Nov. 29, 1960 G. S. KNOX 2,962,096

WELL HEAD CONNECTOR

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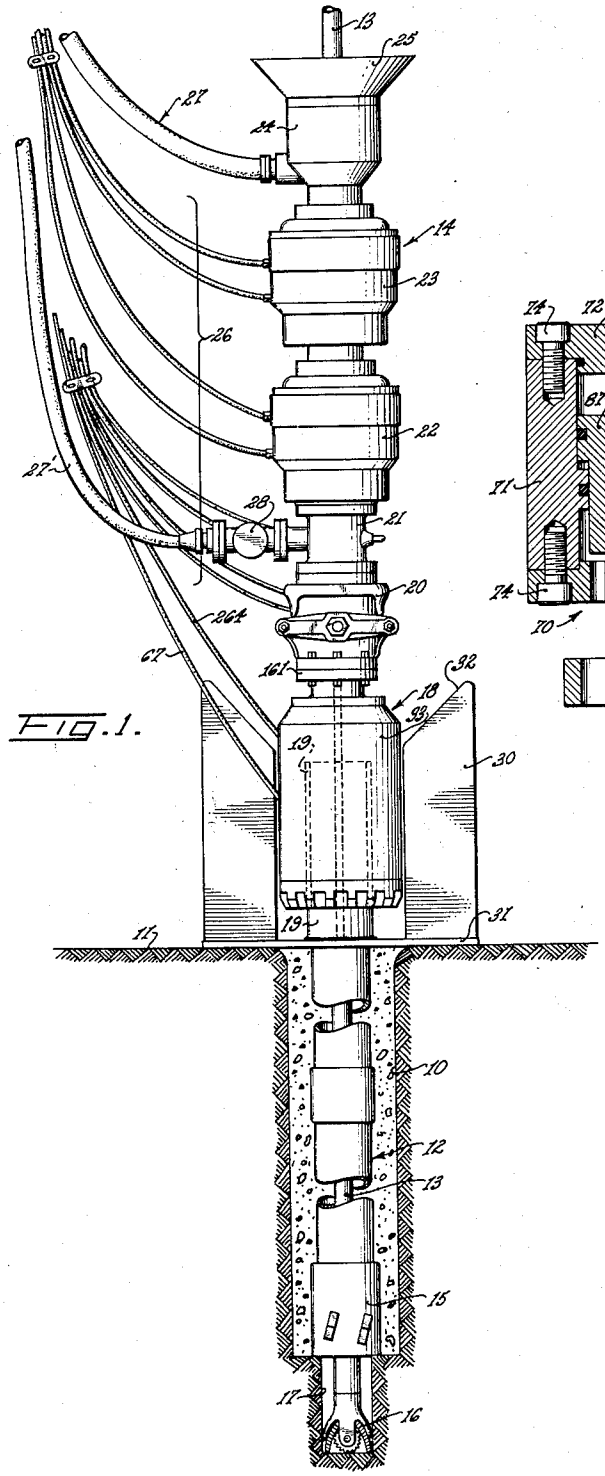
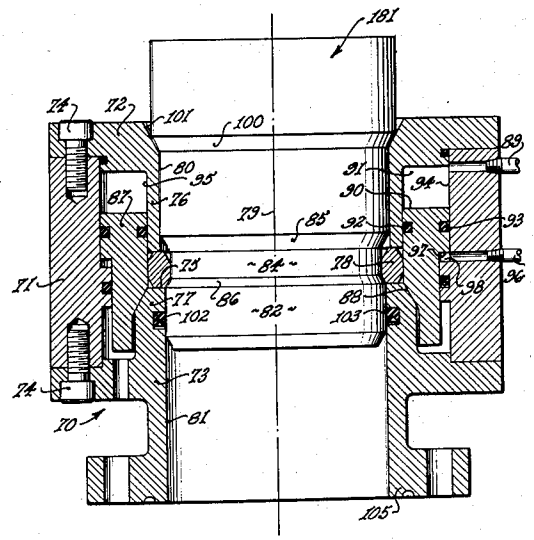


FIG. 1.

FIG. 6.



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WELL HEAD CONNECTOR

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Fig. 2.

