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MARINE RISER LINER APPARATUS AND METHODS OF INSTALLING SUCH APPARATUS

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FIG. 1a.

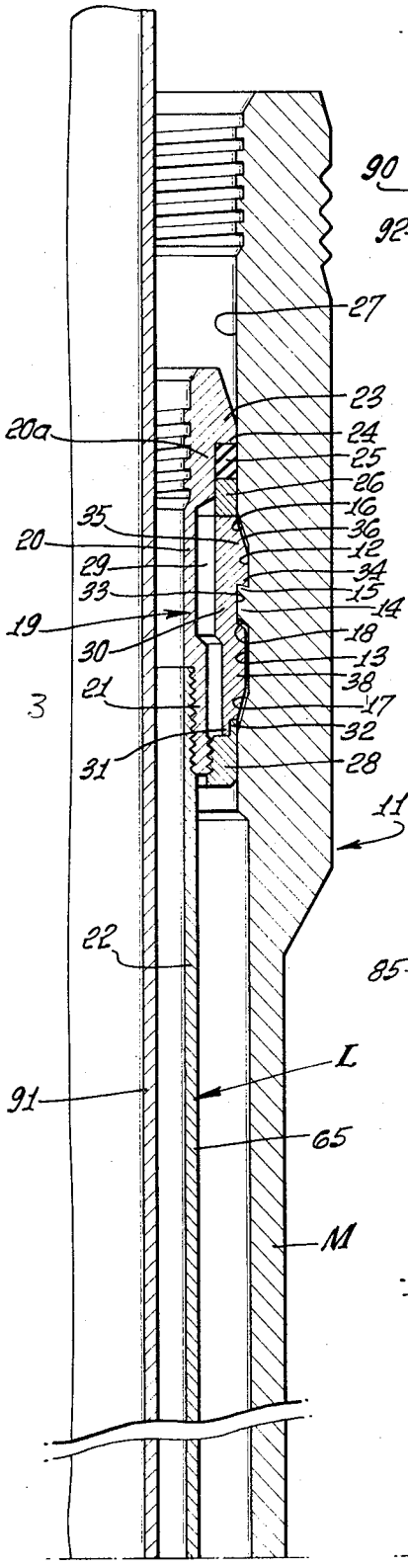


FIG. 1b.

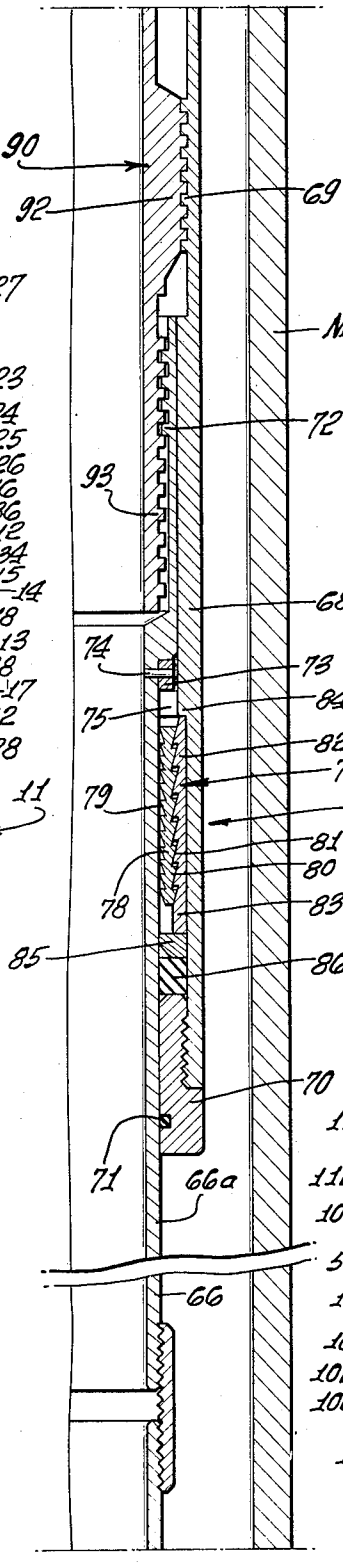
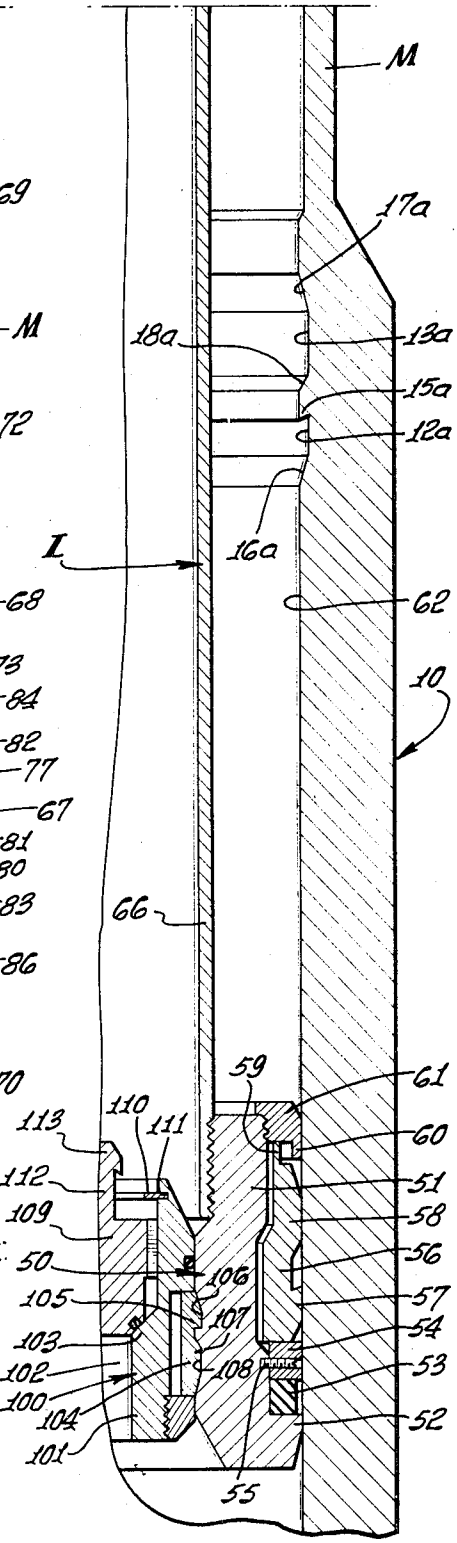


FIG. 1c.



