardly tapering, frusto-conical surface 35 disposed to engage seat 34 in face-to-face contact for support of the mandrel on hanger member 3. The wall of bore 4 is interrupted, above seat 34, by an inwardly opening transverse annular groove 36 having a flat top wall 37 lying in a plane at right angles to the axis of the mandrel 5. Mandrel 5 is provided with a radially extending, outwardly opening bore 38 accommodating a latch pin 39 which is identical in all respects to latch pin 25. Thus, latch pin 39 has an upwardly facing, horizontal, flat tip surface 40 disposed just below top wall 37 of groove 36 when the mandrel is engaged with seat 34. Latch pin 39 also has a downwardly and inwardly slanting lower tip surface 41 disposed to come into engagement with the top of hanger member 3 as the mandrel is lowered into the hanger member, surface 41 serving to cam the latch pin 39 inwardly in bore 38 so that the tip of the latch pin can ride along the plain cylindrical upper portion of bore 4 until the mandrel is seated, whereupon the latch pin is spring-biased outwardly into engagement in groove 36 in the manner hereinbefore described with reference to latch pin 25.

FIG. 1 illustrates the hanger member 3 after it has been landed, by manipulation of handling joint 13, with the handling joint and sub 12 still in place. For removal of handling joint 13, it is necessary that the threaded connection between sub 12 and the upper end portion of hanger member 3 be disengaged and this, of course, can only be accomplished by rotation of the handling joint while the hanger member is held against rotation. To make this possible, a stop pin 44 is provided, being driven into a suitable radially extending bore through the cylindrical wall of groove 20, the arrangement being such that the head of the stop pin 44 substantially fills groove 20. Accordingly, if the hanger member 3, once being seated, rotates on its seat, latch pin 25 will come into engagement with the head of stop pin 44 and prevent further rotation of the hanger member. It will thus be seen that the stop pin 44 coacts with latch pin 25 to hold the hanger member against rotation and so enable the operators to unscrew the handling joint. A stop lug 45 is welded in groove 36 to cooperate with latch pin 39, preventing rotation of mandrel 5, in the same manner just described.

FIG. 5 illustrates the manner in which latch pin 25 can be disengaged in order to allow removal of hanger member 3. For this purpose, the handling string terminates in a retrieving adaptor 46 having internal threads adapted to cooperate with the externally threaded upper portion of the hanger member. Retrieving adaptor 46 also has a cylindrical skirt 47 of such diameter as to closely embrace the intermediate cylindrical surface 23 of the hanger member when the retrieving adaptor has been completely made up on the hanger member, as shown. Skirt 47 has a wall thickness only slightly less than the spacing between surface 23 and the cylindrical surface 19 presented by passage 2. Skirt 47 has a tip extending circularly and lying in a plane at right angles to the axis of the adaptor, the axial length of the skirt being such that, when the adaptor has been completely made up on the hanger member, as shown, the tip of the skirt is located in the plane occupied by flat surface 29 of the latch pin. It will be understood that the retrieving adaptor is engaged with the hanger member at a time when the hanger member occupies the seated position illustrated in FIG. 1 and is latched in place. Accordingly, as the retrieving adaptor is threaded onto the hanger member, the tip of skirt 47 moves downwardly into engagement with cam surface 30 of the latch pin. Because of this engagement, continued downward movement of skirt 47 causes the latch pin to be cammed progressively inwardly until, when the adaptor has been fully installed, the latch pin 25 occupies the position seen in FIG. 5 and is fully retracted from groove 20. With the latch pin in this position, hanger member 3 can now be withdrawn upwardly from passage 2, by manipulation of the handling string. It will be understood that a similar, smaller retrieving adaptor (not shown) can be engaged over the threaded upper end of mandrel 5 in order to cause retraction of latch pin 39, in the same manner just described.

