

May 21, 1963

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3,090,437

UNDERWATER WELLHEAD FLOW LINE CONNECTOR

Original Filed Aug. 25, 1959

3 Sheets-Sheet 1

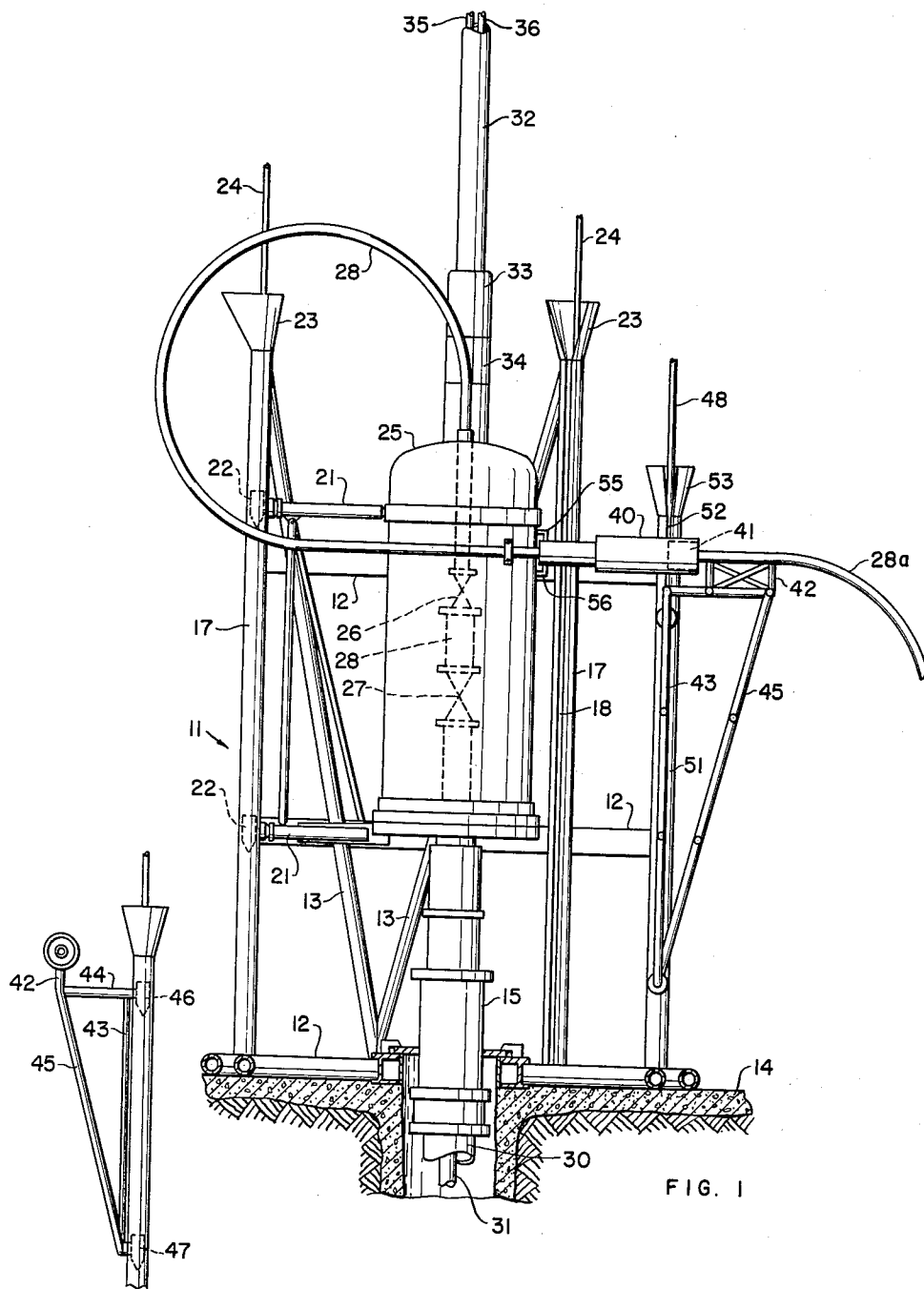


FIG. 1

FIG. 2

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3 Sheets-Sheet 2

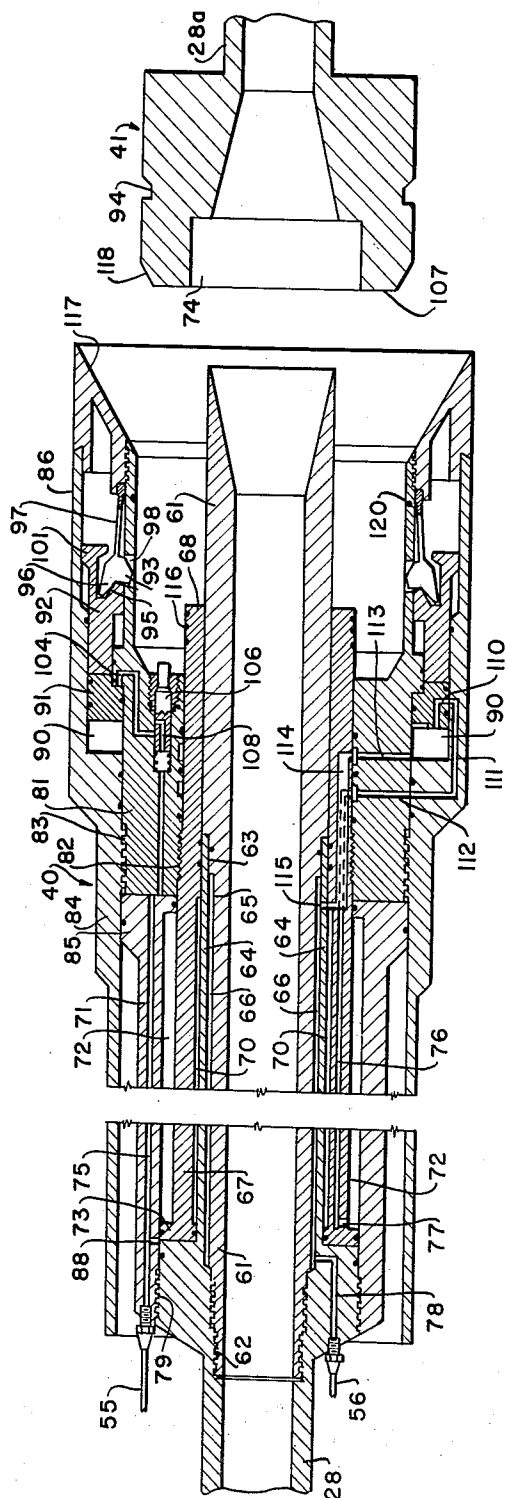


FIG. 3

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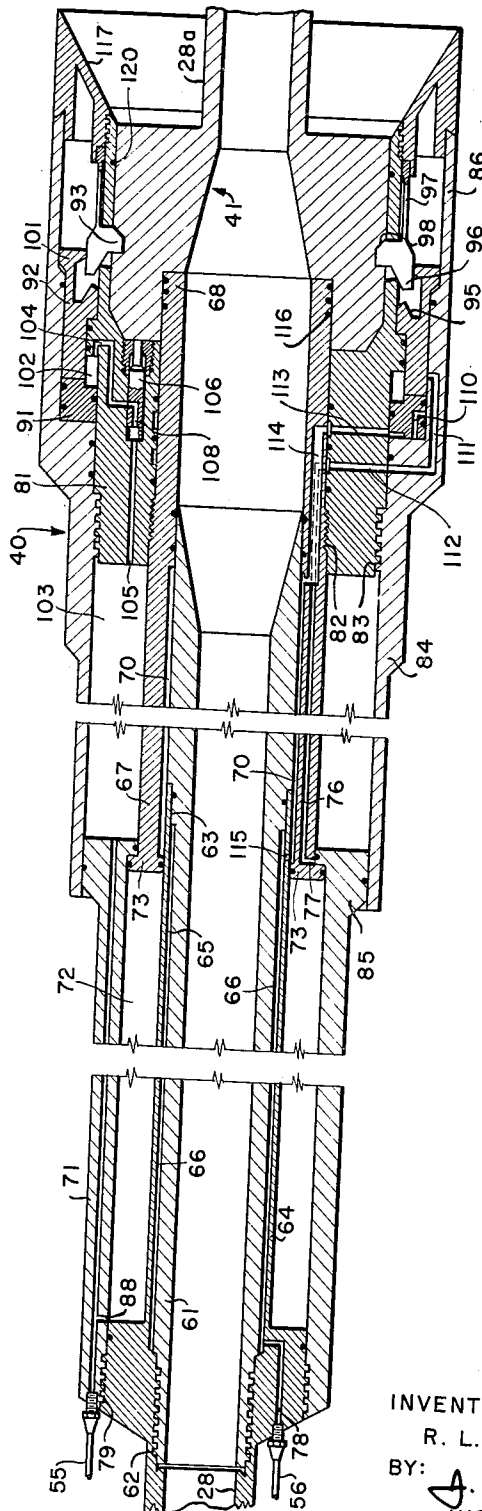
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UNDERWATER WELLHEAD FLOW LINE CONNECTOR

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Continuation of abandoned application Ser. No. 835,931, Aug. 25, 1959. This application Nov. 9, 1961, Ser. No. 152,713

13 Claims. (Cl. 166--66.5)

The present apparatus relates to oil well equipment for use at underwater locations and pertains more particularly to an underwater wellhead apparatus with a remotely-detachable flow line which includes a power-actuated and remotely-operable pipeline connector for connecting the wellhead assembly to an underwater pipeline, such as one running along the ocean floor.