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MARINE RISER LINER APPARATUS AND METHODS OF INSTALLING SUCH APPARATUS

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FIG. 2.

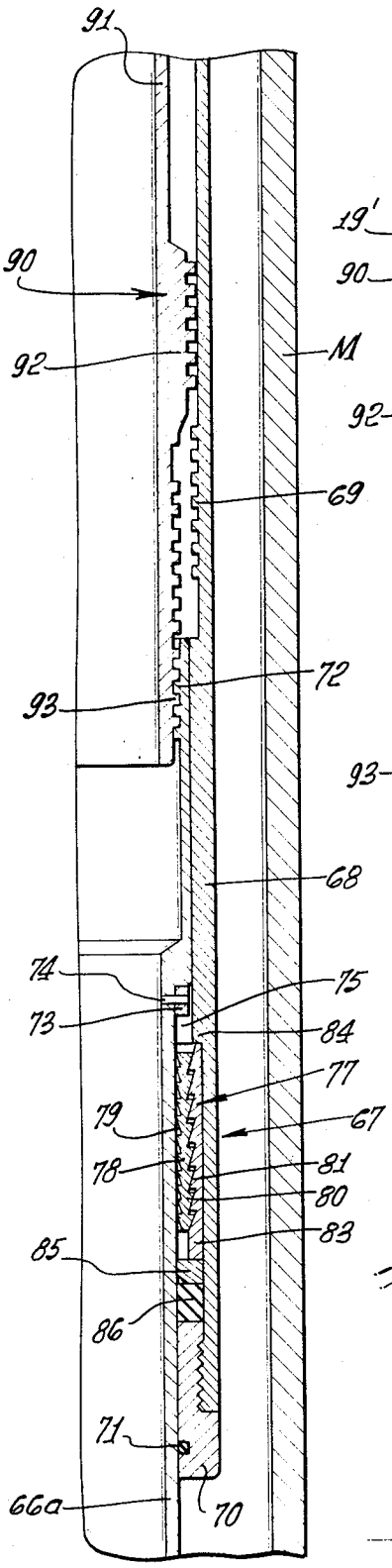


FIG. 3a.

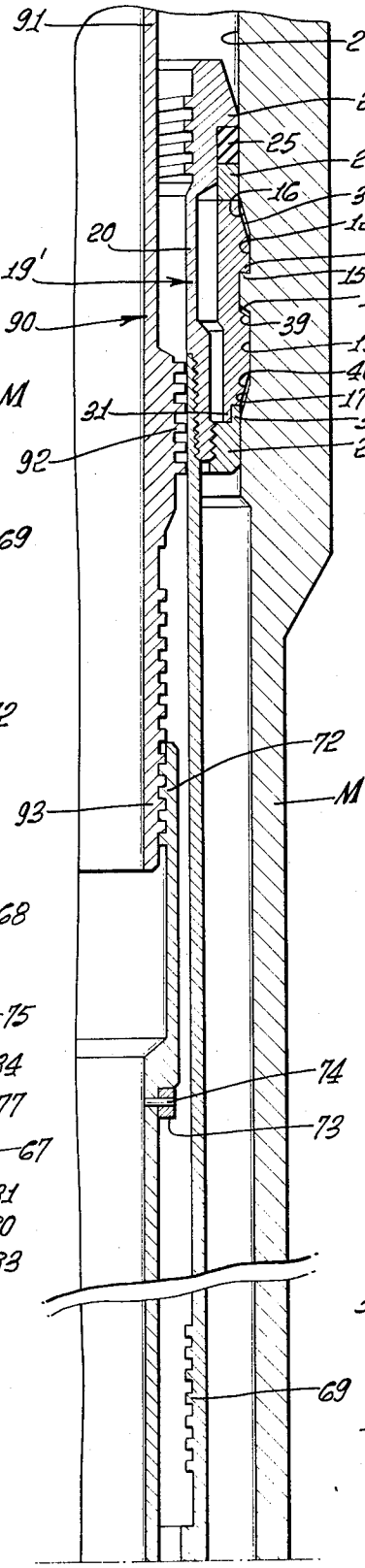
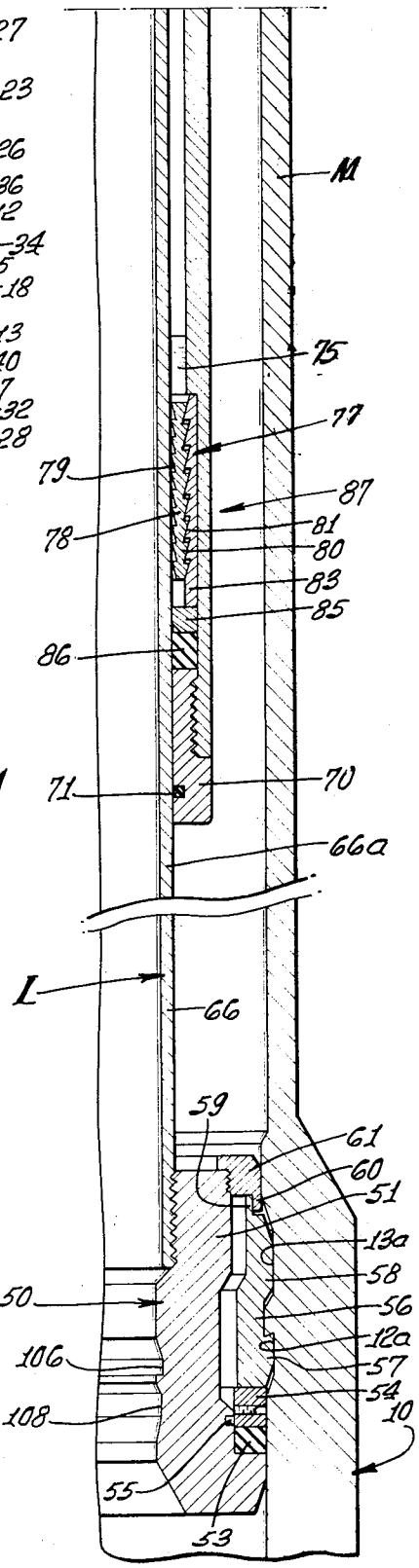


FIG. 3b.



