

May 20, 1969

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3,445,126

MARINE CONDUCTOR COUPLING

Original Filed May 10, 1965

Sheet 1 of 2

FIG. 1.

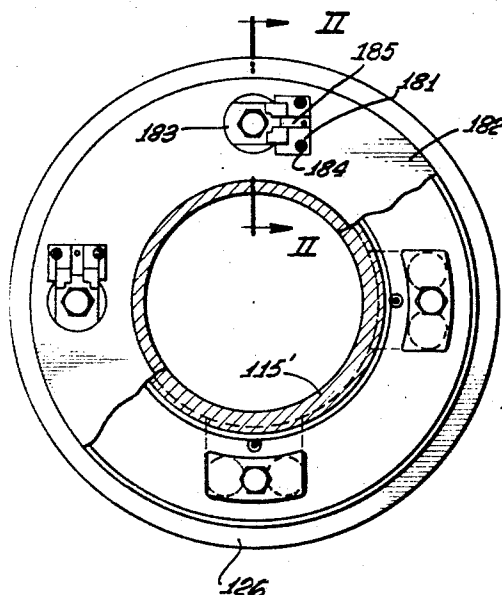


FIG. 3.

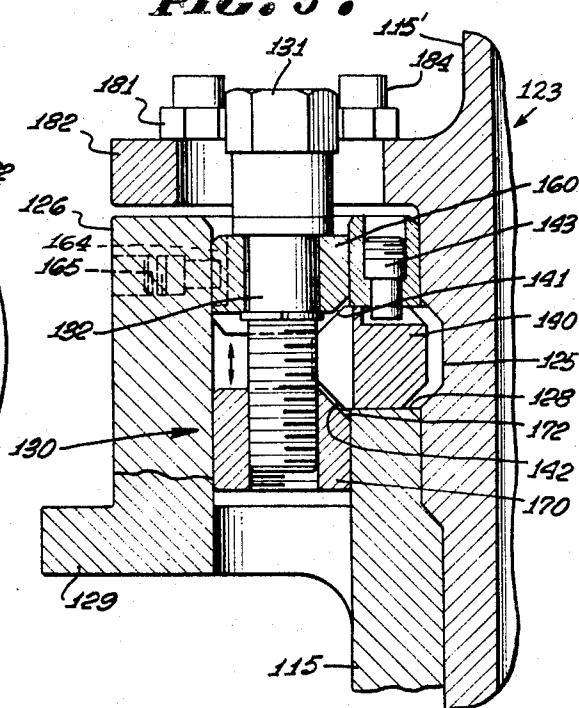


FIG. 2.

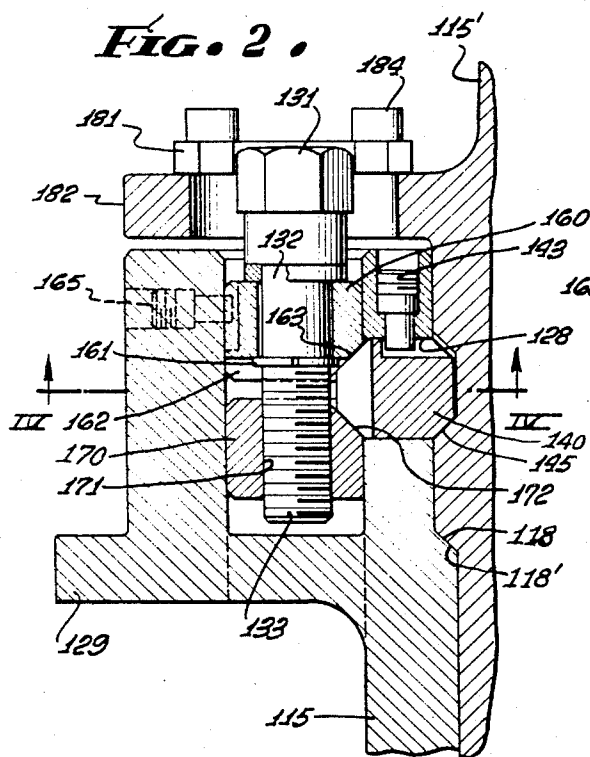
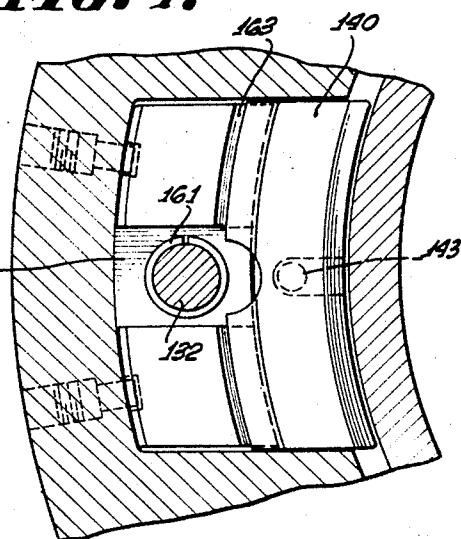