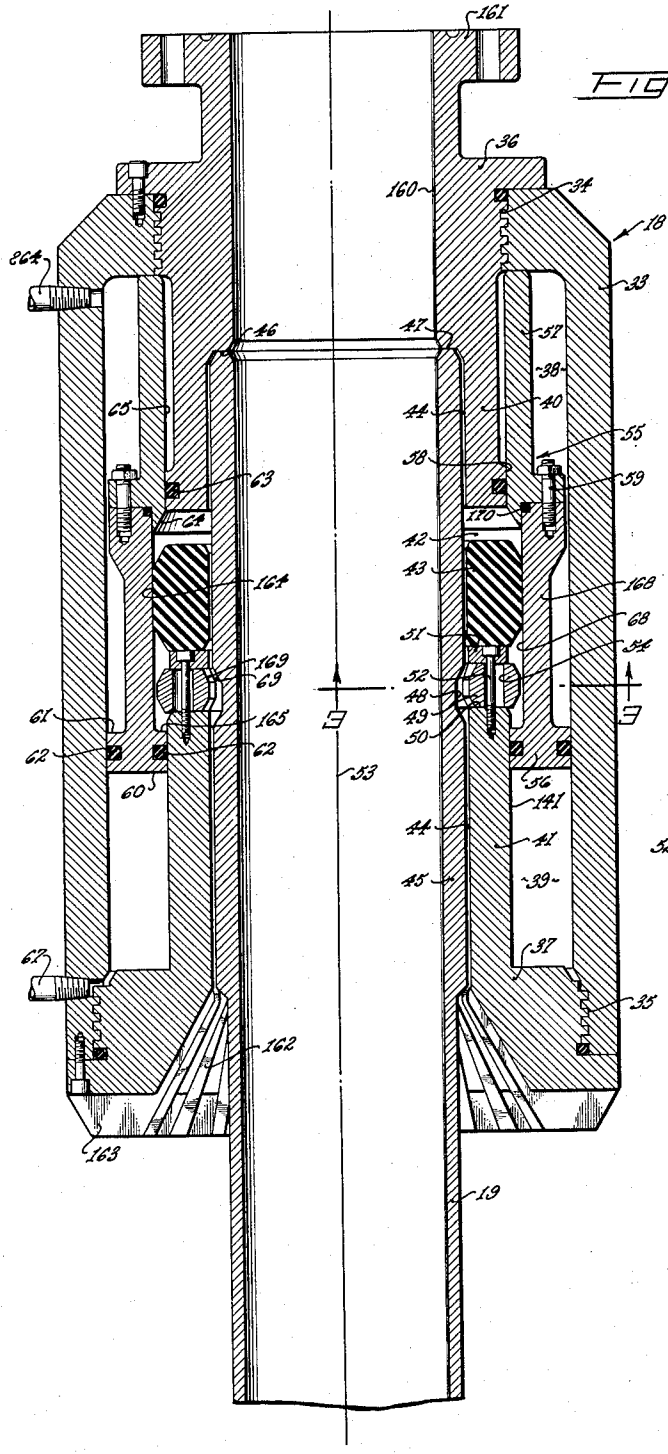
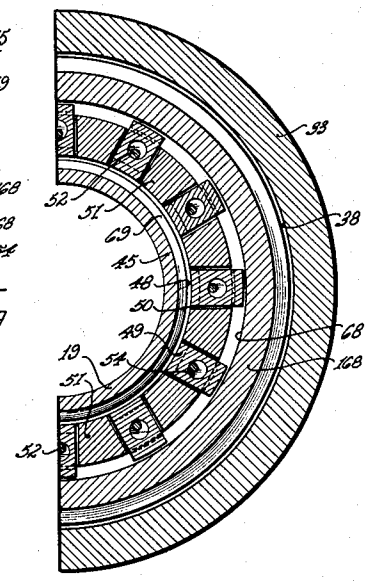


Fig. 3.



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WELL HEAD CONNECTOR

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Fig. 4.