The wellhead apparatus of the present invention is adapted to be used to close wellhead assemblies of the type described in copending patent application, Serial No. 834,096, filed August 17, 1959, now Patent No. 3,064,735. A recent development in the field of oil well drilling is the completion of wells at offshore locations with a wellhead assembly positioned on or close to the ocean floor out of the way of ships which might otherwise damage it in the event of a collision. Equipment positioned on the ocean floor, however, is exposed to conditions such as the corrosive nature of the sea water and the presence of marine life which tends to grow and become encrusted on metallic structures below the surface of the water.

Since it is necessary from time to time to go back into a well wherever it has been completed for servicing or work-over operations, it is desirable to have an underwater wellhead structure of suitable design so that it could be readily removed from the underwater wellhead and raised to the surface. An underwater wellhead structure of this type is shown and described in copending patent application, Serial No. 834,096, filed August 17, 1959.

On removing a wellhead assembly from the top of the well in accordance with present practice, a diver must first be sent to the ocean floor to disconnect the production flow line from the wellhead assembly. Otherwise, the production flow line adjacent the wellhead assembly must be raised to the surface of the water along with the wellhead assembly when the latter is removed from an underwater wellhead and raised to the surface. Divers can be used effectively only at relatively shallow water depths of up to about 150 feet.

An object of the present invention is to provide a remotely-controlled hydraulically-operated pipeline coupling device for use in connecting an underwater pipeline to an underwater wellhead assembly which closes an offshore well and controls the production of fluid therefrom.

A still further object of the present invention is to provide a remotely-controlled hydraulically-operated pipeline connector for use in connecting underwater pipelines to an underwater wellhead assembly, with the pipeline connector being provided with sealing means and locking means that are carried internally within the coupling so as to minimize or substantially eliminate corrosion and the growth of marine organisms on the metallic working portions of the coupling.

Still another object of the present invention is to provide a remotely-controlled hydraulically-operated pipeline coupling for use between an underwater pipeline and a wellhead assembly, wherein the sealing and locking elements of the coupling are carried by one-half of the coupling and are actuated successively by the application of a single pressure fluid thereto.

These and other objects of the present invention will be

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understood from the following description taken with regard to the drawing, wherein:

FIGURE 1 is a schematic view illustrating a wellhead assembly of the present invention positioned on the ocean floor;

FIGURE 2 is a side view of the pipeline coupling lowering mechanism shown in FIGURE 1; and,

FIGURES 3 and 4 are views taken in longitudinal cross-section of a hydraulically-operated pipeline connector or coupling, of the type to be used with the wellhead assembly of FIGURE 1, in its uncoupled and coupled positions, respectively.

Referring to FIGURE 1 of the drawing, a wellhead support structure 11 is shown as comprising a series of interconnected girders 12 and cross-bracing member 13. The bottom-most girders 12 may rest on a cement pad 14 which may be poured on the ocean floor in a manner described in copending patent application, Serial No. 830,538, filed August 30, 1959. A casinghead 15 is fixedly secured to the wellhead support structure 11 and is preferably installed therewith at the time the wellhead support structure is positioned over the well to be drilled.

Suitable apparatus is provided for guiding well equipment into place upon the casinghead 15, both during and after drilling operations. In the particular apparatus illustrated in FIGURE 1, the vertical members 17 of the wellhead support structure comprise vertical guide tubes 17 each having a vertical slot 18 cut through the wall thereof. Each piece of equipment to be lowered into place on the well casinghead 15 may be provided with two or more guide arms 21 adapted to extend through the guide slot 18 of two or more guide tubes 17 where they are connected to guide cones 22. The guide cones are of a diameter slightly less than the inner diameter of the guide tubes 17 and preferably have a lower portion that tapers downwardly.

Preferably, each of the guide tubes 17 has a cone-shaped flange 23 attached to its upper end which serves to align the guide cones 22 as they move downwardly into the guide tubes 17. Each of the guide cones 22 is provided with a vertical hole therethrough of a diameter slightly larger than the guiding cables 24 which are secured at their ends to the wellhead support structure within the bottom of the guide tubes 17 and extend upwardly to the surface where they are suspended from a drilling vessel or barge (not shown) from which operations are being carried out.

In FIGURE 1 the guide arms 21 are shown as being connected to a container 25 which may be employed to surround the wellhead assembly or production control unit of the well. For purposes of simplifying the drawing and description thereof, the wellhead assembly of the present invention is shown as comprising a pair of control valves 26 and 27 which are positioned in the production flow line 28 coming from the well. Although the well is illustrated as having a single string of well casing 30 and a single string of production tubing 31 extending downwardly into the well, it is to be understood that the present wellhead apparatus could be employed with wells having multiple strings of casing and tubing.

Normally, the production control unit or wellhead assembly enclosed within the container 25 comprises the necessary piping, valves, chokes, and other equipment normally connected together and mounted on the top of a well, and known as a "Christmas tree," together with the necessary hydraulic or electrical systems including pumps, reservoirs, motors, and etc., to operate the valves at the head of the well from a remote location. A typical example of a suitable underwater production control unit or wellhead assembly for use at an offshore well location, and the manner in which it is locked to the

casinghead 15, is shown and described in copending patent application, Serial No. 834,096, filed August 17, 1959.

