

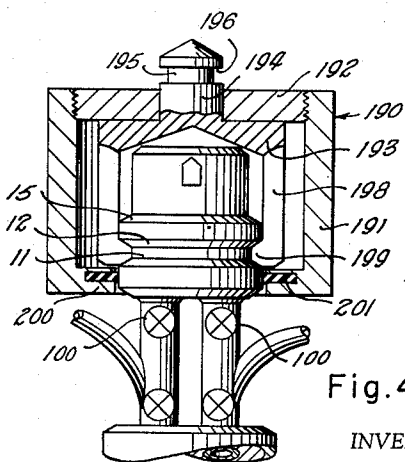
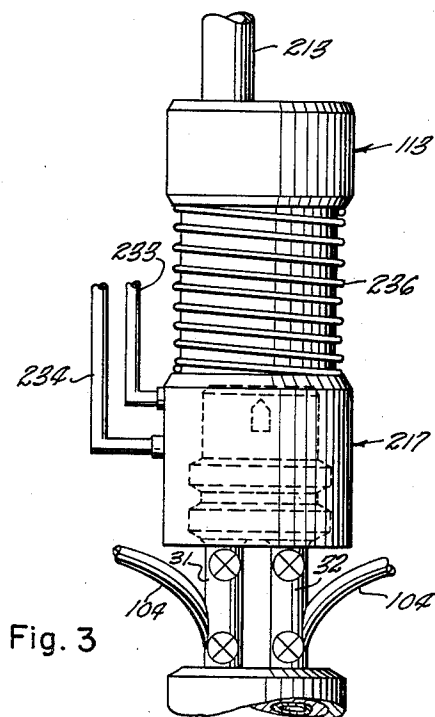
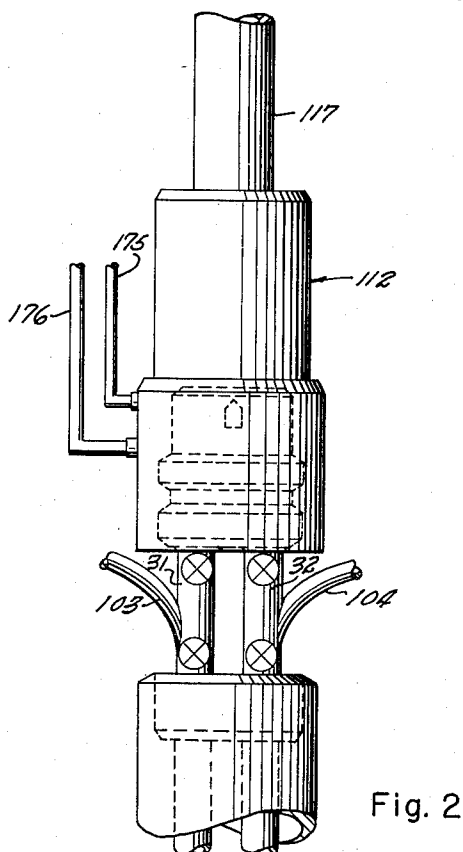
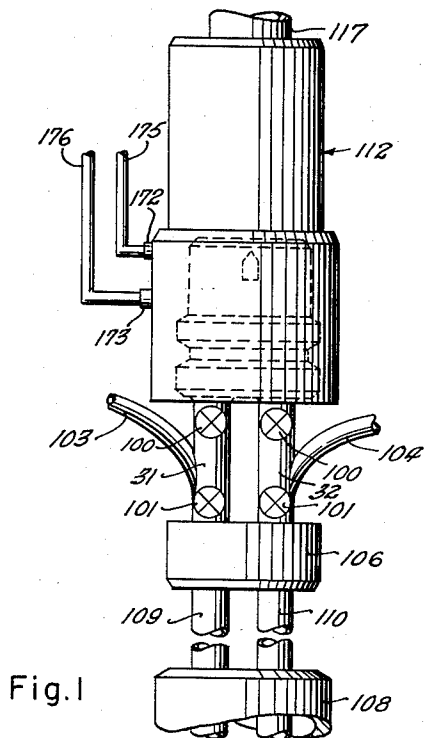
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LATCH MEANS