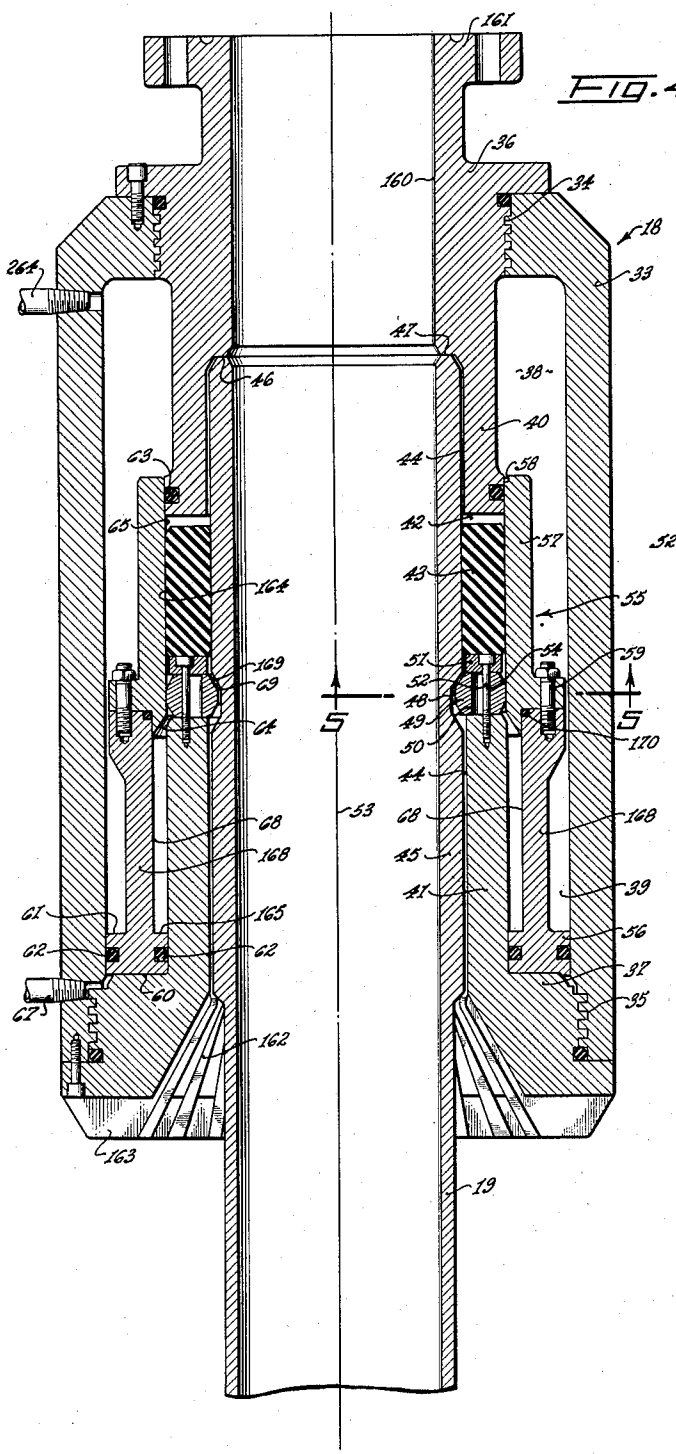
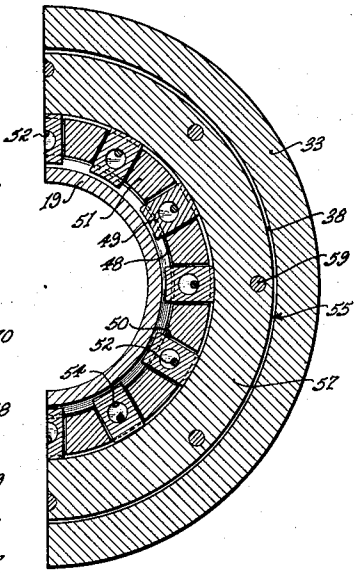


Fig. 5.



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2,962,096

WELL HEAD CONNECTOR

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20 Claims. (Cl. 166—75)

This invention relates generally to specialized oil tool equipment usable for releasably connecting and sealing a well head assembly to a projecting well head fitting. More particularly, the invention has to do with a novel well head connector which may be connected to a well head assembly, typically including one or more gate valves, blowout preventers and other equipment joined together in end-to-end relation, the connector then comprising part of the assembly and serving to releasably connect and seal the latter to a projecting fitting such as submarine stub casing terminating above the ocean floor, and the like. When locked to the fitting, the connector prevents inadvertent endwise separation of the well head assembly therefrom, suitable packing in the connector serving to seal off between the fitting and connector housing to contain pressure inside the latter and also prevent entrance into the well head assembly of outside fluid.

The invention finds useful application in off-shore well drilling and producing operations, where well casing has already been sunk in the submarine hole with the free end of the casing projecting above the ocean floor. At such times it is necessary and desirable to fasten blowout prevention equipment, safety valves, and other auxiliary apparatus to the casing head, from a remote location, i.e. the ocean surface, prior to further drilling to producing zones, and the problem of connecting and disconnecting such equipment to the casing is greatly simplified through the use of the novel connector to be described.

Accordingly, it is a major object of the invention to provide a novel well head connector comprising an assembly including a connector housing adapted to be fastened to an end of the auxiliary well head equipment described above, the housing having a passage extending axially upwardly therethrough and into which a projecting well head fitting is receivable as the housing is advanced relatively over the end of the fitting. Within the housing are one or more locking or latching elements that are movable relatively toward the passage axis by camming means in response to fluid pressure application thereto until the latches are brought into locking relation with the received fitting. The latches are blocked against axial dislodgement from the housing, so that when they are in locking relation with the fitting the connector body is blocked against axial separation therefrom. The latches are preferably receivable in a groove sunk in the fitting periphery, interengageable housing and fitting shoulders limiting reception of the fitting in the housing passage when the latches are opposite the pre-cut fitting groove.

For sealing off fluid pressure seeking to pass between the housing and fitting, an internally tenacious packing annulus extends about the passage in engagement with the received fitting periphery and the connector assembly. In one form of the invention, the packing annulus freely receives the fitting therethrough prior to pressurization of the annulus, causing it to move inwardly into pressure sealing engagement with the fitting periphery. Such

pressurization is preferably accomplished by the same cam carrying means movable to actuate the latching elements, and in that event the packing then seals off between the fitting and movable means, as for example a fluid actuated piston, which carries the cam.