FIG. 4.



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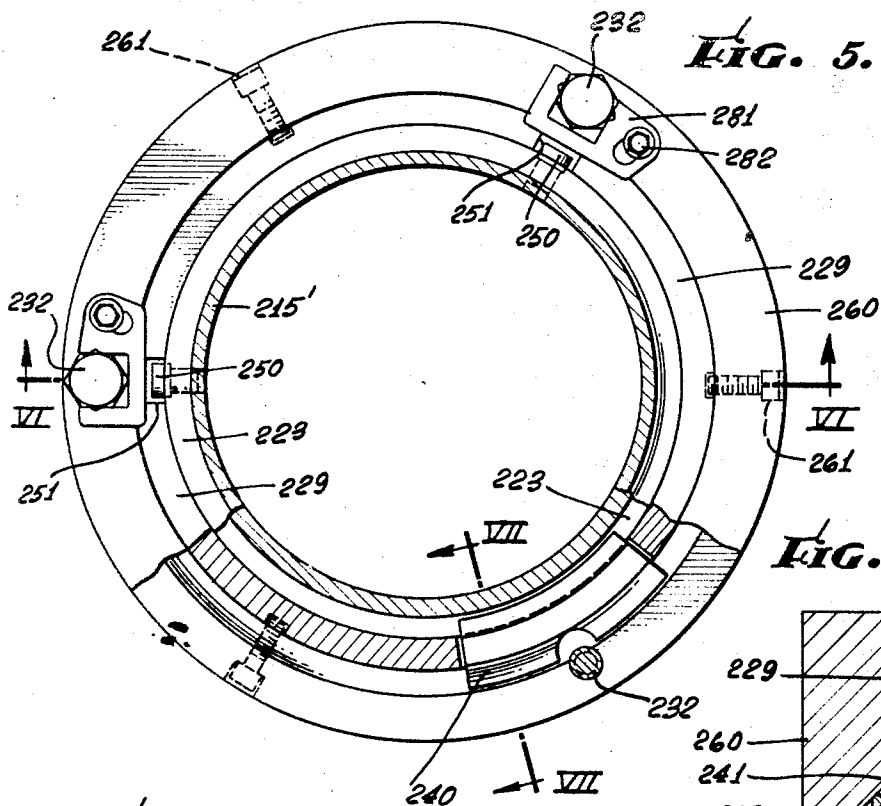


FIG. 5.

FIG. 6.