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3 Sheets-Sheet 1



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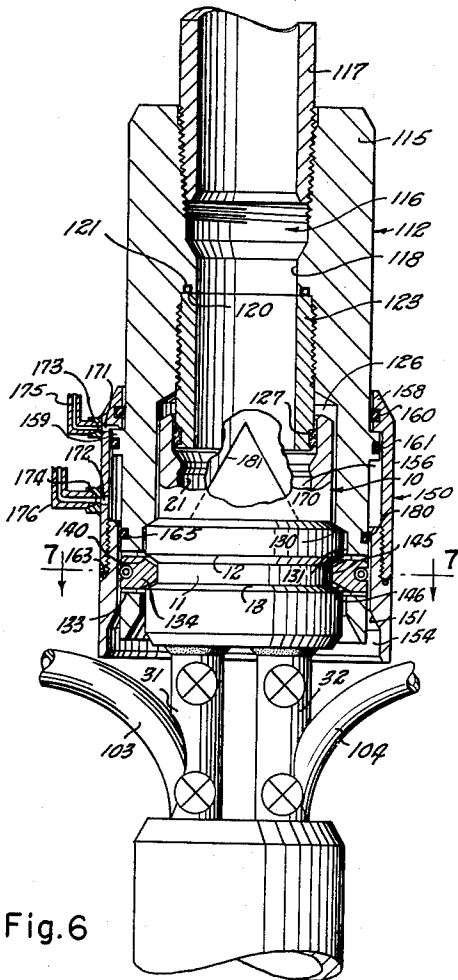


Fig.6

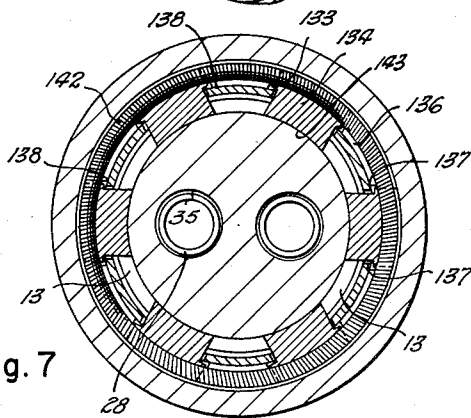


Fig. 7

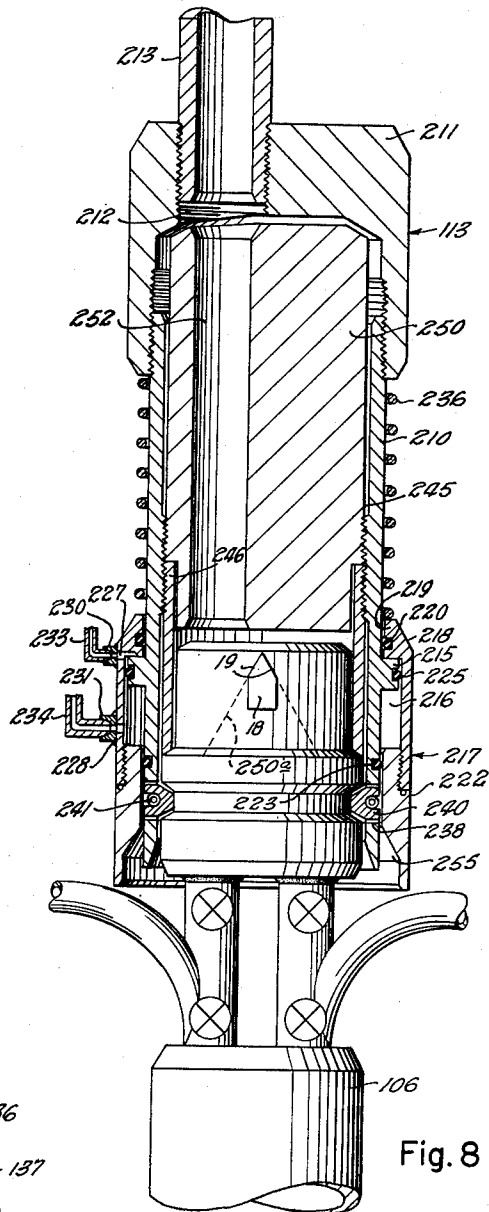


Fig. 8

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LATCH MEANS

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This invention relates to well tools and more particularly to latch means for well tools and pulling tools for said well tools.

An object of this invention is to provide a new and improved latch means for securing well devices to a plurality of well flow conductors.

Another object is to provide a latch means which may be secured to a pair of tubing strings and has a pair of bores or flow passages, the bores or flow passages of the tubing strings communicating with the flow passages of the latch member, wherein the bores of the latch member are provided with locking means and sealing surfaces whereby the flow of fluids between the tubing strings and the bores of the latch member may be controlled by well devices locked in the bores and engaging the seal surfaces.