Additional objects of the invention include the provision of inserts restricting lateral play of the latches in openings formed in the connector body, so that the latches remain retained therein, and cutters facing the passage opening at the bottom of the connector for milling off marine deposits on submarine casing as the well head assembly, including the connector body, is rotated and lowered downwardly over the casing. The connector may also be used to receive and attach to fittings such as tool extensions, as will be described, the connection being controllable from a remote location.

Other features and objects of the invention, as well and the details of an illustrative embodiment, will be more fully understood from the following detailed description of the drawings, in which:

Fig. 1 is an elevation showing a complete well head assembly connected onto well casing projecting above the ocean floor;

Fig. 2 is a vertical section taken through the well head connector with the casing received therein but not yet connected;

Fig. 3 is a half section taken on line 3—3 of Fig. 2;

Fig. 4 is a vertical section through the well head connector shown in Figs. 2 and 3, and after its connection to the casing;

Fig. 5 is a section taken on line 5—5 of Fig. 4; and

Fig. 6 is a vertical section taken through a modified type of connector into which a tool member has been inserted and latched therein.

The connector will first be described in connection with its application to submarine stub casing, although it will be understood that the use of the connector is not restricted to this particular application. Accordingly, in Fig. 1 a drill hole 10 sunk below the ocean floor 11 contains a string of casing 12 cemented in position for further suitable drilling operations. The drill pipe shown at 13 above the well head assembly or equipment string generally designated at 14 extends downwardly therethrough, and through the casing string and the casing shoe 15, for turning a drill bit 16 in the bottom hole 17.

The well head assembly includes the connector 18 shown fastened onto the casing stub 19, with a master gate valve 20, a T 21, stand-by and blowout preventers 22 and 23, drill pipe packer 24, and guide funnel 25 connected in end-to-end sequence upwardly from the connector 18. Suitable lines generally designated at 26 extend from the equipment included in the well head assembly to the drilling platform or vessel at the ocean surface, for conducting fluid pressure for actuating the equipment. Also, a mud return line 27 extends upwardly from drill pipe packer 24 to conduct drilling fluid, passing downward through drill pipe 13, back to the surface. A second mud line 27' extends from a surface pump to the pressure operated valve 28 connected to the T 21 for introducing mud to the casing in the event it becomes necessary to kill pressure in the well after the blowout preventers have been closed.

It will be understood that when the well head assembly 14 is lowered toward the casing stub 19, the well head connector 18 is guided by vertical guide fins 30 mounted on a base plate 31 in turn connected to the casing stub 19. Thus, the downwardly and inwardly slanted edges 32 of the fins guide the connector 18 over the casing

stub so that it may be detachably connected thereto as will be described.

Referring now to Figs. 2 and 3, the well head connector body **18** includes an axially elongated shell **33** having opposite open ends into which body caps **36** and **37** are respectively threaded at **34** and **35** forming chambers **38** and **39** between the shell **33** and the cap bosses **40** and **41** which project toward one another in the shell, the shell **33** and body caps **36** and **37** together forming a housing. Partly filling a space **42** between the opposite ends of the bosses **40** and **41** is an internally tenacious packing annulus **43** preferably made of rubber, the annulus axial dimension being shorter than the distance between the boss ends so that the annulus is free to float in the space between the boss ends. The annulus extends around a continuation of the cylindrical passage or bore **44** formed by the cap bosses **40** and **41**, and into which passage the upper portion of casing stud **45** is receivable upwardly into the connector body, as shown.

Upward reception of the casing into the passage **44** as the connector **18** is lowered downwardly over the casing is limited by interengagement of annular stop shoulder **46** on the cap **36** with the end **47** of the casing, at which time an annular groove **48** sunk in the periphery of the casing extends opposite the circularly spaced series of latches or locking dogs or elements **49** carried in openings **50** in retaining plate **51** which is secured to the cap boss **41** by means of bolts **52**. The latches **49** are movable toward and away from the passage axis **53**, so that they may move into and out of the annular groove **48** sunk in the casing, the latches being blocked against vertical displacement from the openings **50** by the unslotted head portion of the retaining plate **51**. Also, lateral play of the latches in the openings **50** is limited by the bolts **52** extending downwardly through openings **54** in the latches that are wider than the bolt diameters, as shown. Thus, interengagement of bolts **52** with the latch shoulders at opposite sides of the openings **54** limits inward and outward travel of the latches in the openings **50**.