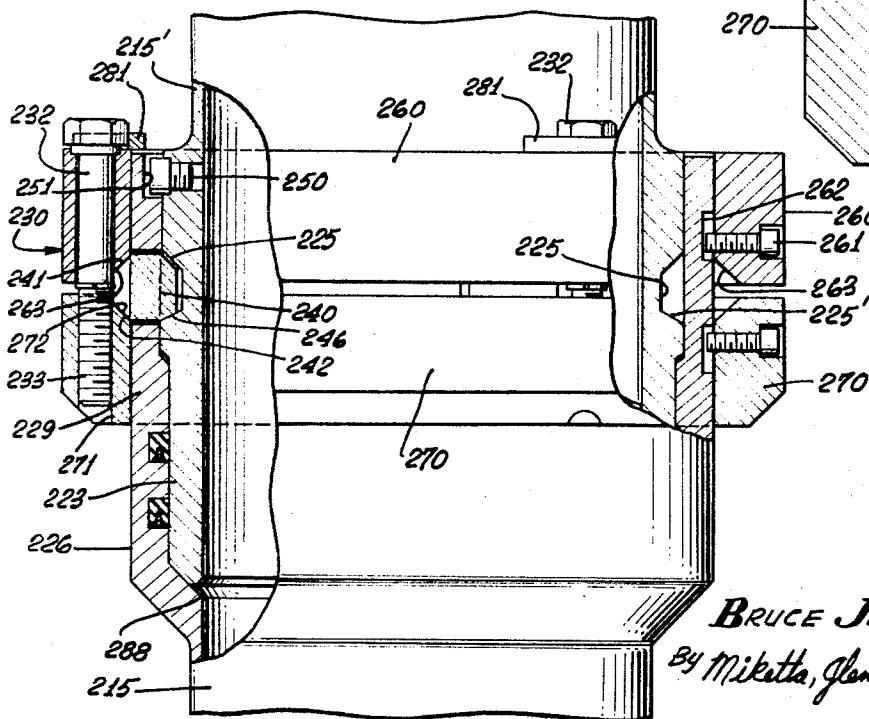
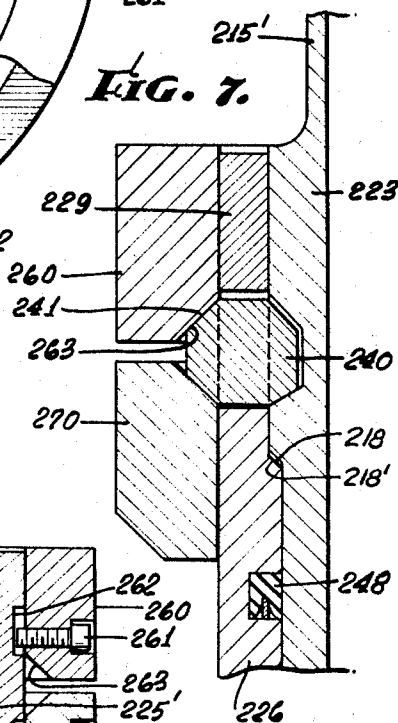


FIG. 7.



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MARINE CONDUCTOR COUPLING

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Original application May 10, 1965, Ser. No. 458,813.

Divided and this application May 19, 1966, Ser. No. 554,632

Int. Cl. F16I 55/00

U.S. Cl. 285—85

3 Claims

ABSTRACT OF THE DISCLOSURE

A marine conductor coupling for releasably tightly connecting conductors or conduits such as may be used in oil well drilling. The coupling provides a tight continuous wedging between a gib and socket means which are connected to the adjacent ends of the pipes or conductors to be joined. The pipes are constantly axially wedged toward one another through opposed force transmitting wedging dogs and latching dogs.

This application is a divisional application of my copending application, Ser. No. 458,813 filed May 10, 1965 entitled "Marine Conductor Coupling" now abandoned which is a continuation-in-part application of my previously copending application, Ser. No. 300,277 filed Aug. 6, 1962, entitled "Marine Conductor Coupling" now abandoned.

This invention relates in general to oil well drilling and production and pipe couplings employed therein to join successive sections of pipe or conduits. More particularly, this invention relates to a marine coupling particularly well suited for use in subsea oil well drilling to releasably tightly couple successive conductor conduits, control tubes and other pipes run down through sea water to connect to equipment on the ocean floor.