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MARINE RISER LINER APPARATUS AND METHODS OF INSTALLING SUCH APPARATUS

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FIG. 4a.

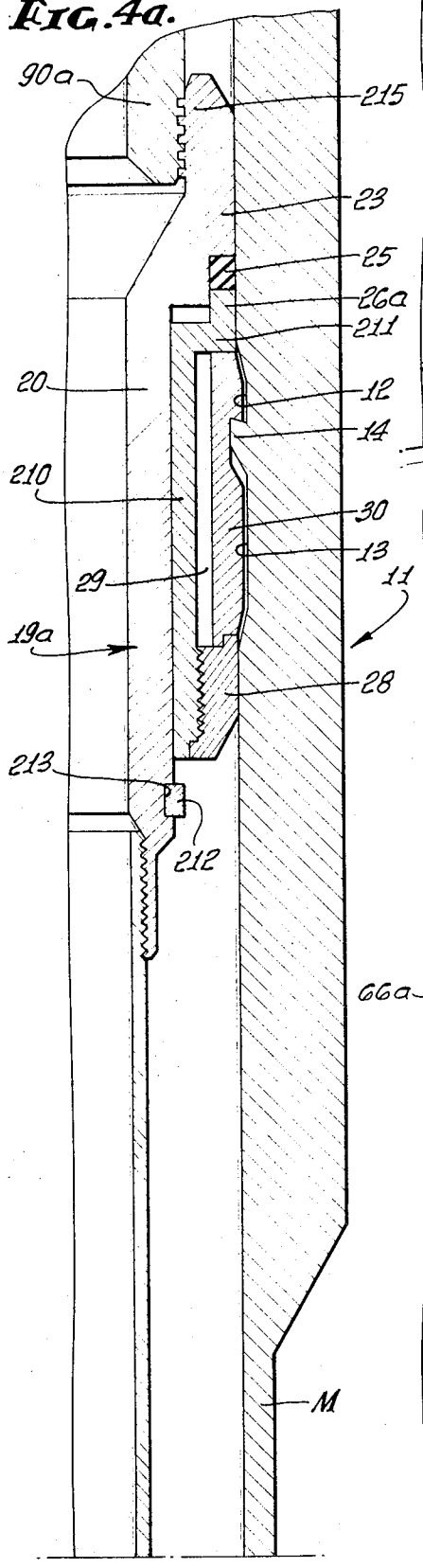


FIG. 4b.

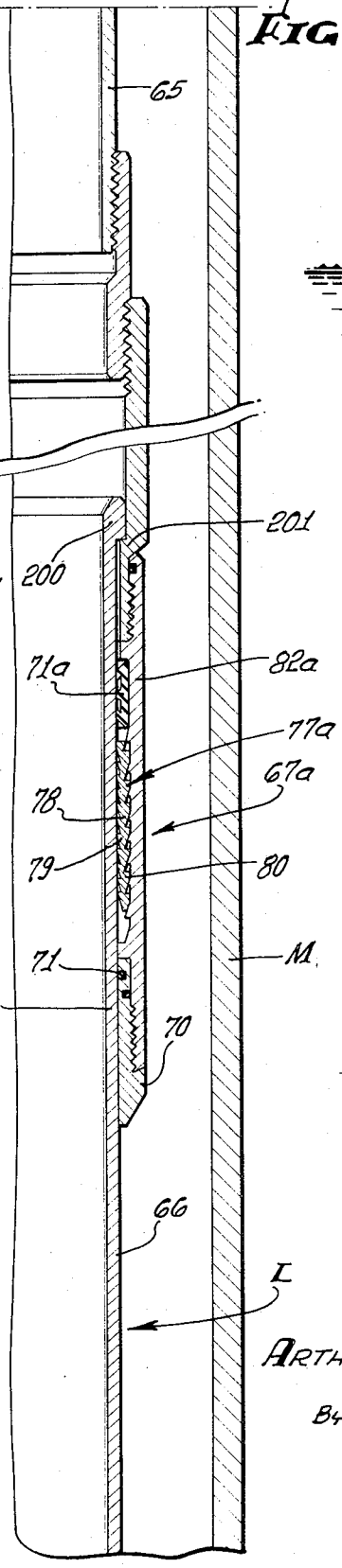
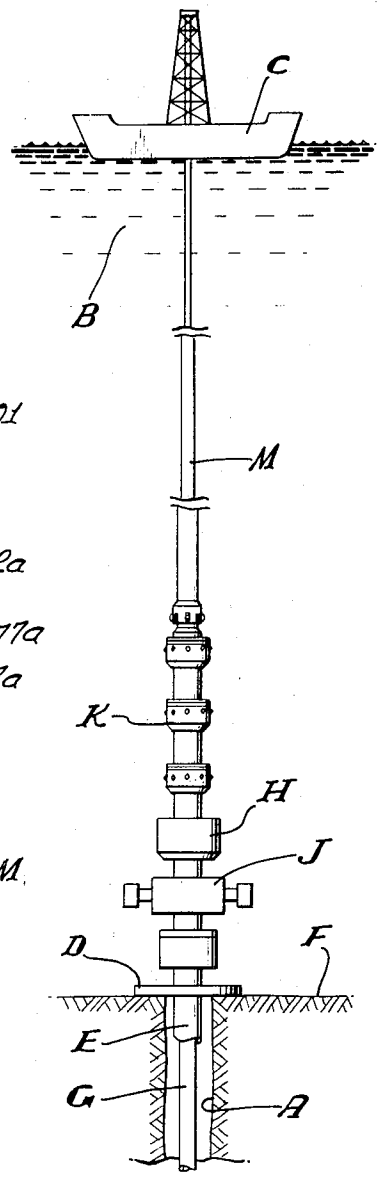


FIG. 5.