The container 25 and the wellhead assembly contained therein is normally lowered into place by means of a string of pipe 32 known as a "running string" which has a running head 33 attached to the lower end thereof which may be connected to the top of container 25 or to its lubricator 34. The lubricator or wellhead closure 34 may be of any desired type suitable for use in offshore underwater wellhead assemblies. A typical lubricator or wellhead closure of this type is shown and described in copending application, Serial No. 830,587, filed August 30, 1959, now abandoned. A wellhead closure of this type permits re-entry into the well for well control or workover purposes. During normal production of a well the running string 32, running head 33 and any pressure tubing strings 35 and 36 which may be contained therein, are disconnected from the wellhead assembly and drawn to the surface. When not in use the guide cables 24 are dropped to the ocean floor where they may later be retrieved by grappling hooks or other suitable means when it is desired to use them again to lower equipment to the wellhead. During work-over or other operations on the well, the running string 32 and the running head 33 may be replaced by a marine conductor pipe string and a landing head or seal (not shown).

The production flow line 28 as it leaves the top of the wellhead assembly or the container 25 is preferably, though not necessarily, curved in an arc of substantial radius so that various tools, instruments, or other devices may be circulated through the production flow line and down into the well. As the flow line 28 passes horizontally by the container 25 it is preferably rigidly fixed thereto as by welding, clamping, bolting, etc.

A pipeline coupling or a pipeline connector consisting of a female portion 40 and a male portion 41 is installed in the production flow line 28 at a point close to the wellhead assembly or its container 25. Preferably, the male portion 41 of the coupling is fixedly mounted on a carriage 42 which is, in turn, fixedly secured by means of suitable braces 43, 44 and 45 (FIGURE 2) to one or more guide cones 46 and 47. The guide cones 46 and 47 are slidably mounted on a guide cable 48 which passes downwardly through a vertical guide tube 51 which is similar in design to guide tubes 17 and is provided with a slot 52 therein and a cone-shaped flange 53 on the top thereof. A suitable stop member is provided in the guide tube 51 so as to limit the downward movement of the cones 46 and 47 within the guide tube 51 so that the carriage 42, at the end of its travel, is positioned with the male portion 41 of the coupling on a level with the female portion 40. Instead of employing a stop member within the guide tube 51, the slot 52 therein could be terminated at some point above the bottom of the tube 51 so as to limit the downward travel of the lower guide cone 47.

The precise placement of the slot 52 in the guide tube 51 serves as aligning means between the carrier 42 and the cable 48 to position the male portion 41 of the coupling in substantially coaxial register and spaced relationship with the female portion 40 of the coupling. In some installations it may be found more advantageous to lower the male portion 41 of the coupling on its carriage 42 that is suspended between two parallel guide cables 48 which terminate in two parallel guide tubes 51. The portion 28a of the production flow line extending from the male portion 41 of the coupling is preferably flexible, but may also be a preformed rigid section, to facilitate positioning it on the ocean floor and attaching it to the female portion 40 of the coupling. In the event that the well has two or more production flow lines, then the wellhead assembly would be provided with two or more couplings.

The pipeline coupling 40-41 to be used in connecting the underwater pipeline 28a to the wellhead assembly

may be of any suitable type which is provided with a housing to protect its working parts against corrosion caused by the sea water and the growth of marine organisms. The connector 40-41 is preferably positioned substantially horizontally, i.e., up to about 45 degrees from the horizontal, for ease in making the connection. Additionally, the pipeline connector of the present invention is positioned to one side of the present wellhead assembly so that after the pipeline coupling 40-41 is disconnected, either the male end 41 of the coupling together with its pipeline 28a, or the female end 40 together with the wellhead assembly and container 25, can be raised to the surface independently while the other portion of the coupling and its attached equipment remain at the ocean floor or in their original position. The coupling 40-41 is of the power-actuated, remotely-operated type which may be of either the pneumatic, hydraulic, or electrical type with the power leads or fluid-pressure operating lines running independently to the surface. However, the coupling 40-41 is preferably of the remotely-controlled, hydraulically-operated pipeline coupling as shown in FIGURES 3 and 4 of the drawing. The female portion 40 of the coupling contains both the sealing and locking mechanism for forming a fluidtight seal with the male portion 41 of the coupling. The female portion of the coupling comprises a central tubular member 61 which forms an extension of the production flow line 28 and is fixedly secured thereto as by threads 62. The outer surface of tubular member 61 is reduced in diameter as at 63 so as to seat the end of a sleeve 64 which extends outwardly from the flow line 28. The outer surface of the tubular member 61 is further reduced in diameter, as at 65, to provide an annular flow passage 66 which is in communication at one end with the pressure fluid conduit 56. The outer surface of the sleeve 64 and the outer surface of the tubular member 61 and its largest diameter are fitted flush so as to serve as a guide tube on which a tubular or sleeve-type piston 67 is slidably mounted. The inner diameter of the piston 67 is enlarged over a portion of the length thereof in order to form an annular fluid passage 70 between the inside of the piston 67 and the outside of the sleeve 64.