Received in the chambers **38** and **39** is a piston actuator **55**, including a lower annular piston **56** in sliding engagement with the inner wall of shell **33** and the outer wall of cap **41** together forming the chamber **39**, and an upper annular guide **57** in slidable engagement with the boss surface **58**. The piston and guide are interconnected by suitable fasteners such as screws **59** and they therefore move up and down together in accordance with differential fluid pressure application to the oppositely facing piston surfaces **60** and **61**. Suitable O-ring seals **62** and **63** carried by the lower piston **56** and the upper cap boss **40**, seal off against pressure communication between the upper and lower chambers **38** and **39** and against pressure communication from these two chambers to the chamber **42** which receives pressure of well fluid escaping from the end of the casing and in between the casing and the upper bore **44**. O-ring seal **170** seals off between the interengaged flanged ends of guide **57** and piston skirt **168**.

In this connection, it will be understood that well fluid may pass upwardly from the casing through the connector body **18** via reduced passage **160** in the cap **36**, abutment flange **161** integral with the cap being connectible with the next above item of well head equipment in the equipment string, such as the master gate **20** shown in Fig. 1 in abutting relation therewith.

Carried at the lower end of the connector body **18**, and preferably by the lower cap **37**, is a circularly arranged series of milling cutters **162**, which extend downwardly and outwardly along the taper shown, and then radially outwardly at **163**. When the connector body is lowered down upon the casing stub **19** and simultaneously rotated, the cutters chew off deposits on the casing surface such as marine encrustations, including barnacles, scale or rust formed on the casing.

After the connector body **18** is fully lowered downwardly on the casing so that the shoulders **46** and **47** are inter-engaged, fluid pressure application through line **264** and into the upper chamber **38** acts against the piston actuator surface **61** to displace or move the actuator downwardly relative to the connector body, the packing **43** and the latches **49**. During such downward travel the annular cam surface **64** formed on the upper guide **57** engages the cam face **164** of the packing in the path of piston downward displacement, and continued downward displacement of the actuator results in laterally inward compression of the packing annulus engaged by the cam into sealing engagement with the casing and also with the bore **65** of the guide **57**, as shown in Fig. 4. Well fluid pressure is then contained against escape from the chamber **42** not only by the packing **43** but also by the O-ring **63**.

In addition, downward travel of the cam **64** results in inward displacement of the latches **49** engaged by the cam, until the latch inner ends are received within the casing groove **48**. At this time the latches block endwise separation of the connector **18** from the casing. Also, outward pressure on the latches cannot cause them inadvertently to longitudinally displace the piston actuator, since the actuator guide blocks the latches against lateral displacement, the latches and actuator guide being in engagement at angles in axial radial planes that are less than the angle of repose.

It is important that the piston actuator **55** be sealed from exposure to, or otherwise rendered non-responsive to, fluid pressure in the central bore of the connector. It is also important that connectors designed for submarine use be so constructed that the areas of the piston atcuator **55**, exposed to submergence pressure, be effectively balanced so that this pressure will not tend to cause axial movement of the actuator. For this purpose, the diameter of boss surface **58** on cap boss **40**, and the diameter of boss surface **141** of cap boss **41** are the same, and opposed cam and piston surfaces **64** and **165** have equal axially projected areas. When these measures are taken the connection between the connector **18** and casing stud upper portion **45** will become secure and stable after packing **43** has been radially compressed and latches **49** have been inwardly displaced by full downward movement of the actuator. Therefore, after the actuator has been moved all the way down, there is no further need to maintain fluid pressure in line **264** and chamber **38** and there is no danger of the connector becoming accidentally disconnected from the casing even though lines **264** and **67** should break or be torn loose from the connector body. Also, the high pressure seal established between the compressed packer **43**, the outer periphery of casing **45**, and the bore **65** of guide **57** not only contains well fluid pressure against escape from chamber **42**, but also prevents entrance into chamber **42** of pressurized fluid surrounding the exterior of the casing, as for example ocean water. Such exterior pressure exerted against the opposed cam and piston surfaces **64** and **165** does not tend to displace axially the piston actuator, since surfaces **64** and **165** thereof have equal axial projection, as explained above.

When it is desired to disconnect the body **18** from the casing stub, suitable fluid pressure is supplied to lower lines **67** communicating with the lower chamber **39**, to upwardly displace the piston actuator **55** so that the bore **65** of the guide **57** no longer holds the annular packing **43** and the latches **49** in inwardly displaced condition. In other words, as the piston actuator moves upwardly the relatively enlarged bore **68** of the piston skirt **168** moves opposite the latches and the packing annulus, relieving the latter and allowing the former to move outwardly from the casing groove **48**. Such outward latch

movement is effected when the connector body **18** is lifted off the casing stub, the latch bevels **169** camming against the tapered cam surface **69** of the casing extending annularly and upwardly and outwardly relative to the bottom of the groove **48**. At this time, the connector body is free to be withdrawn upwardly off the casing stub.