Latch pins 25 and 39, coacting with grooves 20 and 36, respectively, serve two functions. First, they allow the operator to determine, from a remote position above the well, whether the hanger member and mandrel have been properly seated. In this connection, it will be understood by those skilled in the art that, as the production casing string is lowered, an obstruction may be encountered at a time when the hanger member 3 is approximately seated. Movement of the string downwardly thus stops, and it could be assumed that the hanger member has engaged seat 17. There is thus an ambiguity, insofar as the situation appears to the operators, since the operators cannot tell for certain whether seating has been accomplished or an obstruction encountered. Under these circumstances, an upward strain applied to the handling string will be opposed by engagement of surface 29 with the top wall 21 of groove 20 if the hanger member is actually properly seated so that the latch pin 25 is engaged in groove 20. Such engagement is observable because the load applied via the handling string will be in excess of the weight of the production casing string. If, on the other hand, hanger member 3 has not been properly seated, then latch pin 25 will not be engaged in groove 20 and only the weight of the production casing string will oppose the upward force applied to the handling string. The difference in loads existing for the two situations is observable by the operators at their location remote from the well head and serves as a positive indication as to whether or not the hanger member is in fact seated properly in body member 1. Latch pin 39 serves in the same general fashion to allow the operators to determine whether or not mandrel 5 is properly seated on the hanger member.

The second function served by the latch pins is to secure the hanger member and the mandrel positively in place against fluid pressures existing in the well. Thus, so

long as latch pin 25 is properly engaged in groove 20, high pressures existing between the production and surface casings cannot blow the hanger member 3 out of the well head. Similarly, so long as latch pin 39 is properly engaged in groove 36, fluid pressure between the tubing string and the production casing cannot blow mandrel 5 out of the well head. In this connection, though only a single latch pin has been illustrated for each of the hanger member and the mandrel, it will be understood that more than one pin can be employed where the well head construction is to be subjected to very high well pressures. Thus, two diametrically opposed latch pins can be employed, or three latch pins can be employed, with equal angular spacings therebetween.

Hanger member 3 is provided with a plurality of vertical flow ducts 48 and a plurality of angularly spaced vertical bores 49, each bore 49 having an upper portion 50 of larger diameter and a lower portion of smaller diameter. A plurality of bolts 51 extend downwardly each through a different one of the bores 49, the length of the bolts being such that, when the bolt heads engage the shoulder 52 between the upper and intermediate portions of the hanger member 3, the tips of the bolts project well below bottom face 53 of the hanger member. A helical compression spring 54 is disposed about each bolt 51 in the larger diameter bore portion 50, springs 54 being engaged between the bolt head and the shoulder at the bottom of bore portion 50 in each case.

Below hanger member 3, an annular movable valve plate 55 surrounds casing 10. Plate 55 has a flat upper face 56 adapted to engage bottom face 53 of the hanger member, circular grooves 57 and 58, concentric with the circular opening of the valve plate, being provided to accommodate sealing rings 59 and 60, respectively. The radial spacing between grooves 57 and 58 is greater than the diameter of flow ducts 48 and the ducts 48 are so located that, when valve plate 55 engages the hanger member, the lower ends of all of the ducts 48 are disposed between sealing rings 59 and 60 and therefore excluded from communication with the annular space between the production and surface casings.

The threaded tips of bolts 51 are each engaged in interiorly threaded upwardly opening bores 61 in valve plate 55 so that the valve plate is suspended from the hanger member via the bolts. The lengths of bolts 51, and the normal or extended dimensions of springs 54, are such that, assuming that the bolts are free to move upwardly relative to the hanger member, the springs are effective to bring the valve plate simultaneously into engagement with the hanger member so that good seals are accomplished by sealing rings 59 and 60.

From FIG. 1, it will be observed that the heads of bolts 51 are disposed immediately adjacent to the upper portion 11 of hanger member 3 to which sub 12 is to be attached. The proportions of sub 12 are such that, when the same is fully made up on the hanger member, lower end face 62 of the sub is disposed at a point near shoulder 52, such point being well below the transverse plane occupied by the tops of the bolt heads when springs 54 are relaxed. Hence, installation of sub 12 serves first to engage end face 62 with the heads of bolts 61 and then to force the bolts downwardly until the bolt heads engage shoulder 52 and valve plate 55 is spaced well between lower face 53 of the hanger member. With the valve plate in this position, flow ducts 48 are open at their lower ends for communication with the space between the production and surface casings. Ducts 48 are also open at their upper ends via the space between shoulder 52 and end face 62 of sub 12, for communication with the annular space between the conductor casing or riser 9 and the handling string.