The outside wall, forming the chamber in which piston 67 is slidably mounted, is formed by a coaxial sleeve or tubular member 71 which is fixedly secured to the end of the pipe 28 as by threads 79. The inner diameter of the tubular member 71 is increased over a substantial portion of its length to form an annular fluid passageway 72 between the outer wall of the piston 67 and the inner wall of the tubular member 71. The annular fluid passageway or chamber 72 forms the piston chamber in which the head 73 of the piston 67 moves. The length of the chamber 72 determines the length of the stroke of the piston 67. Thus, it is apparent that the length of the chamber 72 must be at least equal to the distance the opposite end 68 of the piston 67 must travel in order to be positioned in fluidtight engagement within a recessed portion 74 of the male portion 41 of the coupling.

Extending through the tubular member 71 which forms the cylinder wall for piston head 73 is a fluid passageway 75 in communication between the pressure fluid line 55 at one end of the apparatus and the space outside the other end of the tubular member. Extending through a substantial length of the piston wall 67 is a fluid passageway 76 which is in communication through a port 77, just below the head 73 of the piston 67, with the annular fluid chamber 72. The annular flow passage 66 is in communication through conduit 78 with the pressure fluid line 56 at the end of the coupling.

A collar 81, forming a tandem piston head with piston head 73, is fixedly secured, as by threads 82, on the outside of the piston 67 just below the tubular member 71, or at a distance from the head 73 of the piston 67 equal to or slightly greater than the stroke of the piston. Fix-

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edly secured to the outside surface of the annular collar or tandem piston 81 is a cylindrical housing 84 which is also in sliding fluidtight engagement with the end 85 of the tubular member 71. Preferably, the end 85 of the tubular member 71 is enlarged in diameter for design purposes so that a collar 81 of substantial thickness may be employed in order to increase the effective area against which pressure fluid acts, as well as to accommodate the necessary valve and conduit arrangement for unlatching the present coupling.

The piston head 73 moves within a chamber formed by the annular sleeve 64 and the tubular member 71. While it is possible to consider the enlarged end 85 of the tubular member 71 to be a piston moving within the chamber formed by the cylindrical housing 84 on the outside and the piston 67 on the inside, for purposes of clarification the enlarged end 85 of the tubular member 71 will be considered hereinbelow as the stationary end of a piston chamber since the tubular member is fixedly secured at 72 to the flow line 28. Thus, the collar 81 will be considered to be a tandem piston fixedly secured to and movable with piston 67, with the outside wall of piston 67 and the inside wall of housing 84 forming the piston chamber into which a pressure fluid is applied to move the piston 67, collar 81 and housing 84 axially along the central tubular member 61. A port 88 in the tubular member 71 is in communication between the fluid passage 75 therethrough and the space outside thereof at the end of chamber 72, whereby a pressure fluid may be applied to the outer face of the piston 73 for driving it to the right.

The extending portion 86 of a cylindrical housing 84 is enlarged in diameter providing a wall of substantial thickness for containing the locking mechanism of the present coupling. A portion of the wall of the end 86 of the cylindrical housing 84 is recessed to form a piston chamber 90 in which an annular piston 91 is slidably mounted. The piston 91 is fixedly secured to and slidable with a locking piston 92 which may be either in ring form or may comprise a plurality of individual locking elements adapted to engage a plurality of locking dogs 93 which are adapted to be seated in a locking groove 94 formed on the outer surface of the male portion of the coupling, as illustrated in FIGURE 4. The locking piston 92 is provided with a downwardly sloping surface 95 adapted to engage upwardly sloping surfaces 96 of the dogs 93 for raising the dogs 93 into the wall of the cylindrical housing 86 so that the female portion 41 of the coupling can be withdrawn.

The locking dogs or latching members 93 are spring-loaded in any suitable manner, as by being provided with spring-like arms 97 which allow the dogs 93 to extend normally through slots 98. A locking head 101 is carried at the end of the locking piston 92 for locking the dogs 93 in place in the annular groove 94 of the male portion 41 of the coupling, as shown in FIGURE 4.

In the locked position shown in FIGURE 4 of the drawing, a chamber 102 is formed in back of piston 91 between the outer surface of the collar 81 and the inner surface of the locking piston 92. At the same time another chamber 103 is formed between the collar 81 and the enlarged end 85 of the tubular member 71 and between the cylindrical housing 84 and the piston 67. In the locked position the chambers 102 and 103 are in communication through fluid passageways 104 and 105 and through passageway 108 of a spring-loaded valve 106 which has been forced inwardly by the face 107 of the male portion 41 of the coupling to be positioned, as shown in FIGURE 4, so that the passageways 104 and 105 are in communication through 108.