It will be observed that when the connector **18** is latched to the well casing, it cannot be inadvertently unlatched by means other than application of fluid pressure to chamber **39**, since the piston actuator **55** is retained in downward position by gravity and also by frictional engagement of guide bore **65** with the compressed packing. Therefore, the well head connector is assured of remaining connected to the casing under all operating conditions.

In addition, when the piston actuator is in its up or released position shown in Fig. 2, it cannot be inadvertently downwardly displaced by means other than application of fluid pressure to chamber **38** inasmuch as frictional engagement between the expanded packing **43** and the piston skirt bore **68** holds the actuator in its up position.

Referring now to Fig. 6 showing an alternate form of connector **70**, the latter includes an annular body shell **71** with body caps **72** and **73** connected into the upper and lower open ends of the shell by cap screws **74**. Within the gap or opening **75** formed between the oppositely facing open ends of the cap bosses **76** and **77** is a snap ring **78** opposite portions of which are free to be moved inwardly toward the axis **79** of the bores **80** and **81** formed by the caps for endwise reception of a tool extension **181**.

The snap ring is movable inwardly to project into a groove **84** sunk in the periphery of the tool extension between bevels **85** and **86**, by downward travel of a piston actuator **87**, an annular cam surface **88** of which is engageable with the ring to displace it as described. Such downward travel of the actuator occurs when suitable fluid pressure is supplied from line **89** to the upward facing piston surface **90** in the upper chamber **91** formed by the shell **71** and the upper cap boss **76**. A concentric pair of O-rings **92** and **93** carried by the actuator **87** seal off against the shell bore **94** and the annular outer surface **95** of the boss **76**, between which the piston is slidable in its endwise travel.

Fluid pressure application from line **96** to the downwardly facing piston surface **97** in a lower chamber **98** serves to displace the piston upwardly when it is desired to release the snap ring from its inwardly displaced condition blocking endwise separation of the tool **181** from the connector **70**. Once the snap ring is released, it is free to be cammed outwardly by engagement with the tool bevel **86** as the tool is lifted upwardly out of the connector body.

In this embodiment of the invention, downward reception of the tool extension into the bores **80** and **81** is limited by engagement of the tool bevel **100** with the upwardly facing countersunk annular shoulder **101** formed in the bore of the upper cap **72**. Also, an internally tenacious packing annulus **102** carried in an annular cavity **103** sunk in the bore **81** of cap **73** engages the periphery **82** of the tool and also the cavity wall to prevent escape of well fluid pressure between the tool and the bore **81**, the pressure of the fluid itself forcing packing **102** into pressure sealing engagement with these tool and bore surfaces. Finally, a suitable flange **105** integral with the lower cap **73** is adapted to be connected with another item of equipment in the well head assembly, the connector **70** then being a part of the assembly.

I claim:

1. The combination, comprising vertically projecting submarine well head casing having a groove sunk in its periphery, a housing having a passage extending axially vertically therein and into which the casing is upwardly received, locking means retained in the housing and bodily movable therein toward and away from said passage, actuating means within the housing and including a cam movable vertically and relative to said locking means from an inactive position in response to fluid pressure application to said actuating means to an active position in which said cam holds said locking means in said groove in locking relation with the received casing periphery whereby said locking means blocks relative vertical separation of said casing and housing, said housing containing port means through which fluid pressure is communicable to the actuating means, and an annulus of internally tenacious packing material carried within the housing and sealing off between the housing and the received casing periphery about the passage axis.

2. The invention as defined in claim 1 including a guide for said housing projecting above the upper end level of said casing, and means connecting the guide to said casing in laterally spaced relation therefrom so that said housing is received in said space when the housing is advanced downwardly over the end of said casing.

3. The invention as defined in claim 1 including interengaged casing and housing shoulders limiting casing reception in said passage, said housing having an abutment at its upper end for abutting a well head equipment string and said casing terminating below the level of said abutment.

4. A well head fitting for combination with a well head connector assembly, said assembly comprising a housing including a longitudinally and axially extending outer shell and closure members at opposite ends thereof forming a cylindrical passage extending longitudinally through at least one of said members and a longitudinally extending chamber lying radially outwardly of said passage, lock means retained longitudinally by at least one of said members in the housing and movable laterally into and out of said passage, an actuator within said chamber and movable longitudinally relative to said lock means in response to operating pressure application to said actuator, said actuator blocking movement of the lock means laterally outwardly from said passage when the actuator is in one predetermined position and unblocking said lock means for outward lateral movement when the actuator is in another predetermined position, said housing containing port means through which operating pressure is communicable to said actuator and an annulus of internally tenacious packing material carried within said housing about said passage and sealing off between the housing and said fitting when the fitting is locked therein, said well head fitting comprising an elongated tubular well casing stub having an elongated end portion of increased radial thickness receivable within said passage, said casing stub end portion having an annular groove sunk inwardly from the stub outer surface in spaced relation to the stub terminal end, said groove being sized to receive said locking means when said actuator is moved to said one predetermined position, whereby said casing stub may be locked in holding relation with said well head connector assembly.