Still another object of the invention is to provide a latch means having a latch head to which a plurality of tubing strings may be connected.

A further object is to provide a latching means whose latch head is provided with bores communicating with the flow passages of each of the tubing strings wherein the bores are provided with means engageable by well devices to position and lock the well devices in the bores to control the flow of fluids through the tubing strings.

Still another object is to provide a latch head, connectable to the upper ends of a plurality of tubing strings, which is provided with means releasably engageable by running and pulling tools whereby the tubing strings may be lowered to and raised from a well head from a remote position, as at the surface of a body of water where the well head is located at the bottom of the body of water.

Another object is to provide a latch means having bores aligned with the flow passages of a plurality of tubing strings or well flow conductors which is provided with orienting means for properly positioning running and pulling tools relative to the bores.

Still another object is to provide running and retrieving tools for use with a latch means having a latch head which are releasably securable to the latch head and which are remotely controlled whereby running and pulling tools may be secured to and detached from the latch head by control means remote from the latch head.

A further object is to provide a running and pulling tool for the latch head which is provided with a means for engaging the latch head to secure the tool to the latch head and with a tubular means which is alignable with a preselected one of the bores of the latch head.

A still further object is to provide a running and pulling tool for the latch means providing an imperforate conduit or well flow conductor communicating with both bores of the latch head, the running and retrieving tool and the latch head having coengageable sealing means to seal therebetween.

Another object is to provide a running and retrieving tool for the latch means having a lubricator guide alignable with a selected one of the bores of the latch head whereby a lubricator may be extended through the lubricator guide into the selected bore to be locked therein in sealing engagement with the seal surface of such selected bore.

Additional objects and advantages of the invention will be readily apparent from the reading of the following

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description of a device constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

FIGURE 1 is a partly schematic front plan view of the latch means and of a running and pulling tool of the invention showing the latch means engaged by the running and pulling tool during lowering or raising of a tubing hanger and of its associated tubing strings toward or from a sub surface well head;

FIGURE 2 is a view similar to FIGURE 1 showing the tubing string hanger in position in the well head;

FIGURE 3 is a partly schematic front plan view of another form of the running and pulling tool secured to the latch means;

FIGURE 4 is a vertical partly sectional and partly schematic view showing a protective housing releasably secured to the latch means;

FIGURE 5 is a vertical sectional view of the latch head of the latch means embodying the invention showing a plug positioned in one of the bores of the latch head and a lubricator positioned in the other of the bores of the latch head;

FIGURE 6 is a vertical sectional view of the running and pulling tool of FIGURES 1 and 2 in position on the latch head, portions of the latch head being broken away;

FIGURE 7 is a cross-sectional view taken on line 7-7 of FIGURE 6; and

FIGURE 8 is a vertical sectional view of the running and pulling tool of FIGURE 3 shown releasably secured on the latch head.

Referring now to the drawings, the latch means of the invention includes a latch head 10 provided on its outer surface with an external recess 11 defined by outwardly divergently extending upper and lower shoulders 12 and 13. The latch head has an intermediate downwardly and outwardly extending stop shoulder 15 spaced above the external latch recess 11. The upper portion 17 of the latch head is reduced to provide the intermediate stop shoulder and a pair of orienting lugs 18 are rigidly secured to the upper reduced portion of the latch head adjacent the upper end thereof in any suitable manner, as by welding. The orienting lugs 18 have upper cam shoulders 19 which converge upwardly to a point.

The latch head is provided with a pair of longitudinally extending flow passages or bores 21 and 22 in the lower portion thereof whose upper ends communicate with the large bore or flow passage 24 which provides a cylindrical sealing surface 25. Each of the bores 21 and 22 is provided with an internal flange 26 spaced from the lower end of the latch head which has an upwardly facing stop shoulder 28 and a downwardly facing lower stop shoulder 29. The flow conduits 31 and 32 telescope into the lower ends of the bores 21 and 22, respectively, such telescoping being limited by the engagement of the upper ends of the flow conduits 31 and 32 with the lower stop shoulders 29 of the internal flanges.