The piston 91 is provided with a flow passageway 110 while the cylindrical housing 84 is provided with passageway 111 and the collar 81 is provided with passageway 112. These flow passageways 110, 111 and 112 form a continuous flow passage so that in the unlatched position the chamber 90 formed on one side of the annular piston

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91 is in communication through flow passageways 110, 111, 112, 76 and 77 with the annular fluid chamber 72. The chamber 90 is also in communication through a passageway 113 through the collar 81, through passageway 114 in the piston 67 and through port 115 in the annular sleeve 64 so as to communicate through annular flow passage 66 and conduit 78 with the fluid pressure line 56. The annular fluid passageway 70 between the piston 67 and the sleeve 64 is in communication at all times through port 115 with the annular flow passageway 66 and thence through conduit 78 with the pressure fluid conduit 56. The outer surface of the piston 67 near the end 68 thereof is provided with suitable sealing means 116, such for example as O-ring seals or rings of packing, which act as a primary seal between the male and female portions of the coupling. The inner surface of the cylindrical housing 84, or the outer surface of the male coupling 41, is provided with a seal 120 which closes the space between the housing 84 and the male portion 41 of the coupling in a fluidtight manner. The ends of the female 40 and the male 41 portions of the coupling are bevelled, as at 117 and 118, respectively, to aid in aligning the two portions of the coupling when the female portion is forced toward the male portion.

A connection is made between the male and female portions of the coupling shown in FIGURE 3 by applying a pressure fluid from any suitable source through conduit 55. The pressure fluid passes through fluid passageway 75 and port 88 to exert pressure against pistons 81 and 73, respectively, moving them to the right together with the cylindrical housing 84 and the locking dogs 93. As the cylindrical housing 84 approaches the male portion 41 of the coupling, tapered faces 117 and 118 of the female and male portions of the coupling align the two portions so that the end 68 of the piston 67, containing the sealing rings 116, moves into and is seated within the recessed opening 74 of the male portion 41 of the coupling. The end 68 of the piston 67 continues to slide into the recessed portion 74 until the face 107 of the male portion 41 of the coupling forces the fluid transfer valve 106 to the left, aligning the conduit 108 therein with conduits 104 and 105. At this time, the locking or latching dogs 93 are positioned over slots 98 so they may enter the annular groove 94 in the outer surface of the male portion 41 of the coupling. With the valve 106 in the position shown in FIGURE 4 of the drawing, the continued application of a pressure fluid through conduits 55 and 75 and into chamber 103 causes pressure to be exerted through conduits 105, 108 and 104 and into chamber 102 where pressure is applied to the right side of the piston 91 causing locking piston 92 to move to the left so that the locking head 101 of the locking piston bears against the top of the locking dog 93, thus anchoring it in place.

During the sealing and locking operations of the coupling described above, fluid in the annular chamber 72 is exhausted through port 77, passageways 76, 112, 111, 110 and into chamber 90 and thence through passageways 113 and 114, port 115 and passageways 66, 78 and 56 to the hydraulic fluid reservoir (not shown).

To disengage the coupling shown in FIGURE 4, pressure fluid is applied through conduits 56, 78 and 66 and thence through port 115 and passageways 70, 114 and 113 to exert a pressure on the left side of piston 91, thus forcing it to the right. As the locking piston 92 is forced to the right, the locking head 101 is removed from the top of the locking dog 93 and the downwardly sloping face 95 of the locking piston 92 engages the upwardly sloping face 96 of the locking dog 93 to raise the spring-loaded locking dog 93 into its retracted position, as shown in FIGURE 3 of the drawing. As the piston 91 reaches the end of its travel to the right, the conduit 110 therein is brought into communication with the conduit 111 of the cylindrical housing so that pressure fluid from the chamber 90 flows through passageways 110, 111, 112,

76 and port 77 to exert a pressure on the underside of the piston head 73, thus causing it to move to the left. As the piston 91 moved to the right in FIGURE 4 to unlock the dogs 93, fluid in the chamber 102 is exhausted through fluid passageways 104, 108 and 105 into the chamber 103 and thence through passageway 75 and conduit 55 to the hydraulic fluid reservoir (not shown). At the same time, fluid in the chamber 72 to the left of the piston 73 is exhausted through port 88 and conduit 55 to the reservoir. In operation, pressure fluid may be supplied to unlock the coupling of the present invention in a manner described in copending patent application, Serial No. 830,587, filed August 30, 1959, wherein a pair of tubing strings 35 and 36 (FIGURE 1) are inserted through a running string or marine conductor 32 to supply pressure fluid selectively to conduits 55 and 56 leading to the coupling.

This patent application is a continuation of United States patent application, Serial No. 835,931, filed August 25, 1959, now abandoned.