While the present invention is susceptible of use in drilling of oil wells on land, it is particularly well suited for use in subsea oil well drilling where marine conductors and control tubes, as disclosed in my copending application, Ser. No. 326,917 filed Nov. 29, 1963, now Patent No. 3,332,484 are employed. The use of a conductor pipe running from the oil well rig down to the subsea well or formation is common in subsea oil well drilling and producing operations for the transmission of fluids to or from the well through the sea water environment as well as for drilling therethrough with conventional drill pipe. As disclosed in my above-mentioned copending application, control tubes may be employed on a subsea well to control the operation of oil well drilling tools during drilling operations and the well operation during production.

Previously, marine conductor pipe conduits or sections have been coupled by threaded couplings screwed together. The threading of one conduit into another on board the drilling or production vessel is a time-consuming task. Also, various troubles such as cross-threading and even unintentional uncoupling of successive conduits or sections can occur which cause additional undue delay and expense. Such uncoupling may be due to movement of the conduits caused by drilling vibration, movement of sea water about the conduits and movement of the vessel or floating barge mounting the well rig relative to the well. In some instances attempts to rotate the conduit counter to the direction of its coupling threads to back out a tool engaged in the well has caused inadvertent uncoupling. Prior attempts to solve this problem have consisted of welding metal straps across the coupling joints to prevent their uncoupling and use of various

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forms of clamps, all of which have been unsatisfactory.

It is the principal object of this invention therefore to disclose and provide a coupling capable of rapid coupling and uncoupling of successive conduits or pipes which will not become unintentionally uncoupled in use, is very easily operated on board a drilling vessel, below the sea at a well site or in a trench or well dug on land and in which the coupling parts may be continuously wedged together by the coupling locking means.

It is another object of the present invention to disclose and provide a threadless coupling for use between successive conduits as employed in oil well drilling and producing operations which will allow a rapid continuously tightly wedged closed coupling of successive conduits and permit rotation of the conduits in either direction without causing interference with the conduit interior or possible drilling and producing operations conducted through the conduits and coupling.

It is a further object of this invention to disclose and provide a simply constructed easily and rapidly operated latching means for a marine coupling employed between successive conduits which will effect a very strong mechanical continuously wedging couple without interfering with drilling or producing operations to be conducted through the coupling.

It is another object of the invention to disclose and provide a latching means as in the foregoing object which presents an exterior configuration capable of being easily lowered through annular guide means in instances where the coupled conduits are being guided to a subsea oil well and will not interfere with the use of the conduit interior for transmission of fluids or containing control tubes.

A still further object of this invention is to disclose and provide a marine coupling and torque transmitting means employed therein such that turning torque applied between coupled conduits due to intended or unintended rotation thereof will be transmitted through the coupling without uncoupling such conduits, yet which means is easily and readily uncoupled by merely separating the conduits by non-rotative movement in the direction of their axes after release of the associated latching means.

Generally stated, the marine conductor coupling comprises an annular gib means supported on the end of a first conduit and including means for supporting a circumferential latching dog, an annular socket means supported on a second conduit for receiving the gib means, and including a seat for abuttingly receiving the landing surface of the first conduit gib means, a plurality of latching dogs mounted on the annular socket means for movement radially inwardly into the annular gib means circumferential groove so as to continuously wedge the gib means landing surface against the seat in the annular socket means, a pair of opposed force transmitting wedges for continuously wedging the latching dog, and latching pins for selectively moving the opposed force transmitting wedging dogs.

Other objects as well as various advantages of the marine conductor coupling, in accordance with my invention, will become obvious to those skilled in the art from a consideration of the following detailed description of an exemplary embodiment thereof. Reference will be made to the appended sheet of drawings in which:

FIG. 1 is a plan view of an exemplary embodiment of the marine conductor coupling in accordance with my invention;

FIG. 2 is a vertical section of the embodiment of FIG. 1 taken in the plane II—II showing the latch means in notch engaging and gib wedging or latched position;

FIG. 3 is a vertical section as in FIG. 2 showing the latch means in unlatched non-wedged position;

FIG. 4 is a horizontal section taken of the embodiment of FIG. 2 in the plane IV—IV;

FIG. 5 is a plan view of alternative exemplary embodiment of the marine conductor coupling in accordance with my invention;

FIG. 6 is a vertical sectional view of the embodiment of FIG. 5 taken therein in the plane VI—VI; and

FIG. 7 is a detail sectional view of the embodiment of FIG. 5 taken therein in the plane VII—VII.