The longitudinal bores of the latch head above the upwardly facing shoulders 28 are provided with threads 34 whereby such well devices as the lubricator 40 may be secured in either of the longitudinal bores 21 and 22. The longitudinal bores above their threads 34 are each provided with a downwardly and inwardly extending intermediate stop shoulder 35 and a cylindrical sealing surface 36 which extends between the intermediate stop shoulder 35 and the internal locking recess 38 of each longitudinal bore. The internal locking recesses 38 are defined by inwardly divergently extending upper and lower shoulders 39 and 39a. The upper ends of the longitudinal bores are provided with downwardly and inwardly extending upper cam shoulders 42. The internal lock recesses 38 are provided for receiving the locking means or lugs

44 of such well devices as the plug 45 illustrated in FIGURE 5.

The plug 45 may include a seal mandrel 46 into whose upper end is threaded a top sub 48 provided at its upper end with an external flange 49 having an undercut downwardly facing shoulder 50 which may be engaged by the hooks of the dogs of such running and pulling tools as the Otis running tool illustrated in FIGURE 63, page 4158, of the Composite Catalog of Oil Field and Pipeline Equipment, 1957 edition, and the Otis pulling tool illustrated in FIGURE 67, page 4159, of the Composite Catalog of Oil Field and Pipeline Equipment, 1957 edition.

A valve cage 52 is threaded on the lower end of the seal mandrel 46 and its upper end is spaced below the downwardly facing shoulder 53 of the seal mandrel provided by a reduced lower portion thereof. A packing assembly 54 is disposed about the seal mandrel between the downwardly facing annular shoulder 53 thereof and the upper end of the valve cage 52 in order to engage the sealing surface 36 of either of the longitudinal bores 21 or 22 of the latch head. The valve cage is provided with longitudinally spaced shoulders 56 and 57 which are adapted to engage the stop shoulders 35 and 28, respectively, of the bores of the latch head to limit downward movement of the plug 45 in such bores and to properly position the packing assembly 54 in sealing engagement with the seal surface 36.

The lower reduced portion 60 of the valve cage 52 is provided with an internal annular flange 52 spaced below the upwardly and inwardly extending valve seat 61 provided on the lower end of the seal housing. A valve 64 is longitudinally movably disposed in the valve cage and has a downwardly and outwardly extending seal surface 66 engageable with the valve seat 61 to prevent flow of fluids upwardly from the lateral ports 65 of the valve cage and through the seal housing. The stem of the valve 64 extends downwardly through the passage 67 provided by the internal flange 62 which serves to guide the longitudinal movement of the valve in the valve cage. A spring 68, whose opposite ends engage the upper shoulder provided by the internal flange 62 and the downwardly facing shoulder 69 of the valve 62, biases the valve toward closed position wherein it engages the seat 61.

The seal mandrel is also provided with a plurality of lateral apertures 70 in which are positioned a plurality of lugs 71 which are movable outwardly into the internal lock recesses 38 of the longitudinal bores of the latch head to lock or anchor the seal mandrel in sealing position in the longitudinal bore. The lugs are provided with lateral flanges (not shown) which limit their outward movement by engaging the seal housing when the lugs are in fully expanded positions. The lugs are provided with outwardly convergent upper and lower outer shoulders which serve to cam the lugs inwardly toward retracted positions upon engaging downwardly or upwardly facing obstructions during upward or downward movement, respectively, of the seal mandrel through the longitudinal bores 21 or 22.

The lock lugs 71 are moved outwardly into expanded positions and locked therein by a lock mandrel 75 which is mounted in the seal mandrel for limited longitudinal movement therein and whose upper end extends upwardly of the top sub 48. The lock mandrel is provided with an external lock flange 78 having an upper downwardly and outwardly extending annular cam shoulder 79. The upper cam shoulder 79 of the lock flange of the lock mandrel is adapted to engage the inner upwardly and inwardly extending cam shoulders 82 of the lock lugs whereby upon upward movement of the lock mandrel relative to the seal mandrel the engagement of the cam shoulders 79 and 82 moves the lock lugs 71 outwardly to the expanded positions wherein they extend outwardly of the seal mandrel. The lock mandrel is biased upwardly toward the locking position illustrated in FIG-

URE 5 by a spring 83 whose opposite ends engage the upwardly facing annular shoulder 84 of the seal mandrel and the downwardly facing shoulder 85 of the lock flange. The outer lock surface 88 of the lock flange, when the mandrel is in the upper locking position illustrated in FIGURE 5, engages the internal surfaces 89 of the lock lugs to prevent their inward movement toward retracted positions.