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United States Patent Office 3,721,292 Patented Mar. 20, 1973

3,721,292

MARINE RISER LINER APPARATUS AND METHODS OF INSTALLING SUCH APPARATUS

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Int. Cl. E21b 7/12
U.S. Cl. 166—.5 19 Claims

ABSTRACT OF THE DISCLOSURE

A liner installed in a deep water marine riser extending from a region near the floor of the ocean to a drilling vessel or platform floating in or positioned above the ocean, the lower portion of the liner being anchored in the lower portion of the marine riser, with the upper portion of the liner hanging or supported in the upper portion of the marine riser, the liner string between the anchoring and hanging portions being tensioned and maintained in tension.

The present invention relates to marine riser system, and more particularly to liners to be secured within deep water marine risers to reduce the effective internal diameter of the marine riser system.

Underwater well bores are drilled from fixed platforms or from floating drilling vessels, the latter being used in relatively deep water, as water exceeding depths of several hundred feet, and which, it is contemplated, may soon be as much as 5,000 feet deep. Marine riser pipe string systems are used, forming an outer enclosure extending from a region at the ocean floor to the drilling vessel or platform, the riser pipe having a relatively large diameter. This pipe is subject to the hydrostatic pressure of the drilling mud used in drilling the underwater well bore. As the mud weight increases, the hydrostatic pressure correspondingly increases, approaching an unsafe value to which the large diameter pipe is subjected. Moreover, the velocity of the drilling mud and cuttings flowing upwardly around the drill pipe and through large diameter marine riser pipes may be insufficient to insure the removal of the cuttings through the riser to the drilling vessel.

In general, an objective of the present invention is to provide a marine riser pipe system embodying liner apparatus to be secured within marine riser pipes to reduce the effective internal diameter of the system, thereby subjecting smaller diameter pipe to the hydrostatic head in the system, which it is capable of containing effectively and safely, and also insuring upward flow of the drilling fluid and cuttings through the riser system at a sufficiently high velocity to carry the cuttings to the drilling vessel or platform for disposal.

Another object of the invention is to provide a marine riser system embodying a liner and associated apparatus for securing it in tension between the lower and upper portions of an encompassing or outer string of marine riser pipe of larger diameter than the liner. The associated apparatus will effect the pack-off between the liner and the riser pipe to prevent the hydrostatic pressure within the liner from being imposed on the riser pipe.

A further object of the invention is to provide a method of running a liner in a string of marine riser pipe, landing the upper portion of the liner in the upper portion of the riser pipe, anchoring the lower portion of the liner in the lower portion of the riser pipe, and placing and maintaining the liner in tension between its landing and anchoring portions.

Yet another object of the invention is to provide a marine riser system embodying a liner set in outer marine riser pipe, and in which the liner may be removed from the outer riser pipe when desired.

This invention possesses many other advantages and has other objects which may be made more clearly apparent from a consideration of several forms and methods embodying the invention. These forms and methods are shown and described in the present specification and in the drawings accompanying and constituting a part thereof. They will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense.

Referring to the drawings:

FIGS. 1*a*, 1*b* and 1*c* together constitute a quarter longitudinal section through a marine riser string and a marine riser liner apparatus disposed therewithin, the liner apparatus hanging from the upper portion of the marine riser string, FIGS. 1*b* and 1*c* being lower continuations of FIGS. 1*a* and 1*b*, respectively;

FIG. 2 is a view similar to FIG. 1*b*, with the parts in a different relative position;

FIGS. 3*a* and 3*b* are views corresponding to FIGS. 1*a*, 1*b* and 1*c*, illustrating the liner string anchored in tensioned relation between the upper and lower portions of the marine riser string, FIG. 3*b* being a lower continuation of FIG. 3*a*;

FIGS. 4*a* and 4*b* are views similar to FIGS. 1*a* and 1*b* of another embodiment of the invention, FIG. 4*b* being a lower continuation of FIG. 4*a*; and

FIG. 5 is a somewhat diagrammatic view of an underwater well bore in conjunction with a floating drilling vessel, a marine riser string and associated equipment extending between the well bore and vessel.

As illustrated diagrammatically in FIG. 5, an underwater well bore A extends downwardly from the floor F of a body of water B on which a drilling barge or vessel C is floating. A suitable base D rests on the ocean floor, there being a plurality of concentric casing strings E, G extending downwardly into the well bore and being suitably cemented therein. One of the strings of casing G is connected through a connector or connectors H, and one or more blowout preventers J, and flexible joints K to the lower portion of a marine riser conductor pipe M extending upwardly to the drilling barge C. As is well known, the operation of drilling of the well bore is conducted from the floating barge through the marine riser pipe, connectors and blowout preventers therebelow, and the casing G in the well bore, the drilling operation taking place below the lower end of the casing.

During the initial drilling operations of the well A, the hydrostatic pressure in the marine riser system M increases, a point being reached when it is desired to install a liner L in the marine riser to contain the hydrostatic pressure and also to reduce the effective internal diameter of the marine riser system, so as to maintain the velocity of the drilling fluid returns sufficient to lift the cuttings from the drilling operation to the drilling vessel.

As disclosed in the form of invention illustrated in FIGS. 1 to 3, a riser liner string L is to be installed within the outer marine riser string of pipe M, the liner string extending from the lower portion **10** of the outer pipe to the upper portion **11** of the outer pipe. The riser liner string L is to be supported or landed in the upper portion **11** and anchored in the lower portion **10**, being placed under tension between such portions.

The upper portion of the marine riser pipe is formed as a landing nipple having an internal, circumferentially continuous lock groove **12** and an internal, circumferentially continuous locator groove **13**, these grooves being separated by an internal flange **14**. The upper surface **15** of this flange forms a lower side of the lock groove **12** and may be disposed normal to the axis of the landing nipple, but is preferably tapered or inclined slightly in an upward direction, forming an acute angle with the base

of the lock groove. The upper side **16** of the lock groove is tapered in an upward direction, forming a retracting or cam surface. The lower side **17** of the locating groove **13** is tapered in a downward direction and its upper side **18** is tapered in an upward direction, thereby providing upper and lower tapered or cam surfaces.