5. A well head connector assembly, comprising a housing having a passage extending longitudinally and axially vertically therethrough and into which an axially vertically projecting cylindrical well fitting is receivable, locking means retained within the housing and movable out of the path of reception of said fitting in said passage and openly laterally facing said passage, said locking means being bodily movable laterally toward said passage, actuating means including a cam, said actuating means being movable in the housing in response to fluid pressure application thereto to move said locking means laterally into locking relation with the received fitting periphery whereby said locking means blocks relative vertical separation of said fitting and housing, said housing containing port means through which fluid pressure is communicable to said actuating means and an

annulus of internally tenacious packing material carried within said housing and extending about said passage in exposed relation thereto for sealing off between said housing and the fitting periphery, said housing having an abutment at one end thereof for abutting a well head equipment string and having a shoulder for seating the fitting to terminate in said passage in spaced relation to said abutment, said locking means comprising a plurality of locking elements circularly spaced about the passage axis and movable in a horizontal plane inwardly toward the passage axis by said cam, said cam being vertically movable to engage the outer sides of said locking elements, and inserts carried in said housing and loosely received between locking element shoulders engageable with said inserts to limit element play toward and away from said passage axis.

6. A well head connector assembly, comprising a housing having a passage extending longitudinally and axially vertically therethrough and into which an axially vertically projecting cylindrical well fitting is receivable, locking means retained within the housing and movable out of the path of reception of said fitting in said passage and openly laterally facing said passage, said locking means being bodily movable laterally toward said passage, actuating means including a cam, said actuating means being movable in the housing in response to fluid pressure application thereto to move said locking means laterally into locking relation with the received fitting periphery whereby said locking means blocks relative vertical separation of said fitting and housing, said housing containing port means through which fluid pressure is communicable to said actuating means and an annulus of internally tenacious packing material carried within said housing and extending about said passage in exposed relation thereto for sealing off between said housing and the fitting periphery, said housing having an abutment at one end thereof for abutting a well head equipment string and having a shoulder for seating the fitting to terminate in said passage in spaced relation to said abutment, said locking means comprising a snap ring.

7. A well head connector assembly, comprising a housing having a passage extending longitudinally and axially vertically therethrough and into which an axially vertically projecting cylindrical well fitting is receivable, locking means retained within the housing and movable out of the path of reception of said fitting in said passage and openly laterally facing said passage, said locking means being bodily movable laterally toward said passage, actuating means including a cam, said actuating means being movable in the housing in response to fluid pressure application thereto to move said locking means laterally into locking relation with the received fitting periphery whereby said locking means blocks relative vertical separation of said fitting and housing, said housing containing port means through which fluid pressure is communicable to said actuating means and an annulus of internally tenacious packing material carried within said housing and extending about said passage in exposed relation thereto for sealing off between said housing and the fitting periphery, said housing having an abutment at one end thereof for abutting a well head equipment string and having a shoulder for seating the fitting to terminate in said passage in spaced relation to said abutment, and cutters facing the passage axis at the end of said housing opposite said one end for cutting off deposits on the fitting as said housing is rotated and advanced over the fitting.

8. A well head connector assembly having a longitudinally extending central passage into which a cylindrical well fitting is receivable, comprising a longitudinally extending outer shell having cylindrical bore portions, closure means secured to each end of the shell and including longitudinally spaced cylindrical bosses offset radially inwardly from said bore portions, said closure means forming said passage, lock means longitudinally positioned by at least one of said bosses and movable in a lateral plane into and out of said passage, a lock actuator having a cam shoulder directly engagable with said lock means, said actuator having cylindrical slide surfaces sealingly engaging at least one of said bosses and said cylindrical bore portions of the shell and movable longitudinally of the lock means in response to fluid pressure application to said actuator to bring said cam shoulder into engagement with said lock means to move the lock means laterally inwardly into a locking position engaging and holding the received fitting against relative separation from the housing, the plane of contact between the actuator and lock means in said locking position being substantially perpendicular to said lateral plane of movement of the lock means whereby pressure transmitted by the lock means to the actuator cannot inadvertently shift the actuator longitudinally to free the lock means, said housing containing port means through which fluid pressure is communicable to said actuator and internally tenacious packing material carried within said housing and extending about said passage in exposed relation thereto for sealing off between said housing and the fitting periphery.