When it is desired to position the plug 45 in a selected one of the bores 21 or 22 of the latch head, a suitable running tool, such as an Otis running tool illustrated in FIGURE 65 of the Composite Catalog of the Oil Field and Pipeline Equipment, page 4158, 1957 edition, is secured to the upper end of the lock member by means of a shear pin which extends through the lateral aperture 90 adjacent the upper end of the lock mandrel. The spring 83 holds the lock mandrel in the upper position illustrated in FIGURE 5 as the plug is lowered to the latch head. The lock lugs 44 of course extend outwardly of the seal mandrel 46 so that their lower outer shoulders engage any upwardly facing obstructions, such as the annular shoulder 42, as the seal mandrel passes therethrough. When the lock lugs engage such upwardly facing obstructions, downward movement of the seal mandrel 46 is arrested but the lock mandrel is moved downwardly relative to the lock lugs and the seal mandrel until its upper shoulder 79 is disposed below the lock lugs so that the lock lugs are again free to move inwardly. Downward force imparted to the seal mandrel when the downward movement of the lock mandrel is stopped by the engagement of its lower end with the upwardly facing shoulder 84 of the seal mandrel then causes the lower upwardly and outwardly extending shoulders of the lock lugs to cam the lugs inwardly to permit further downward movement of the seal mandrel. When the lock lugs again pass the obstruction and are again free to move outwardly, the force of the spring 83 moves the seal mandrel downwardly relative to the lock mandrel to again cause the engagement of the cam shoulder 46 with the lower inner shoulders 82 of the lock lugs to move the lock lugs outwardly into the expanded position illustrated in FIGURE 5.

When the plug 45 reaches the position illustrated in FIGURE 5, wherein downward movement of the seal mandrel is arrested by the engagement of its shoulders 56 and 57 with the upwardly facing shoulders 35 and 28, respectively, of the bore in which the plug is located, the seal assembly 54 engages the seal surface 35 to seal between the plug and the bore and the lock lugs are in their expanded positions in the internal lock recess 38 of such bore. Upward jars are then imparted to the running tool to shear the shear pin by which the running tool is connected to the lock member whereupon the running tool is released from the lock member for removal from the latch head. The lock member is then left in the upper position in the seal mandrel, its outer surface 88 being disposed inwardly of the internal surfaces 89 of the lock lugs thus locking the lock lugs in their expanded positions. The valve 64 then prevents upward flow of fluids through the selected bore while permitting downward flow whenever a downwardly acting pressure differential is created across the valve.

When it is desired to remove the plug from the latch head, a suitable pulling tool, such as the Otis running tool illustrated in FIGURE 67, page 4159, of the Composite Catalog of Oil Field and Pipeline Equipment, 1957 edition, is lowered into the latch head to first move the lock mandrel 75 downwardly relative to the seal mandrel 46 so that the lock flange 78 thereof is moved below the lock lugs 71, which are then free to move inwardly. The hooks of the dogs of the pulling tool then engage the undercut shoulder 50 of the top sub of the seal mandrel whereupon an upward force imparted to the pulling tool causes the plug to be removed upwardly from the bore and the latch head in

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which it is disposed. The camming engagement of the upper downwardly and outwardly extending shoulders of the lock lugs during such upward movement moves the lock lugs inwardly into retracted position upon meeting such downwardly facing obstructions as the upper shoulders defining the upper ends of the internal lock recesses 38 to permit such removal of the plug from the latch head. If desired, the pulling tool may be provided with a prong which may extend through the lock mandrel and engage the valve 64 to move it downwardly prior to the engagement of the hooks of the dogs of the pulling tool with undercut shoulder 50 of the top sub so that the fluids may pass through the plug during its upward movement through a well flow conductor in the event that well fluids are present to facilitate such removal of the plug or to equalize the pressures across the seal mandrel prior to its upward movement.

If desired, a lubricator 40 may be releasably secured in either of the well bores 21 or 22. The lubricator is provided at its lower end with a seal mandrel 92 having external threads 93 which are engageable with the internal threads of either bore of the well head to secure the lubricator in such bore. The lubricator seal mandrel has a reduced upper portion which is threaded into a connector 94 which in turn is threaded on the lower end of the lubricator section 95. The reduced upper portion of the seal mandrel provides an upwardly facing shoulder 96. A seal assembly 97 is disposed on the seal mandrel between the upwardly facing shoulder 96 and the lower end of the connector 94.