I claim as my invention:

1. A pipeline coupling unit comprising
 - (a) first and second mating members positionable in spaced or coupled relationship and having flow passageways therethrough and adapted to be positioned initially in spaced relationship and approximate coaxial alignment,
 - (b) said first member being provided with a sealing surface around its flow passageway for receiving a sealing surface of said second member
 - (c) sealing means on one of said sealing surfaces adapted to seal between said sealing surfaces of the first and second members,
 - (d) said second member comprising
 - a fixed tubular member adapted to be aligned with said first member,
 - a slidable tubular member outside and slidable relative to said fixed tubular member and concentric therewith,
 - actuating means engaging said slidable tubular member to move said tubular member between retracted and extended positions to engage said first mating member,
 - (e) said sealing surface of said second member being located on the extendable end portion of the slidable member, and
 - (f) aligning means carried by said slidable member and disposed radially from said sealing surface of the second member and engageable with the first member whereby said first and second members are movable from approximate to substantial alignment to permit co-engagement of the sealing surfaces.
2. The apparatus of claim 1 including releasable latching means carried by the slidable member and engageable with said first member to latch the members in coupled relation.
3. The apparatus of claim 2 wherein the slidable member is adapted to concentrically surround said first member and includes secondary seal means between the end thereof and the releasable latching means to seal and latch to said first mating member.
4. A pipeline coupling unit adapted to connect an underwater wellhead to an underwater pipeline, said coupling unit comprising
 - first and second mating members having central flow passageways therethrough adapted to be initially positioned in spaced relationship and approximate coaxial alignment and subsequently positionable in coupled relationship,
 - said second member of said coupling comprising
 - a fixedly-positioned central tubular member adapted to be aligned with said first member,
 - sleeve means carried by said tubular member and having an end portion telescopically extendible beyond the end of said tubular member into re-

- leasable sealing engagement with said first member,
 - actuating means carried by said second member and operatively-connected to said sleeve means for moving said sleeve means into engagement with said first member,
 - annular resilient seal means carried on at least one surface of said extendible end of said sleeve means and engageable in fluidtight contact with said first member, and
 - axially-directed aligning means disposed radially from said seal means on said second member for engaging said first member to bring said first and second members into substantial axial alignment.
5. The apparatus of claim 4 including releasable locking means carried by the extendible end of said sleeve means engageable with said first member.
 6. The apparatus of claim 4 wherein, one of said members of said coupling being provided with seating means at the end thereof coaxial with said central flow passageway for receiving at least a portion of the adjacent end of said other member.
 7. The apparatus of claim 4 including secondary seal means carried by said sleeve means between the extending end thereof and said locking means and engageable in fluidtight contact with said first member.
 8. A pipeline coupling unit adapted to connect an underwater wellhead to an underwater pipeline, said coupling unit comprising
 - first and second mating members positionable in spaced or coupled relationship and having central flow passageways therethrough adapted to be positioned initially in spaced relationship and approximate coaxial alignment,
 - said second member of said coupling comprising
 - a fixedly-positioned central tubular member adapted to be aligned with said first member,
 - sleeve means carried outwardly of and by said tubular member in fixed spaced coaxial relationship forming piston chamber means outside said tubular member,
 - piston means axially slidable relative to said tubular member in said piston chamber,
 - said piston means being telescopically extendible beyond the end of said tubular member into releasable sealing engagement with said first member and surrounding at least a portion of said first member when connected thereto,
 - resilient seal means carried on at least one surface of the extending end of said piston means and engageable in fluidtight contact with said first member, and
 - conduit means through said second coupling member for applying a pressure fluid selectively to said piston means to connect and disconnect said coupling.
 9. The apparatus of claim 8 including axially-directed aligning means disposed radially from said seal means on said second member for engaging said first member to bring said first and second members in substantial axial alignment.
 10. A hydraulically-actuated pipeline coupling unit adapted to connect an underwater wellhead to an underwater pipeline, said coupling unit comprising first and second mating members having central flow passageways therethrough adapted to be brought into spaced relationship and substantially coaxial alignment, one of said members of said coupling being provided with a seating recess in the end face thereof coaxial with said central flow passageway for receiving at least a portion of the adjacent end of said other member thereinto, said second

member of said coupling comprising a fixedly-positioned central tubular member adapted to be aligned with said first member, sleeve means carried outwardly of and by said tubular member in fixed spaced coaxial relationship forming an annular piston chamber outside said tubular member, annular piston means axially slidable on said tubular member in said piston chamber, said annular piston means being of a length sufficient so that one end thereof extends from said piston chamber and beyond the end of said tubular member to connect operatively with said first member, seal means carried on the extending end of said piston means and adapted to be positioned in fluidtight contact with said first member, releasable locking means carried by the extending end of said piston means engageable with said first member, and conduit means through said second coupling member for applying a pressure fluid selectively to said piston means to connect and disconnect said coupling.