A riser liner hanger **19** cooperates with the grooves **12, 13** for the purpose of supporting the liner string L and devices associated therewith. As shown, this liner hanger includes an upper tubular mandrel or body **20**, the lower end of which has a threaded box **21** for threadly receiving the upper end of the upper liner string section **22**. At the upper end of the body is an outwardly directed flange **23** providing a downwardly facing body shoulder **24** bearing against an elastomer packing ring **25**, the lower end of which engages a lower ring or abutment **26** movably mounted on the body **20**. As described hereinbelow, the body is movable downwardly within the ring **26** for the purpose of compressing the packing ring **25** between the upper and lower abutments **24, 26** and expanding it outwardly into firm sealing engagement with the inner wall **27** of the landing nipple **11**.

The body **20** has a nut **28** threaded on its lower end and which provides, with the upper body portion **20***a*, an elongate groove **29** in which a split, inherently expansible locking sleeve **30** is disposed. This sleeve is confined between the ring **26** and the body nut **28**, its inherent outward expansion being limited by engagement of its lower stop portion **31** with an encompassing upwardly directed stop rim **32** on the upper portion of the nut. The split locking sleeve has an intermediate, circumferentially continuous, external groove **33** adapted to receive the inwardly directed nipple flange **14**, the upper end of this groove providing a downwardly facing lock shoulder **34** companion to and adapted to engage the upwardly facing lock shoulder **15** of the nipple flange. The lock shoulder **34** forms the lower end of an upper lock portion **35** of the sleeve, which is adapted to project outwardly into the lock groove **12** of the nipple, this upper lock portion having an upwardly tapering cam surface **36** engageable with the companion retracting cam surface **16** of the nipple, to contract the lock sleeve **30** inwardly of its grooves **12, 13** when the liner hanger **19** is to be removed from the outer riser string M.

The locking sleeve **30** also includes a lower elongate locator portion **38** adapted to fit within the locating groove **13** when aligned therewith, this locator portion having an upper tapered cam surface **39** engageable with the companion cam surface **16** on the nipple, and a lower downwardly tapering cam surface **40** for enabling the sleeve to slide past coupling and other spaces during lowering of the liner hanger **19** toward and into the landing nipple **11**. The locator portion has a periphery of longer extent than the periphery of any internal groove along which the liner hanger is movable, so as to retain the locking sleeve **30** in a contracted position and prevent its upper lock portion **35** from expanding into coupling spaces or against other shoulders along which the liner hanger and its locking sleeve are movable. It is only when the locator portion **38** is positioned opposite the locating groove **13** in the landing nipple that the sleeve **30** can expand inherently outwardly to place its lock portion **35** within the lock groove **12**, the liner hanger thereby being supported against downward movement within the nipple **11**.

The lower portion **10** of the outer marine riser string is also constituted as a landing nipple, having essentially the same configuration as the upper landing nipple **11**, but oppositely arranged; that is, its internal locking groove **12***a* is located below its locating groove **13***a*, providing a downwardly directed locking shoulder **15***a*, the downwardly tapering cam surface **16***a* forming the lower side of the locking groove. The locating groove **13***a* also has its sides **17***a*, **18***a* tapering upwardly and downwardly.

A riser liner anchor **50** has its main body portion **51** threadedly secured to the lower end of the riser liner string L, the anchor **50** being substantially the same as the linear hanger **19**, but with its parts oppositely disposed with respect thereto. Thus, the anchor includes the main body **51** having a lower shoulder or abutment **52** engaging an elastomer packing ring or sleeve **53**, an upper abutment **54** engaging this ring and normally prevented from moving relatively toward the lower abutment **52** by a shear screw **55** securing it to the body **51**. Bearing against the upper abutment ring **54** is the lower end of a split, inherently expansible locking sleeve **56** having a lower lock portion **57** and an upper locator portion **58**, the lock portion being adapted to be disposed within the lock groove **12***a* and the locator portion within the locating groove **13***a* in the lower nipple. The lock sleeve tends to expand inherently outwardly, such expansion being limited by engagement of an upper stop portion **59** on the sleeve with a downwardly extending rim **60** on a body nut **61** threadedly secured to the main portion of the body **51**.

The riser liner anchor **50** can shift downwardly through the entire outer marine riser system M, with the lower locking sleeve **56** sliding past the locator and lock grooves **13***a*, **12***a* of the lower nipple **10** to a position therebelow. When the anchor **50** is then shifted upwardly, the locating and lock sleeve **56** will expand outwardly into the locator and lock grooves **13***a*, **12***a* to secure the anchor **50** to the lower nipple **10** against upward movement, the lock portion **57** engaging the lock shoulder **15***a*. When the lock sleeve **56** has been locked to the nipple, a continuation of an upward pull on the body **51** will shear the screw **55** and then move the lower abutment **52** toward the upper abutment **54** to compress and expand the packing ring **53** outwardly into firm sealing engagement with the inner cylindrical wall **62** of the lower nipple.

The riser liner string L includes a relatively short upper portion **65**, the remainder **66** of the liner string, which extends almost the entire distance from the lower landing nipple **10** toward the upper landing nipple **11**, having its upper portion telescopically disposed within the upper liner string portion **65**. The telescoping portions comprise a riser liner tensioner **67**, the outer body **68** of which has an upper internal thread **69** and also a head or sub **70** threadedly secured to its lower end, this sub being relatively slidable along the periphery of the inner liner portion **66** and having one or more seal rings **71** thereon slidably sealing against such periphery. The inner liner string portion **66** has an upper internally threaded head **72** of the same hand and pitch as the other internal thread **69**, but of substantially greater axial extent. A key **73** is secured by a screw **74**, or the like, to the inner member **66** and fits within a keyway **75** in the outer body member **68** of the tensioner to initially prevent relative rotation between the upper and lower liner string portions **65, 66**.