It will be apparent that the seal assembly 97 engages the seal surface 36 of the bore when its threads 93 are engaged with the internal threads 34 of the bore and that the lower end thereof engages the upwardly facing shoulder 28 of the bore of the latch head to limit downward movement of the lubricator into the bore. It will thus be apparent that the lubricator may be removably positioned in a selected bore of the latch head by extending the lubricator into such bore and rotating it to cause the external threads to engage the internal threads of the bore to rigidly secure the lubricator in position in such bore. The seal assembly 97 then seals between the lubricator and the bore to prevent flow of fluids between the lubricator and the latch head. The lubricator of course may be removed from the bore in which it is secured by rotating it in the opposite direction.

The flow conduits 31 and 32 of the latch head are provided with upper and lower valves 100 and 101, respectively, which control flow of fluids therethrough and through the flow lines 103 and 104 of the flow conduits 31 and 32, respectively. The lower ends of the flow conduits 32 are connected to a suitable tubing hanger 106 which is provided with suitable locking means, not shown, by means of which it may be locked to a well head 108 when it is lowered into engagement therewith. The tubing hanger 106 has connected thereto a plurality of tubing strings 109 and 110 which are in communication with the flow conduits 31 and 32, respectively. The means for releasably locking the tubing hanger to the well head 108 may be of the type illustrated in my co-pending application Serial No. 770,505, filed October 29, 1958, or by any other suitable means.

It will be apparent that when the tubing hanger 106 is positioned on the well head 108 flow of fluids through the tubing string may be controlled by means of the valves 100 and 101 of the flow conduit. The valves are remotely controlled where the well head 108 is in an inaccessible location, such as the bottom of a body of water. The valves 100 and 101 may be controlled by any suitable hydraulically or pneumatically operated means or by any suitable electrically operated means.

For example, if the valve 100 of the flow conduit 31 is closed and its valve 101 is open, fluids may flow between the tubing string 109 and the flow line 103 while if the valve 100 is also open fluids may also flow upwardly

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into the latch head. If desired such flow to the latch head is prevented by a well tool, such as the plug 45, disposed in the bore 21 which communicates with the flow conduit 31. Flow of well fluids through the flow line 103 of course may also be controlled with a suitable valve, not shown, connected in the flow line 103 at the surface of the water or on shore.

The valves of the flow conduit 32 may similarly be selectively opened or closed to control flow through the flow line 104 and to the bore 22.

The latch head and the tubing strings may be lowered to the well head 108 by means of either the running and pulling tool 112 illustrated in FIGURES 1, 2 and 6 or by means of the running and pulling tool 113 illustrated in FIGURES 3 and 8. The running tool 112 includes a body 115 having a central bore 116 into whose upper end may be threaded the lower end of the handling string 117 by means of which the running and pulling tool is lowered and raised. The body is provided with an internal annular flange 118 having a downwardly facing annular shoulder 120 provided with a downwardly facing annular recess in which may be disposed a suitable seal means, such as an O-ring 121, for sealingly engaging the upper end of a seal sleeve 123. The seal sleeve is threaded into the body below the internal flange 118 and its lower end extends into the enlarged intermediate portion 126 of the bore 116 of the body and into the large bore 24 of the latch head. The seal sleeve is provided with an external annular recess adjacent its lower end in which may be disposed a suitable seal means 127 which engages the seal surface 25 of the latch head when the running and pulling tool 112 is secured to the latch head.

The reduced upper portion 17 of the latch head is telescoped into the intermediate enlarged portion 126 of the body 115 and its stop shoulder 15 engages the downwardly facing annular stop shoulder 130 of the body 115 to limit movement of the latch head into the body 115. The downwardly facing stop shoulder 130 of the body 115 is provided by the lower enlarged portion 131 of the bore 116 of the body.

The lower portion of the running and pulling tool body below its lower stop shoulder 130 is provided with a plurality of circumferentially spaced lateral apertures 133 in which are disposed the lock lugs 134. The lateral apertures communicate with an external annular recess 136 of the body. The lock lugs are enlarged at their outer ends to provide inwardly facing lateral shoulders 137 which are adapted to engage the outwardly facing annular surface 138 defining inner end of the external recess to limit inward movement of the lock lugs. The lock lugs are provided with external transverse slots 140 which are aligned with the external recess 136 of the body 115. A garter spring 142 is received in the slots 140 and the external annular recess 136 to resiliently urge the lock lugs inwardly toward the latching position illustrated in FIGURE 6. The lock lugs 134 have inner surfaces 143 which correspond in curvature to the external surface of the latch head between the upper and lower shoulders 12 and 13 of the external recess 11.