Accordingly, when the handling string is manipulated to land the hanger member, flow ducts 48 are open and there is free communication between the space between the production and surface casings, on the one hand, and the space between the conductor casing and handling string, on the other. So long as the handling string is left attached to the hanger member, engagement of end face 62 of sub 12 serves to maintain valve plate 55 in its open position so that flow ducts 48 remain open. Accordingly, before installation of mandrel 5 when the tubing string is run in, cement can be pumped downwardly through casing 10 for cementing of the casing, well fluid being free to pass upwardly between the production and surface casings, through ducts 48 in the hanger member, and then upwardly between the conductor casing and the handling string. When the cementing operation has been completed, removal of the handling string, with its sub 12, allows springs 54 to actuate valve plate 55 to its closed position.

Typically, the embodiment of the invention illustrated is useful in applications where the well head is to be installed in the floor of a shallow body of water, the operation being carried out from a floating vessel or fixed platform. Body member 1 is fixed to the top of the last joint of the surface casing and run down with sub 8 and conductor casing or riser 9 attached thereto as shown. With the surface casing string completed, so that the body member 1 is in its final position, hanger member 3 is then installed. Preliminarily, the hanger member is fixed to the top of the last joint of production casing, and sub 12 is made up on the top of the hanger member so that bolts 51 are depressed and valve plate 55 is in the open position seen in FIG. 1. The production casing string, with the hanger member thereon, is now further lowered by manipulating the handling joint until the string comes to a stop. Assuming that this occurs because of seating of the hanger member on seat 17, latch pin 25 will spring outwardly and engage the groove 20. That this has occurred can be determined by applying an upward force to the handling string, as hereinbefore described. The production casing is now cemented by pumping the cement composition down the production casing, well fluid being allowed to pass upwardly through the open flow ducts 48 in the hanger member. Sub 12 is now retrieved by rotating the handling string, causing latch pin 25 to come into engagement with stop pin 44 in groove 20, so that the hanger member cannot rotate and rotation of the handling string will unscrew the sub. Removal of the handling string and sub 12 allows springs 54 to actuate valve plate 55 to its closed position so that upward flow of fluid through flow ducts 48 is precluded. Latch pin 25, engaged in groove 20, acts to prevent upward displacement of the hanger member.

The well is now hydraulically fractured in conventional fashion. Mandrel 5 is then attached to the last joint of the tubing string and a handling joint is made up on the top of the mandrel. The tubing string is then lowered, the operator again observing when downward motion ceases. Assuming that lowering of the tubing string terminates because of seating of the mandrel on seat 34, latch pin 39 will spring outwardly into groove 36, latching the mandrel in place. The operators again test for seating by applying an upward strain on the handling string, as hereinbefore described. Further well completion steps can be carried out in conventional fashion.

A good fluid seal is established between hanger member 3 and the cylindrical wall portion 19 of passage 2 by a sealing ring 63 disposed in an outwardly opening transverse annular groove in the hanger member immediately above seat-engaging surface 18. A seal is provided between the top of body member 1 and sub 8 by a sealing ring 64 disposed in a downwardly opening groove located in a portion of the sub opposed to the top end face of body member 1, as seen in FIG. 1.

While one particularly advantageous embodiment of the invention has been chosen for illustrative purposes, it will be understood by those skilled in the art that various changes and modifications can be made therein

without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. In a well head construction adapted for underwater installation, the combination of

a body member having an upright passage therethrough;

a hanger member having a vertical bore for communication with a string of pipe to be suspended therefrom,

said hanger member being dimensioned for downward insertion into said passage and said body and hanger members having cooperating shoulder means engaged, when said hanger member is inserted into said passage, for support of said hanger member on said body member,

said hanger member having a recess opening outwardly thereof and located above said shoulder means,

said body member having an inwardly opening recess located opposite said outwardly opening recess when said hanger member is supported by said shoulder means,

the portion of said hanger member between said shoulder means and said outwardly opening recess filling said passage,

the portion of said hanger member above said outwardly opening recess being of smaller diameter than the diameter of the portion of said passage above said inwardly opening recess, whereby an annular space is provided between said hanger and body members which extends from the tops of said members downwardly to the location of said recesses;