The upper portion **66***a* of the lower liner string **66** can shift upwardly within the upper portion **65** of the liner string, but cannot move downwardly with respect thereto, because of the provision of a one-way clutch or gripper device **77** between the upper and lower portions. Thus, a split, one-way latch ring or sleeve **78** surrounds the periphery of the lower liner string portion **66***a*, the ratchet sleeve having upwardly directed internal ratchet teeth **79** thereon adapted to engage the periphery of the liner string. The ratchet sleeve has external cam teeth **80**, the exterior surfaces **81** of which taper in a downward and inward direction and coact with companion internal cam teeth **82** formed on the interior of an outer body **83**, the upper end of which engages a downwardly facing shoulder **84** on the outer body **68** of the upper liner string portion, and the lower end of which engages a ring **85**, which, in turn, engages an elastomer packing sleeve **86** contacting the upper end of the body sub **70**. Relative downward movement of the ratchet ring **78** within the cam member **83** forces the split ratchet sleeve inwardly and embeds its

teeth 79 more securely into the periphery of the liner string portion 66*a*, thereby preventing its downward shifting with respect to the upper liner string 68.

The riser anchor 50, hanger 19 and liner string L therebetween are lowered down through the outer marine riser string M on a running tool 90 suitably secured to a tubular running string 91. This running tool extends downwardly within the upper liner string 65 and has an upper threaded head 92 threadedly engaging the upper internal thread 69, and a lower threaded portion 93 threadedly engaging the lower internal thread 72, thereby coupling the upper and lower liner string portions 65, 66 to each other against relative longitudinal movement. The distance between the liner hanger 19 and the liner anchor 50 is greater initially than the distance between the locking grooves 12, 13 and 12*a*, 13*a* in the upper and lower nipples 11, 10. Accordingly, lowering of the entire assembly on the running tool 90 through the outer marine riser M can continue until the riser liner hanger 19 is disposed within the upper nipple 11, the locator portion 38 of the upper locking sleeve 30 being disposed opposite the locating groove 13, whereupon the locking sleeve 30 can expand outwardly and place the upper lock portion 35 into the lock groove 12, and with its lock shoulder 34 engaging the upwardly facing lock shoulder 15 on the nipple. At this time, the riser liner anchor 50 will be disposed within the lower nipple 10 below its locator and lock grooves 13*a*, 12*a*, as illustrated in FIGS. 1*a*, 1*b*, 1*c*. The running string 91 and running tool 90 are then rotated to the right (both sets of threads 69, 92 and 72, 93 being left-hand and of the same pitch) until the upper running head 92 is unscrewed from the upper internal thread 69, a substantial threaded engagement still remaining between the lower set of mating threads 72, 93. The antirotation key 73 and keyway 75 will prevent the upper and lower liner string portions 65, 66 from turning, the entire weight of the riser liner string L being carried by the upper lock shoulder 34, the parts then being in the position illustrated in FIG. 2. The running string 91 and running tool 90 are then elevated, the threaded engagement between the lower threads 93, 72 causing the lower liner string 66 to be moved upwardly, shifting the anchor 50 upwardly until its split locking sleeve 56 comes opposite the locating and lock grooves 13*a*, 12*a* in the lower nipple 10, at which time the sleeve 56 will expand outwardly into such grooves to prevent further upward movement of the liner anchor 50 in the nipple, which secures the lower end of the liner string against upward movement within the outer riser string M. The prior unthreading of the running tool 90 from the upper internal threads 69 permits the upper telescoping of the lower liner string portion 66*a* within the upper liner string portion 65.

After the anchor 50 has been locked in place, an upward strain can be taken on the running string 91 and running tool 90 secured thereto, to impart a desired degree of tension to the riser liner string 66, the liner stretching and sliding upwardly within the ratchet portion of the liner tensioner 67. Such upward movement will effect shearing of the screw 55 of the anchor and the compression of the lower packing 53 between the upper and lower abutments 52, 54 and its expansion into sealing engagement with the wall 62 of the lower nipple 10. After the desired degree of tension has been exerted on the liner string L, the running string 91 and running tool 90 can be relaxed. However, any tendency of the riser liner L to contract will be prevented by the gripping of the ratchet teeth 79 with the periphery of the liner portion 66*a*, the tendency of the liner to contract pulling the ratchet sleeve 78 downwardly and causing it to be cammed more firmly into gripping engagement with the periphery of the liner. The tendency of the ratchet sleeve to shift downwardly will carry the cam sleeve 83 downwardly with it, to force the upper abutment ring 85 toward the lower sub 70, compressing the packing 86 into firm sealing engagement with the periphery of the liner, and also to pull the upper portion 65 of the liner L downwardly. Such downward movement causes the upper abutment 23 of the liner hanger to shift toward the lower abutment 26, to compress the packing 25 therebetween and force it into firm sealing engagement against the inner wall 27 of the upper nipple 11, the tensile pull on the body 20 being transmitted through the locking sleeve 30 and its lock shoulder 34 to the nipple shoulder 15. The parts are then in the position illustrated in FIGS. 3*a*, 3*b*, in which the liner L is retained in tension between the anchor 50 secured to the lower nipple 10 and the liner hanger 19 secured to the upper nipple 11.

The running tool 90 can then be disconnected from the riser liner tensioner 67 by rotating the running string 91 and running tool 90 to the right, to completely unthread the lower portion 93 of the running tool from the internally threaded portion 72 of the riser liner tensioner, the running tool 90 then being elevated and removed from the riser apparatus.

A testing device 100 may be mounted in the lower anchor body 51 prior to the lowering of the apparatus through the outer riser string M. This testing device includes a body 101 having a passage therethrough 102 and an upwardly facing valve seat 103, a split expansible lock sleeve 104 being mounted on the body, this sleeve having an upper lock portion 105 disposed in a lock groove 106 in the anchor body and a locator portion 107 disposed in a locator groove 108 in the anchor body 51. A removable test plug 109 is disposed against the seat 103 to close the passage 102 through the test body, the upward extent of movement of this test plug being limited by its engagement with a snap retainer ring 110 mounted in a groove 111 in the upper portion of the test body. This test plug has a fishing neck 112 and an upper head 113 for permitting the test device to be withdrawn after the testing operation has been conducted.