The lock lugs 134 have upper and lower inwardly convergent shoulders 145 and 146, respectively. The lower shoulders upon their engagement with the intermediate stop shoulder 15 of the latch head tend to cam the lock lugs outwardly to permit movement of the body downwardly over the stop shoulder to the position wherein the lock lugs are engaged in the external recess 11 of the latch head. The upper downwardly and inwardly extending shoulders 145 of the lock lugs tend to cam the lock lugs outwardly to permit upward movement of the body upon their engagement with the upwardly and outwardly extending upper shoulder 12 of the latch head upon upward movement of the lock body relative to the latch head. The lock lugs are free to move to their outer

position wherein their outer portions then extend outwardly of the body when a lock sleeve 150 of the running and pulling tool is in an upper position on the body 115 and the downwardly facing shoulder 151 thereof is disposed above the lock lugs so that the lock lugs are free to move into the enlarged lower portion 154 of the lock sleeve.

The lock sleeve has an upper section 156 provided with an upper internal flange 158 which is disposed above the external flange 159 of the body. The upper internal flange of the upper section of the lock sleeve and the external flange of the body are provided with annular recesses in which are disposed the O-rings 160 and 161, respectively, which seal between the body and the upper section. The lower section 163 of the lock sleeve is engaged by an O-ring 165 or other similar sealing means disposed in an external recess of the body above the lateral slots 133 and below the external flange 159. The upper end of the lower section 163 of the lock sleeve and the downwardly facing shoulder of the internal flange 158 of the upper sleeve section together with the upper section form a chamber 170 in which the external flange 159 of the body is disposed.

It will be apparent that the lock sleeve may move between the lower locking position illustrated in FIGURE 6, wherein further downward movement is limited by the engagement of the upper shoulder of the external flange of the body with the downwardly facing shoulder of the internal flange of the upper sleeve section, and an upper position wherein the upper end of the lower section of the lock sleeve engages the lower shoulder of the external flange of the body. In such upper position of the lock sleeve, the downwardly and outwardly extending shoulder 151 of the lock sleeve is disposed above the lock lugs 134 so that the lock lugs are then free to move outwardly of the body 115 until they engage the lock sleeve.

The lock sleeve is provided with a pair of ports 171 and 172 communicating with the bores of suitable fittings 173 and 174, respectively, rigidly secured to the lock sleeve in any suitable manner, as by welds. A pair of flexible conduits 175 and 176 are secured to the lock sleeve by means of the fittings 173 and 174 in any suitable manner, as by welds. The conduits 175 and 176 may be connected to suitable source of fluid under pressure whereby fluid under pressure may be selectively admitted through the ports 171 and 172 into the chamber 170 above or below the external flange of the body 115.

It will be apparent that when the fluid under pressure is introduced through the conduit 175, while the conduit 176 is open, the pressure acting on the internal flange 158 of the lock sleeve will cause the lock sleeve to move upwardly on the body 115 while fluid which is in the chamber 170 below the external flange of the body flows out of the chamber through the conduit 176. When the lock sleeve is in the upper position on the body an upward pull imparted to the body will cause the lock lugs to be cammed outwardly since the lock surface 180 of the lock sleeve is now disposed above the lock lugs and the lock lugs are now free to move outwardly into the enlarged portion 154 of the bore of the lock sleeve. The locking lugs 134 are prevented from moving outwardly out of the lateral apertures by the force of the garter spring when the lock sleeve 150 is in its upper position. In addition the enlarged bore portion 154 is in alignment with the lock lugs and the engagement of the outer ends of the lock lugs with the lower portion of the lock sleeve, should the garter spring fail for any reason, would also prevent movement of the lock lugs out of the lateral apertures. The running and pulling tool 112 may thus be freed from the latch head.

When it is desired to secure the pulling and running tool 112 to the latch head, the lock sleeve is maintained in its upper position by the introduction of pressure under fluid into the chamber 170 above the external flange

through the conduit 175. The lower end of the body is then telescoped over the latch head, the lock lugs being cammed outwardly upon the engagement of their lower shoulders with the upper shoulder 15 of the latch head since the lugs are now free to move outwardly into the enlarged portion 154 of the bore of the lock sleeve. When the downward telescoping movement of the body 115 is arrested by the engagement of its internal annular stop shoulder 130 with the upwardly facing stop shoulder 15 of the latch head, the lock lugs 134 are aligned with the external lock recess 11 and moved inwardly thereinto by the action of the garter spring 142. Fluid under pressure is then admitted to the chamber 170 below the external flange 159 of the body through the conduit 176 while the conduit 175 is opened to permit escape of fluid from the chamber above the external flange. As a result, the lock sleeve moves downwardly on the body to the position illustrated in FIGURE 6 wherein the lock surface 180 is aligned with the outer ends of the lock lugs and prevents their outward movement. In the event that any lock lug is not in the locking position shown in FIGURE 6, the downwardly and outwardly extending shoulder 151 of the lock sleeve cams such lug inwardly to its locking position during downward movement of the locking sleeve on the body 115.