11. A hydraulically-actuated pipeline coupling unit adapted to connect an underwater wellhead to an underwater pipeline, said coupling unit comprising first and second mating members having central flow passageways therethrough adapted to be brought into spaced relationship and substantially coaxial alignment, said first member of said coupling being provided with a seating recess in the end face thereof around said central flow passageway, and latching recess means on the outer surface of said first member for seating coupling locking means, said second member of said coupling comprising a fixedly-positioned central tubular member adapted to be axially aligned with said first member, a sleeve carried by said second member in fixed spaced coaxial relationship outside said tubular member, means closing the annular space between said sleeve and said tubular member at one end thereof to form a piston chamber, an annular piston axially slidable on said tubular member in said piston chamber, said annular piston being telescopically extendible beyond the end of said tubular member to seat within said seating recess of said first member, seal means carried outwardly on the end of said piston adapted to be positioned in said seating recess, a collar fixedly carried on the outside of said annular piston forming a tandem piston movable therewith outside said piston chamber, a tubular housing fixedly secured on the outside of said collar and coaxial therewith, a portion of said tubular housing toward one end thereof being in telescoping slidable fluidtight engagement with said sleeve, the other end of said tubular housing extending a distance sufficient to cover substantially said first member of said coupling at the end of the piston stroke, locking dogs carried by said tubular housing and releasably engageable in the latching recess means on said first member of said coupling, spring means biasing said locking dogs to a locked position, a locking and unlatching piston slidably carried by said tubular housing for selectively holding said locking dogs in locked position in said first member and subsequently unlatching and retracting said locking dogs at the other end of said piston stroke, conduit means through said second coupling member for applying selectively a pressure fluid to first one of said pistons to connect and lock said coupling and then to the other side of said pistons to unlatch and disconnect said coupling.

12. A hydraulically-actuated pipeline coupling unit adapted to connect an underwater wellhead to an underwater pipeline, said coupling unit comprising first and second mating members having central flow passageways therethrough adapted to be brought into spaced relationship and substantially coaxial alignment, said first member of said coupling being provided with a seating recess in the end face thereof around said central flow passageway for receiving a portion of said second member thereinto in fluidtight engagement, and latching recess means on the outer surface of said first member for seating coupling

locking means, said second member of said coupling comprising a fixedly-positioned central tubular member adapted to be axially aligned with said first member, a sleeve carried by said second member in fixed spaced coaxial relationship outside said tubular member, said sleeve being shorter than said tubular member, means closing the annular space between said sleeve and said tubular member at one end thereof, a seal-carrying annular piston axially slidable on said tubular member in a piston chamber formed by the annular space between said sleeve and said tubular member, said annular piston being of a length sufficient so that one end thereof extends from said piston chamber and beyond the end of said tubular member to seat within said seating recess of said first member, seal means carried outwardly on the end of said piston adapted to be positioned in said seating recess, a collar fixedly carried on the outside of said annular piston forming a tandem piston movable therewith outside said piston chamber, a tubular housing fixedly secured on the outside of said collar and coaxial therewith, a portion of said tubular housing toward one end thereof being in coaxial slidable fluidtight engagement with a portion of the outer surface of said sleeve at all times, the other end of said tubular housing having a chamber formed in the wall thereof, which wall extends a distance sufficient to cover substantially said first member of said coupling at the end of the piston stroke, locking dogs normally extending inwardly from said tubular housing into the latching recess means on said first member of said coupling, spring means in contact with said locking dogs urging said dogs to a locked position, a locking and unlatching piston slidably carried within the chamber of said tubular housing for selectively holding said locking dogs in locked position in said first member and subsequently unlatching said locking dogs therefrom, first conduit means through said second coupling member for applying a pressure fluid to one side of said annular and tandem pistons to connect said coupling, second conduit means in communication with said first conduit means for applying a pressure fluid to said locking piston, spring-loaded normally-closed valve means in said second conduit means, said valve means extending beyond said collar and adapted to be opened by contact with said first member of said coupling, third conduit means in said second coupling member for applying pressure fluid to the other side of said locking piston to unlatch said dogs, fourth conduit means in said second coupling member for applying pressure fluid to the other side of said annular piston to disconnect said coupling, valve means operatively connected to said locking piston for closing said fourth conduit means when said dogs are in a locked position, guide means carried by at least one of said coupling members on the cooperating ends thereof for bringing said first member in register with said second member as the members are coupled together, and seal means carried between the inner surface of said tubular housing and the other surface of said first coupling member.

13. A hydraulically-actuated coupling system adapted to effect a remotely-controlled connection and disconnection of a pair of conduits, said coupling system comprising: first and second mating members, one attached to each of the conduits to be connected, with a central flow passage through each mating member in fluid communication with the passage in the conduit to which it is attached; guiding and supporting means for guiding at least one of said mating members and supporting it in spaced relationship and in substantially coaxial alignment with the other mating member; said second mating member of said coupling comprising a fixedly-positioned central tubular member adapted to be aligned with said first member, sleeve means carried outwardly of and by said tubular member in fixed spaced coaxial relationship forming an annular piston chamber outside said tubular member, annular piston means axially slidable on said tubular

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member in said piston chamber, said annular piston means being telescopically extendible beyond the end of said tubular member in releasable sealing engagement with said first member, seal means carried by the extending end of said piston means and engageable in fluid-tight contact with said first member, and conduit means 5 through said second coupling member for applying a pres-

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sure fluid selectively to said piston means to connect and disconnect said coupling.

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