It should be understood that the couplings in accordance with the present invention may be employed to couple successive conduits employed for any oil well drilling or production operation wherein a first conduit is to be releasably coupled to a second conduit without obstruction to the interior or exterior of the conduits and where uncoupling of the connection due to rotation of one conduit relative to the other is to be avoided. The term conduit as used herein refers to any casing, pipe or string used in well drilling or production.

A first exemplary embodiment of a marine conductor coupling according to the present invention is shown in FIGS. 1 through 4. In this exemplary embodiment the lower end of first conduit 115' is provided with an integrally formed gib means 123 having a circumferential groove 125. The upper end of conduit 115 is provided with an annular socket means 126 to receive the portion 123. The annular wall 129 of the receptacle 126 is provided with sufficient thickness, as shown in FIGS. 2 and 3, to receive latching means, indicated generally at 130. The latching means is operable within the annular wall 129 of the socket means with only a manually operable bolt head 131 protruding coaxially from the socket member 126. In this exemplary embodiment, the latching means comprises a plurality of latch pins 132, a plurality of latch elements or locking dogs 140 and a plurality of force transmitting dogs 160 and 170 associated with said pins and latching dogs to cause latching of the first conduit to the second conduit upon downward rotation of the latch pins 132.

The plurality of latch elements or dogs 140, operable by manipulation of latch pins 132, are provided to selectively engage or wedge against the tapered side walls of the circumferential notch 125 on the gib or enlarged member 123 mounted on the end of the first conduit 115'.

The four dogs 140 in the exemplary embodiment are each provided with generally flat top, bottom and side walls or surfaces to facilitate sliding of each dog within the socket or receiver member 126. Means slidably mounting each dog 140 within the socket means for such movement normal to the axis of the socket means are provided by the apertures 128 in the annular wall 129. Each aperture 128 is of generally the same configuration as the exterior of each dog 140 allowing a sufficiently loose fit for each dog to slide freely therein. As shown in FIGS. 2 and 3, the means slidably mounting the dogs 140 are each oriented relative to the vertical annulus of the wall 129 in which the pins 132 are mounted such that each of the plurality of latching pins 132 is vertically aligned with an associated latching dog 140 through associated force transmitting dogs 160 and 170.

In FIG. 2, a latching dog 140 is shown held or wedged into its notch engaging position continuously wedging the gib end wall landing surface, or an annular side wall landing surface 118' down on a socket seat, as seat 118. The associated latching pin 132 has been selectively rotated toward its lowered position whereby it has acted through the force transmitting dogs 160 and 170 to wedge latching dog 140 inwardly, bringing the projecting portion 145 into continuous wedging engagement with the tapered side wall of the circumferential notch 125. Dogs 160 and 170 can still be further tightened together to continue to apply further wedging forces against dog 140.

In FIG. 3, the latching dog 140 is shown out of notch engaging position and where the latching pin 132 has been withdrawn allowing separation of the force transmitting dogs 160 and 170.

Force transmitting dogs 160 and 170 are included in

the latching means of the embodiment of FIGS. 1 through 4 to transmit rotational force of the latching pin 131 into transverse wedging movement of the latching dogs 140 which wedge into the notch 125 of the first conduit 115'. These dogs or latch members may be provided in the form of continuous concentric rings or in arcuate segments as shown in FIGS. 1 through 4. The upper or first force transmitting dog 160 is ported to fit loosely about a non-threaded central portion of pin 132 and is held in place upwardly relative to the pin 132 by a slip ring 161. As seen in FIG. 4, the slip ring 161 is applied to the pin 132 in a channel 162 provided in the bottom surface of the force transmitting dog 160 to raise the upper dog 160 on outward rotation of pin 132. A beveled surface 163 on the dog 160 is adapted to bear or wedge against a mating beveled surface 141 on the dog 140, as best seen in FIG. 3. The upper force transmitting dog 160 is also provided with a vertical channel or slot 164 to receive a limiting pin or stop 165 which limits the upward movement of the dog 160 and latching pin 131 so that it remains in assembled relation within the wall 129.