After the liner L has been hung and anchored in tensioned condition within the outer riser pipe M, pressure can be applied to the fluid in the liner L to ascertain whether there are any leaks in the liner system, as well as testing the efficacy of the anchor and hanger seals 53, 25. After the testing operation has been performed, a suitable fishing tool (not shown) is lowered through the liner string L, the fishing tool (of a known type) moving over the test plug head 113 and around its neck 112, whereupon an upward pull taken on the fishing tool will move the plug 109 upwardly to open the passage 102 through the test device body, the test plug then engaging the retaining ring 110 and pulling upwardly on the body 101, the downwardly holding lock sleeve 104 being cammed inwardly from the lock and locator grooves 106, 108, and permitting the entire test device 100 to be withdrawn through the liner L to the drilling ring R mounted in the vessel C.

Drilling of the well bore can now continue with the internal diameter of the marine riser system having been substantially reduced by virtue of the installation of the liner L. The outer marine riser M has been relieved of the weight of the drilling mud and of the cuttings, the hydrostatic pressure then being imposed upon the smaller diameter liner string. Moreover, the much smaller internal diameter of the liner string will cause the drilling fluid and cuttings to rise at a substantially greater velocity through the riser system and to the drilling rig.

After the well bore has been drilled to the desired depth, it may be desired to remove the riser liner L from the interior of the outer string of riser pipe. A suitable cutoff tool (not shown) is lowered down inside the riser liner to a location below the riser liner hanger 19. The riser liner L is cut off just below the hanger 19, which allows the entire riser liner therebelow to drop downwardly within the outer riser pipe M, the anchor 50 automtically releasing and shifting out of the lock and locator grooves 13*a*, 12*a*, because of the lower cam surfaces

18*a*, 16*a* on the nipple **10**, shifting the lock sleeve **56** inwardly. The outer marine riser string M need only be elevated to permit the liner L to drop freely onto the ocean bottom. Recovery of the entire liner assembly L need not be attempted, since it is probably worn out by the time drilling of the well bore has been completed and could not be used again, as a practical matter.

In the form of invention illustrated in FIGS. 4*a*, 4*b*, the liner string L and riser liner anchor (not shown) are the same as in the other embodiment of the invention, the lower portion **66** of the liner string being telescoped upwardly into the riser liner tensioner **67***a*, the lower liner portion of the string having an upper head **200** which extends above a shoulder **201** of an upper riser liner string portion **65**, the lower end of which is threadedly connected to the outer cam housing **82***a* of the one-way clutch or gripper **77***a*. This cam housing contains a split ratchet sleeve **78** having upwardly facing internal ratchet teeth **79**, external cam teeth **80** coacting with companion cam teeth on the outer cam housing, the structure being essentially the same as illustrated in the other form of the invention. The lower end of the cam housing **82***a* is threadedly secured to a lower sub **70**, carrying a seal ring **71** slidably and sealingly engaging against the periphery of the lower liner string **66**. A second seal ring **71***a* may be disposed within the upper portion of the cam housing **82***a*, which also sealingly engages the periphery of the liner string.

The upper portion **65** of the riser liner string is threadedly secured to the lower end of the liner hanger **19***a*, which is of somewhat modified form when compared with the previously described liner hanger. In this case, the hanger body **20** is surrounded by a carrier **210** which supports the split locking sleeve **30** within a circumferential groove **29** between its upper flange **211** and a lower nut **28** threaded on the carrier. The sleeve **30** is the same as described in the other form of invention, and is shiftable into a lock groove **12** and locating groove **13**, as illustrated and described in the other form of the invention. The carrier **210** is shiftable on the body to a small longitudinal extent, its relative downward movement on the body being limited by its engagement with a split snap ring **212** disposed in a peripheral groove **213** in the body, its upward movement being limited by its ability to compress an elastomer packing ring **25** disposed around the body and engaging an upper shoulder abutment **23** on the body and a lower abutment **26***a* projecting upwardly from the carrier flange **211**. In all respects, the liner hanger **19***a* operates in the same manner as the other liner hanger.

The liner string L, with the liner hanger **19***a* and anchor (not shown) secured to its upper and lower ends, respectively, is lowered down through the outer marine riser pipe M on a running tool **90***a* forming the lower end of a running string (not shown) and which is threadedly secured to the upper left-hand threaded box **215** of the hanger body **20**, the lower portion **66** of the liner string hanging by its head **200** from the shoulder **201** of the upper liner portion **65**. The distance between the hanger **19***a* and anchor **50** is slightly greater than the distance between the grooves **12**, **13** in the upper hanger nipple **11** and the grooves **12***a*, **13***a* in the lower anchor nipple **10**. Lowering continues until the hanger **19***a* locks into the upper hanger nipple **11**, at which time the anchor **50** is disposed a short distance below the grooves **12***a*, **13***a* in the anchor nipple **10**. The riser liner can now be tensioned by lowering a regular casing spear (not shown) down inside the upper portion **66***a* of the lower liner string **66**, this spear latching into such portion, whereupon an upward pull is taken on the spear and the lower liner string portion **66**, to shift the latter upwardly until its anchor **50** becomes coupled to the lower anchor nipple **10** (as in FIG. 3*b*), whereupon an appropriate strain can be taken on the liner string **66**, the liner string sliding upwardly within the one-way gripper device **67***a*. When sufficient tension has been imparted to the liner string **66**, the spear is released, the tendency of the lower liner string **66** to contract being prevented by the gripping action of the one-way ratchet teeth **79** thereon and the coengaging cam elements **77***a*, **82***a*, the tendency of the lower liner string **66** to contract exerting a downward pull on the upper portion **65** of the riser liner string, which is supported by the upper hanger **19***a* from the upper nipple **11**. The tensioning insures a pack-off of the hanger packing ring **25** and of the anchor packing ring **53**.

The casting spear can now be recovered and the riser running tool **90***a* unthreaded from the hanger body **20** and also removed.

The lower portion of the liner assembly is the same as in the other form of the invention, the testing and recovery of the test device **100** being carried out in the same manner as in the other form of the invention. Similarly, removal of the liner string L, when desired, can take place in the same manner as described in connection with the other form of the invention; that is, by cutting off the liner just below the riser liner hanger **19***a*.

I claim:

1. In marine riser apparatus for use in connection with an underwater well bore: a tubular outer marine riser adapted to extend upwardly in the water from a location above the well bore; a tubular riser liner string disposed within the marine riser; anchor means for securing the lower portion of the liner string to a lower portion of the marine riser; hanger means for hanging the upper portion of the liner string to an upper portion of the marine riser; and means for tensioning the liner string between said anchor means and hanger means.