9. A well head assembly, comprising a housing for retaining a cylindrical well fitting, said housing including a longitudinally and axially extending tubular outer shell and closure members at opposite ends thereof forming with the shell a cylindrical passage extending longitudinally through at least one of said members and a chamber about said passage, a cylindrical well fitting receivable within said passage and having on its outer periphery an annular lock shoulder, lock means retained longitudinally by at least one of said members in the housing and movable laterally into and out of the path traversed by said lock shoulder when said fitting is moved longitudinally within said passage, an actuator within said chamber and movable longitudinally relative to said lock means in response to longitudinally acting pressure application to said actuator means first to engage and move said locking means laterally into locking relation with the fitting periphery and then to block and retain positively said locking means against lateral movement out of said locking relation, said housing containing port means through which fluid pressure is communicable to said actuator, and an annulus of internally tenacious packing material carried within said housing about said passage and sealing off between the housing and said fitting when the fitting is locked therein, said locking means being movable by said actuator independently of the exposed extent of said annulus said actuator including a blocking portion engaging said lock means in locking position at an angle in an axial radial plane that is less than the angle of repose in said plane, whereby said actuator is longitudinally immovable by said lock means.

10. A well head connector assembly, comprising a tubular housing having a longitudinally extending axis and connectible in telescopic relation with a longitudinally projecting well fitting, lock means in the housing movable toward and away from said axis and into and out of engaging relation with said fitting, actuating means in the housing having a lock camming surface and a blocking surface engageable with said lock means in the housing, means for transmitting force to displace the actuating means relative to the lock means to shift the camming and blocking surfaces in sequence into engagement with the lock means to move the lock means into engagement with said fitting and for blocking the lock means against movement out of locking relation with said fitting, and an internally tenacious packing annulus for sealing off between the housing and the fitting and having an annular exposed portion facing toward and sealingly engageable with the fitting when the housing and fitting are connected in telescopic relation, at least the major extent of said packing annulus being supported in the housing free of

attachment to the lock means so that said movement of the lock means is achieved positively and independently of sealing engagement of the annulus with said fitting.

11. A well head connector assembly, comprising a tubular housing having a longitudinally extending axis connectible in telescopic relation with a longitudinally projecting well fitting, lock means in the housing movable toward and away from said axis and into and out of engaging relation with said fitting, actuating means in the housing having a lock camming shoulder and a blocking shoulder engageable with said lock means in the housing, means for transmitting force to displace the actuating means relative to the lock means to shift the camming and blocking shoulders in sequence into engagement with the lock means to move the lock means into engagement with said fitting and for blocking the lock means against movement out of locking relation with said fitting, said blocking shoulder having a blocking position in which the blocking shoulder extends in such confining relation to said lock means as to prevent unblocking movement of the actuator in response to force transmission between the lock means and said blocking shoulder, and an internally tenacious packing annulus for sealing off between the housing and fitting and having an annular exposed portion facing toward and sealingly engageable with the fitting when the housing and fitting are connected in telescopic relation, at least the major extent of said packing annulus being supported in the housing in longitudinally spaced relation to said lock means and free of attachment thereto so that said movement of the lock means is achieved positively and independently of sealing engagement of the annulus with the fitting, the annulus being engageable with the fitting independently of cooperation with the lock means and the actuating means being movable relative to the annulus.

12. The invention as defined in claim 11 in which said locking means comprises a plurality of circularly spaced rigid locking elements movable laterally toward said fitting by said camming shoulder.

13. The invention as defined in claim 12 in which said actuating means is movable longitudinally to carry said camming shoulder into engagement with surface portions of said locking elements facing away from the path of reception of the fitting.

14. The invention as defined in claim 11 in which the actuating means includes an annular piston axially reciprocable in the housing in response to alternate application of actuating fluid pressure to oppositely facing piston surfaces.

15. The invention as defined in claim 14 in which surfaces of the actuating means subject to exposure to pressure fluid other than said actuating fluid have substantially equal axially oppositely projected areal extents.

16. The invention as defined in claim 11 in which an annular portion of said packing annulus has lateral extent in the path of movement of an annular portion of said actuating means and is laterally displaceable thereby to force an annular section of said packing annulus into pressure sealing engagement with the periphery of said fitting.

17. The invention as defined in claim 16 in which said packing annulus and locking means are vertically separated and have laterally exposed surfaces facing toward the path of reception of the fitting.

18. The invention as defined in claim 10 including an abutment on said housing engageable with the fitting to limit mutual telescopic reception of the housing and fitting.

19. The invention as defined in claim 18 in which abutment engagement with the fitting positions the fitting in predetermined relation to the lock means for engagement thereby.

20. The invention as defined in claim 10 in which said lock blocking shoulder is engageable with the lock means at an angle in an axial radial plane that is less than the angle of repose in said plane, whereby said actuating means is longitudinally immovable by said lock means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,233,041	Alley	Feb. 25, 1941
2,609,836	Knox	Sept. 9, 1952
2,731,281	Knox	Jan. 17, 1956
2,808,229	Bauer et al.	Oct. 1, 1957
2,808,230	McNeill et al.	Oct. 1, 1957
2,846,178	Minor	Aug. 5, 1958