a latch member slidably disposed in said outwardly opening recess and having

a tip portion of such size and shape as to be capable of engaging in said inwardly opening recess, and

an upwardly facing cam surface extending upwardly and inwardly from said tip portion, said cam surface being located to extend across said annular space when the tip of said latch member is engaged in said inwardly opening recess; and

biasing means operatively associated with said latch member to yieldably bias the same outwardly whereby, upon engagement of said shoulder means when said hanger member is inserted into said passage, said latch member is moved outwardly to engage said tip portion in said inwardly opening recess, thereby latching said hanger member against upward removal from said passage,

said latch member being capable of being disengaged by passage of a cylindrical element downwardly through said annular space into sliding engagement with said cam surface.

2. A well head construction in accordance with claim 1 and wherein

said inwardly opening recess is a transverse annular groove,

said hanger member has an upwardly projecting top portion threaded for attachment to a handling tool, and

a fixed stop is provided in said groove for engagement by said latch member to prevent rotation of said hanger member relative to said body member when the handling tool is rotated to disengage the same from said threaded top portion.

3. A well head construction in accordance with claim 1 and wherein

said outwardly opening recess is a radially extending cylindrical bore, and

said latch member is cylindrical and of a diameter to substantially fill said cylindrical bore,

said tip portion including a flat surface parallel to the longitudinal axis of said latch member.

4. A well head construction in accordance with claim 1 and wherein

said outwardly opening recess is cylindrical,

said latch member is cylindrical and of a diameter to fit slidably in said outwardly opening recess,

said tip portion including a flat surface parallel to the longitudinal axis of said latch member,

said latch member having an axially extending guide groove, and

the construction further comprises a guide pin carried by said hanger member and projecting into said outwardly opening recess to engage in said guide groove,

the angular displacement between said guide groove and said flat surface being such that, when said guide pin is engaged in said groove, said flat surface faces upwardly.

5. A well head construction in accordance with claim 1 and further comprising

a support member having a vertical bore to communicate with a string of pipe to be suspended therefrom,

said support member being dimensioned to be downwardly inserted into said bore of said hanger member,

said support member and hanger member having coacting shoulder means engaged, when said support member is inserted into the bore of said hanger member, for supporting said support member on said hanger member,

said support member having a recess opening outwardly thereof and located above said last-mentioned shoulder means,

said hanger member having an inwardly opening recess located opposite said last-mentioned outwardly opening recess when said support member is so supported on said hanger member,

the portion of said support member between said shoulder means and said outwardly opening recess therein filling said bore in said hanger member,

the portion of said support member above said outwardly opening recess therein being of smaller diameter than the diameter of the portion of said bore in said hanger member above said inwardly opening recess in said hanger member,

whereby an annular space is provided between said hanger and support members which extends from the tops thereof downwardly to the location of said last-mentioned recesses;

a latch member slidably disposed in said outwardly opening recess of said support member and having

a tip portion of such size and shape as to be engageable in said inwardly opening recess of said hanger member, and

an upwardly facing cam surface extending upwardly and inwardly from said tip portion across said last-mentioned annular space when said latch member of said support member is engaged in said last-mentioned inwardly opening recess; and

biasing means operatively associated with said last-mentioned latch member to yieldably bias the same outwardly.

6. In a well head construction, the combination of

a body member having an upright passage therethrough,

said passage including

an inwardly directed upwardly facing shoulder,

a right cylindrical portion above said shoulder, and

a frusto-conical portion slanting upwardly and outwardly from said cylindrical portion,

said body member having a recess opening inwardly into said passage in said cylindrical portion;

a hanger member having an upright bore for com-

munication with a pipe string to be suspended therefrom, said hanger member comprising

a right cylindrical lower portion of such diameter as to fill said cylindrical portion of said passage and having a downwardly facing shoulder adapted to seat against said shoulder of said body member;

an intermediate portion above and of smaller diameter than said lower portion, and

a top portion of smaller diameter than said intermediate portion, said top portion being threaded for attachment to a handling tool,

said lower portion being substantially shorter than said right cylindrical portion of said passage and there therefore being an annular space between said intermediate portion of said hanger member and said right cylindrical portion of said passage, the space between said hanger and body members being open from the top of said members downwardly to said annular space, whereby, when a handling tool with an annular skirt of proper size is attached to said threaded top portion, the skirt can enter said annular space,