A lower or second force transmitting dog 170 is provided with a center tapped hole 171 to receive the threaded portion 133 of the pin 132. Lower force transmitting dog 170 is provided with an upwardly directed beveled surface 172 adapted to abut and wedge a mating surface 142 on the latching dog 140, as best shown in FIG. 3. The dog 140 wedges gib 115' down into tight engagement with socket 115 as shown at 118 in FIG. 2.

Starting with the force transmitting dogs 160 and 170 and the latching dog 140 in the position of FIG. 3, it may be seen readily that rotation of pin 132 will cause a rising of the lower force transmitting dog 170 until it abuts the lower beveled surface 142 of the latching dog 140. The latching pin 132 and upper dog 160 will then be lowered, if not already lowered by the force of gravity, with consequent pressuring of the latching dog 140 between the force transmitting dogs 160 and 170. The application of forces by the dogs 160 and 170 through the beveled surfaces 163 and 172 to the latching dog beveled surfaces 141 and 142 wedges the latching dog to the right in FIG. 3 into the latching position with the dog 140 continuously wedging against the lower tapered side wall of notch 125 in notch engaging position as shown in FIG. 2. A limiting pin 143 is provided in the wall 129 to limit the outward movement of the latching dog 140 in the absence of an inner conduit 115' to insure that the assembly will not become disassembled and the dog 140 lost.

Referring now to FIG. 1, spring loaded safety latch means may be provided on a flange extending from the first conduit 115' to insure the locking of the aforedescribed continuously wedging exemplary latching means. Such spring loaded safety latch means may comprise a plate 181 mounted upon a flange 182 formed integrally with the first conduit 115' and a spring biased latch or cover plate 183 having a hexagonal shaped opening or port to fit over the hexagonal head 131 of the associated latching pin 132. The plate 181 may be secured to the flange 182 by means of fasteners or Allen head bolts 184. Latching plate or cover plate 183 may be pivoted by an arm 185 to the plate 181 and be spring-biased toward the latching pins by conventional means. The latching plates hold the latching pins against loosening under the counter wedging forces exerted thereon by forces tending to separate the gib and socket means.

An alternative exemplary embodiment of marine conductor coupling, according to the present invention, is shown in FIGS. 5 through 7. In this alternative exemplary embodiment, the first conduit 215' is provided with an integrally formed enlarged portion or gib 223. Gib means 223 is provided with a circumferential notch 225 having inclined or tapered side walls in a same manner as shown in the prior embodiment of FIGS. 1 through 4.

The second or lower conduit 215 is provided with the second part of the coupling, the annular socket means

226. The annular wall 229 of the socket means or receptacle 226 mounts the latching means, indicated generally at 230.

As in the prior exemplary embodiment, the latching means indicated generally at 230 includes a plurality of latch pins 232, a plurality of latch elements or latching dogs 240 and a plurality of force transmitting dogs associated with the pins and latching dogs to cause a continuous wedging latching of the first conduit to the second conduit upon downward rotation of the latch pins 232.

The plurality of latch elements or latch dogs 240 are constructed and operate in the same manner as the dogs 140 in the prior embodiment of FIGS. 1 through 4. In this alternative exemplary embodiment, three such dogs 240 are employed rather than the four dogs 140 of the prior embodiment. The wedging of each dog 240 against the lower inclined or tapered surface of notch 225, as shown in FIGS. 6 and 7, to tightly seat the upper conduit 215' down within the socket means of the lower conduit 215 is accomplished by manually operating the latching pins 232, just as in the prior embodiment of FIGS. 1 through 4. However, the force transmitting dogs 260 and 270 of the present embodiment are made in continuous rings extending around the socket wall 226 rather than in separate segments, as in the prior embodiment of FIGS. 1 through 4.