2. In apparatus as defined in claim **1**; and means for retaining said liner string in tension.

3. In apparatus as defined in claim **1**; said liner string including an upper section secured to and depending from said hanger means, a lower section secured to and extending upwardly from said anchor means and in telescopic relation to said upper section; said tension means including means connectible to said lower section for stretching said lower section upwardly along said upper section.

4. In apparatus as defined in claim **1**; said liner string including an upper section secured to and depending from said hanger means, a lower section secured to and extending upwardly from said anchor means and in telescopic relation to said upper section; said tension means including means connectible to said lower section for stretching said lower section upwardly along said upper section; and coengaging retaining means on said upper and lower sections for preventing downward movement of said stretched lower section with respect to said upper section.

5. In apparatus as defined in claim **1**; said liner string including an upper section secured to and depending from said hanger means, a lower section secured to and extending upwardly from said anchor means and in telescopic relation to said upper section; said tension means including means connectible to said lower section for stretching said lower section upward along said upper section; and one-way gripper means on one of said sections engaging said other seciton to permit said upward stretching of said lower section along said upper section, but preventing downward movement of said stretched lower section with respect to said upper section.

6. In apparatus as defined in claim **1**; seal means between said hanger means and upper portion of said marine riser; and seal means between said anchor means and lower portion of said marine riser.

7. In apparatus as defined in claim **1**; said liner string including an upper section secured to and depending from said hanger means, a lower section secured to and extending upwardly from said anchor means and in telescopic relation to said upper section; said tension means including means connectible to said lower section for stretching said lower section upwardly along said upper section; and one-way gripper means on one of said sections engaging said other section to permit said up-

ward stretching of said lower section along said upper section, but preventing downward movement of said stretched lower section with respect to said upper section; seal means between said hanger means and upper portion of said marine riser; and seal means between said anchor means and lower portion of said marine riser.

8. In marine riser apparatus for use in connection with an underwater well bore; a tubular outer marine riser adapted to extend upwardly in the water from a location above the well bore; a tubular riser liner string disposed within the marine riser; said marine riser including a lower nipple having an internal groove and an upper nipple having an internal groove; a lower hanger secured to the upper portion of said liner string and having lock means receivable in said upper nipple groove; an anchor secured to the lower portion of said liner string and having lock means receivable in said lower nipple groove; and means for tensioning the liner string between said lower and upper nipples with said hanger lock means and said anchor lock means disposed in said upper groove and lower groove, respectively.

9. In marine riser apparatus as defined in claim 8; said upper portion and lower portion of said liner string being in telescopic relation to each other; said tensioning means including means connectible to said lower portion for stretching said lower portion upwardly along said upper portion.

10. In marine riser apparatus as defined in claim 8; said upper portion and lower portion of said liner string bein in telescopic relation to each other; said tensioning means including means connectible to said lower portion for stretching said lower portion upwardly along said upper portion; and coengaging retaining means on said upper and lower portions for preventing downward movement of said stretched lower portion with respect to said upper portion.

11. In marine riser apparatus as defined in claim 8; said upper portion and lower portion of said liner string being in telescopic relation to each other; said tensioning means including means connectible to said lower portion for stretching said lower portion upwardly along said upper portion; and one-way gripper means on one of said portions engaging said other portion to permit said upward stretching of said lower portion along said upper portion, but preventing downward movement of said stretched lower portion with respect to said upper portion.

12. In marine riser apparatus for use in connection with an underwater well bore: a tubular outer marine riser adapted to extend upwardly in the water from a location above the well bore; a tubular riser liner string disposed within the marine riser; anchor means for securing the lower portion of the liner string to a lower portion of the marine riser; hanger means for hanging the upper portion of the liner string to an upper portion of the marine riser; means for tensioning the liner string between said anchor means and hanger means; said liner string including an upper section secured to and depending from said hanger means, a lower section secured to and extending upwardly from said anchor means and in telescopic relation to said upper section; a running tool for lowering said riser liner string in the marine riser; first releasable connector means securing said running tool to said upper section; second releasable connector means securing said running tool to said lower section; release of said first connector means enabling said running tool to stretch said lower section upwardly along said upper section; and coengaging retaining means on said upper and lower sections for preventing downward movement of said stretched lower section with respect to said upper section.

13. In apparatus as defined in claim 12; said first releasable connector means comprising a first threaded connection; said second releasable connector means comprising a second threaded connection; rotation of said running tool releasing said first threaded connection without releasing said second threaded connection.

14. A method of securing a tubular riser liner string in a tubular marine riser projecting upwardly in water from a location above an underwater well bore, comprising lowering the liner string in the marine riser until the lower portion of the liner string is at the lower portion of the marine riser and the upper portion of the liner string is at the upper portion of the marine riser, securing the lower portion of the liner string to the lower portion of the marine riser, securing the upper portion of the liner string to the upper portion of the marine riser, and tensioning the liner string between its points of securement to the lower and upper portions of the marine riser.

15. A method as defined in claim 14; and retaining the liner string in tension.

16. A method as defined in claim 14; the liner string being lowered in the marine riser on a running string secured to the liner string, the liner string being tensioned by taking an upward pull on the running string.

17. A method as defined in claim 14; the liner string being lowered in the marine riser on the running string secured to the liner string, the liner string being tensioned by taking an upward pull on the running string, retaining the liner string in tension, and releasing the running string from the liner string.

18. A method as defined in claim 14; the liner string including an upper section and a lower section telescoped one within the other, the liner string being lowered in the marine riser on a running tool secured to at least one of said sections, the liner string being tensioned by taking an upward pull on the running tool, retaining the liner string in tension, and releasing the running tool from said one of said sections.

19. A method as defined in claim 14; the liner string including an upper section and a lower section telescoped one within the other, the liner string being lowered in the marine riser on a running tool secured to both of said sections, releasing the running tool from the upper section while the running tool remains secured to the lower section, tensioning the lower section by taking an upward pull on the running tool to pull the lower section upwardly along the upper section, securing said upper and lower sections to each other to retain the sections in tension, and releasing the running tool from the lower section.

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