there being an outwardly opening recess in said hanger member so located as to face said inwardly opening recess when said shoulders are engaged;

a latch member slidably disposed in said outwardly opening recess and comprising

a tip portion of such shape and size as to be capable of engaging in said inwardly opening recess, and

a cam surface extending upwardly and inwardly from said tip portion and so located as to extend across said annular space when said tip portion is engaged in said inwardly opening recess; and

means operatively associated with said latch member to yieldably bias the same outwardly to engage said tip portion in said inwardly opening recess,

said latch member sliding successively along said frusto-conical and right cylindrical portions of said passage as said hanger member is inserted therein and springing outwardly into latching engagement in said inwardly opening recess when said shoulders are engaged,

said latch member being retractable, to allow removal of said hanger member, by engagement of a handling tool skirt downwardly against said cam surface.

7. In a well head construction for remote installation under water, the combination of

a tubular member having a passage therethrough, said tubular member being adapted for installation as a fixed element of the well head with said passage extending upwardly,

an inner member having a through bore,

said inner member being dimensioned for downward insertion into said passage and said tubular member and inner member having cooperating shoulder means engaged, when said inner member is inserted downwardly into said passage, to fixedly locate said inner member in a predetermined position axially with respect to said tubular member,

said tubular member having an inwardly opening recess spaced axially from said shoulder means,

said inner member having an outwardly opening recess so located as to face said inwardly opening recess when said shoulder means are engaged,

the portion of said inner member between said shoulder means and said outwardly opening recess filling said passage,

said inner member having a portion extending axially beyond said outwardly opening recess and terminating at one end of said inner member, said last-mentioned portion being of smaller diameter than the diameter of the portion of said passage which surrounds the same when said shoulder means are engaged, whereby an annular space is provided between said inner member and the wall of said passage, which space extends from said one end axially to the location of said recesses;

a latch member slidably mounted in said outwardly opening recess and having

a tip portion of such size and shape as to be capable of engaging in said inwardly opening recess, and

a cam surface slanting inwardly from said tip portion and toward said one end of said inner member, said cam surface being located to extend across annular space when the tip of said latch member is engaged in said inwardly opening recess; and

biasing means operatively associated with said latch member to yieldably bias the same outwardly whereby, upon engagement of said shoulder means when said inner member is inserted downwardly into said passage, said latch member is moved outwardly to engage said tip portion in said inwardly opening recess, thereby latching said inner member against upward removal from said passage,

said latch member being capable of being disengaged by passage of a cylindrical element axially through said annular space into sliding engagement with said cam surface.

8. In a well head construction adapted for remote installation under water, the combination of

an outer tubular well head member having an upright passage therethrough;

an inner tubular well head member telescopically engaged within said outer member,

one of said members being provided with a transverse annular groove opening toward the other of said members,

said one member presenting a transverse upwardly directed shoulder engaged by said other member to support said other member against downward movement,

said other member having a recess opening toward said one member, said recess being so located axially of said other member that, when said other member is engaged with said shoulder, said recess is aligned with said groove,

the portion of said inner member between the location of said groove and recess and said shoulder completely filling said passage,

said inner member having a portion extending axially beyond said outwardly opening recess, said last-mentioned portion being of smaller diameter than the diameter of the portion of said passage which surrounds the same when said other member engages said shoulder, whereby an annular space is provided between said inner member and the wall of said passage, which space extends axially to the location of said groove and aligned recess;

a latch member slidably mounted in said recess and having

a tip portion of such size and shape as to be capable of engaging in said groove, and

a cam surface slanting toward said groove and away from said last-mentioned portion of said inner member, said cam surface being located to extend across said annular space when the tip of said latch member is engaged in said groove; and

spring means operatively associated with said latch member to bias the same toward said one member

whereby, upon engagement of said other member with said shoulder, said latch member is moved transversely of said members to engage said tip portion in said groove, thereby latching said members against relative upward movement,

said latch member being capable of being disengaged from said groove by passage of a cylindrical element axially through said annular space into sliding engagement with said cam surface.

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