The upper or first force transmitting dog or ring 260 is provided with ports to receive non-threaded central portions of pins 232 and is held upon the socket wall 226 by locating pins 261 in addition to seating upon the dogs 240. The vertical travel or ring 260 on the wall 226 is limited by the vertical slot 262 receiving the associated guide pin 261. A lower beveled surface 263 on the dog or ring 260 is provided to wedge against a mating beveled surface 241 on the associated dogs 240, as seen in FIGS. 6 and 7.

The lower or second force transmitting dog or ring 270 is provided with tapped holes 271 to receive the threaded portion 233 of the pins 232. An upwardly directed beveled surface 272 is provided on the lower force transmitting ring 270 to wedge against a mating surface 242 on the latching dogs 240, as seen in FIGS. 6 and 7.

Rotation of the pins 232 causes the lower ring 270 to rise until it abuts the lower beveled surface 242 of the latching dog 240. Further rotation of pins 232 brings the upper dog or ring 270 down upon the latching dogs 240, wedging the dogs 240 between the latching rings or force transmitting members 260 and 270. The latching dogs 240 in turn wedge against the lower side wall of the notch 225 to continuously wedge the lower end wall of gib means 223 down tightly against an annular seat 288 formed in the lower portion of the socket 226 as seen in FIG. 6. A very tight rigid coupling is effected due to this continuous wedging action between the force transmitting dogs 260, 270 and the beveled surfaces of the dogs 240 engaged thereby and the continuous wedging action between the inner lower beveled or wedging surface 246 of dogs 240 and the lower inclined or beveled side wall 225' of the notch 225. An annular landing surface 218' may also be employed on the gib means, as seen in FIG. 7, for landing on and being wedged against a socket seat 218.

Safety latch means may also be provided in this alternative exemplary embodiment, as shown in FIG. 5, to prevent loosening of the latch pins 232 which might otherwise occur because of the counter forces exerted thereon due to the wedging rather than blocking, action of the dogs 240, 260 and 270. Such safety latch means may comprise the pivoted plates 281, pivotally mounted by pivot pins 282 upon the upper surface of the upper force transmitting dog or ring 260.

Torque transmitting means for transmitting conduit rotating torque between the first and second conduits when the gib means is received in the socket means, may also be provided in this alternative exemplary embodiment of FIGS. 5 through 7. Such torque transmitting means may

comprise a plurality of laterally extending torque pins 250 mounted, as by a threaded engagement, in the upper conduit gib means 223. Head portions of the torque pins 250 are received into aligned upwardly opening transverse slots 251 provided in the annular wall 229 of the receiver or socket member 226. The torque transmitting means allows the ready coupling and uncoupling of the successive conduits, the pins 250 readily sliding in and out of the slots 251 upon coupling and uncoupling, while providing positive transmittal of conduit turning torque between successive conduits in either rotational direction about the axis of the conduits.

Seal means may also be provided in this alternative exemplary embodiment between the gib means and the socket means. Such seal 248 may be of any conventional sealing material and may be provided in an annular recess in the interior of the socket 226 to seal against the gib means 223 when it is received within the coupling.

From the foregoing detailed description of exemplary embodiments of the marine conductor coupling, it can be seen that a simply operable, exceedingly strong, unailing continuously wedged together coupling between successive conduits may be effected by provision of the coupling according to the present invention. Turning torque between adjacent conduits may be effectively transmitted by the coupling and, if desired, rotation of the string of conduit couplings in either direction may be accomplished.

It is to be observed that the exemplary embodiments have the advantage of permitting the coupling elements to be made with greater tolerances, since they permit the application of locking and wedging forces over a range not limited to precise blocking relations.

No rotation of any individual conductor conduit may occur when coupled to adjacent couplings by the marine conductor coupling of the present invention and no uncoupling of any individual conduit can be accomplished, as was frequently the occurrence in the use of prior art threaded couplings.

More importantly, the latching means of the present invention assures a positive wedging mechanical connection between adjacent conduits which cannot be accidentally unlatched. Manipulation or powering of the plurality of latching pins or rods held in place by the safety latching means is required to unlatch or uncouple each coupling according to my invention. Rotation of the conduit in order to couple and uncouple adjacent sections of the conductor is not necessary. Therefore, in assembling a string of conduits on board a vessel or floating barge over a subsea well, successive conduits may be coupled together merely by lowering a first conduit with gib means, according to the present invention, on its lower end into the annular socket means, according to the present invention, of a prior conduit and turning down the plurality of latching pins of the latching means. The latching pins may be operated manually, with power operated tools such as an air operated socket wrench or by hydraulic pressure fluid operating means. If for some reason a section of conduit must be removed from the string or an upper portion of the conductor disconnected from a lower portion, a diver need merely manually operate the pins 32 to their maximum withdrawal. Where hydraulic means are provided, they may be remotely operated from the vessel. Thereafter the raising of the conductor will cause the individual dogs to move out of notch engaging position and uncouple the conduit.

Having thus described exemplary embodiments of the marine conductor coupling according to my invention, I wish it understood that the foregoing detailed explanations are exemplary in nature only and are not meant to limit the scope of my invention which is defined by the following claims.

I claim:

1. A marine conductor coupling characterized by its tight continuously wedging of coupling gib and socket means together by opposed force transmitting wedging dogs, said coupling comprising:

annular gib means having a free end and a second end, said second end adapted to be mounted about an end of a first conduit, said gib means including an outer surface provided with a radially outwardly facing circumferential latching dog receiving groove having an abutment surface inclined toward said free end of said gib means, and an annular gib landing surface;

annular socket means having a longitudinal axis, said socket adapted to be mounted about an end of a second conduit, said socket receiving said gib means, said socket means including a sidewall overlying said groove and a seat abuttingly receiving said landing surface;

a plurality of latching dogs including means within said sidewalls for mounting each of said latching dogs for movement normal to the said longitudinal axis of said socket means, each of said latching dogs having thereon a bevel surface inclined radially inwardly of the socket means complementary to the inclination of said abutment surface to constantly abut and wedge against said groove abutment surface to wedge said gib means landing surface against said socket means seat and a pair of convergent wedging surfaces inclined radially outwardly of the socket means;

a pair of opposed force transmitting wedging dogs for continuously wedging at least one associated latching dog against said abutment surface of the gib means to continuously wedge said gib means landing surface against said socket means seat, said opposed force transmitting wedging dogs having generally opposed convergent wedging surfaces complementary to said convergent wedging surfaces of said latching dogs to matingly abut and wedge against the pair of convergent wedging surfaces of the associated latching dog, said opposed force transmitting wedging dogs include an upper force transmitting dog including port means therein to slidably receive a body of an associated latching pin therethrough, a ring means mounted on the body of said pin below said upper dog to hold said upper dog upwardly on said pin, and a lower force transmitting dog including a threaded hole means therein to receive said threaded portion of the pin body therein whereby selective rotation of said latching pin in one direction causes said upper and lower force dogs to move toward one another and opposite rotation thereof moves said force dogs away from each other releasing the associated latching dog to be wedged

out of said gib means groove on removal of said gib means from said socket means; and

latching pin means operable for selectively moving said opposed force transmitting wedging dogs together or apart to selectively either continuously wedge said associated latching dog against said gib means abutment surface to wedge said gib means into said socket means or allow said latching dog to be wedged out of said groove by said gib means abutment surface to allow release of said gib means from said socket means and means on said socket member preventing radial inward and outward movement of said force transmitting dogs relative to said socket member, said latching pin means include a plurality of independently operable latching pins, each pin having a body including a lower threaded portion and a head portion.

2. The marine conductor coupling of claim 1 wherein said upper and lower force transmitting dogs each comprise a ring member mounted exteriorly of said socket means and means are provided for mounting each said ring member for non-rotative axial movement about said socket means.

3. The marine conductor coupling of claim 1 wherein said upper and lower force transmitting dogs each comprise a plurality of arcuate segments and means are provided in said socket means for mounting said segments for non-rotative axial movement within a wall portion of said socket means.

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285—111, 315