With the handling string in the position illustrated in FIGURE 6, flow of fluids may take place only between the tubing strings 109 and 110 and through the handling string when the valves 100 and 101 of the flow conduits 31 and 32 are open since the seal sleeve 123 seals between the body and the latch head. The handling string 117 and the running and pulling tool 112 thus form an imperforate conductor whereby flow of fluids may take place from both tubing and strings to the surface. In the event that one of the bores 21 or 22 is provided with a plug then of course flow of fluids can take place only from the tubing string connected to the other open bore of the latch head.

The body 115 is provided with a pair of slots 181 in the intermediate enlarged bore portion 126 thereof in which are received the orienting lugs 18 of the latch head when the body is telescoped on the latch head.

It will be apparent that if desired a plug 45 could be inserted in each or either one of the bores 21 and 22 prior to the connection of the running and pulling tool 112 on the latch head preparatory to the lowering of the tubing string to the well head. In normal operation, the plugs 45 are disposed in both bores of the latch head to prevent flow of well fluids from the tubing strings there-through in the event that the upper valves 100 fail, or are accidentally opened, or in the event that the upper valves are not provided in the flow conduits 31 and 32.

After the tubing strings have been run into place by means of the running and pulling tool 112, the tool is released from the latch head and a protector housing 190 is lowered over the latch head and secured to it to protect it from corrosion. The protector housing 190 includes a sleeve 191 into whose upper end is threaded a retainer ring 192. A collet 193 is disposed within the sleeve 191 and has an extension 194 which extends through the retainer ring 192 and is rigidly secured thereto, as by welding. The extension 194 has an external annular recess 195 which provides a downwardly facing shoulder 196 by means of which the protector housing may be secured to any suitable running or pulling tool. The collet 193 is provided with a plurality of resilient collet fingers 198 provided with inwardly extending bosses 199 which are adapted to extend into the external latch recess 11 of the latch head. The collet bosses 199 have upper and lower inwardly convergent shoulders which are adapted to cam the collet fingers outwardly upon engaging the shoulders 12 or 15, respectively, of the latch head to enable the bosses to move into and out of the external lock recess 11. The protector housing may be releasably secured to the latch head by merely forcing

the collet fingers downwardly over the latch head and can be released from the latch head by merely pulling upwardly on the protector housing. The sleeve 191 of the protector housing is provided with an internal flange 200 having an internal annular recess in which is disposed a suitable seal means 201 which engages the latch head below the external recess thereof to seal between the protector housing and the latch head.

The protector housing 190 is filled with refined oil after it has been lowered into and been filled with water by any suitable means, such as a hose which is inserted into the water and below the opening of the internal flange 200 of the sleeve 191 of the protector housing whereupon the flow of oil, which is of lower density than the water, causes the oil to replace the water which is inside the protector housing. The protector housing is then lowered over the latch head and is forced downwardly thereover. The excess oil in the protector housing flows outwardly past the seal means 201 as the housing is lowered over the latch head which of course displaces some of the oil in the protector housing. The seal means distorts resiliently to permit the escape of such displaced oil. The oil then fills the protector housing and surrounds all external surfaces of the latch head preventing their corrosion by salt water or other chemicals which may be present in the water.

The running and pulling tool 113 includes a body sleeve 210 on whose upper end is threaded a cap 211. The cap has a threaded bore 212 which is eccentrically disposed relative to the cap and in which is threaded the lubricator guide 213. An external flange 215 of the body sleeve extends into the chamber 216 formed by a locking sleeve 217. The locking sleeve has an upper section 218 having an internal flange 219 provided with an internal recess in which is disposed an O-ring 220 or other suitable sealing means which seals between the body sleeve and the lock sleeve. The lower section 222 of the lock sleeve is threaded in the lower end of the upper section. The body sleeve is provided with an external recess in which is disposed an O-ring 223 which seals between the sleeve 210 and the lock sleeve 217 below the chamber 216. The external flange 215 of the sleeve 210 is similarly provided with an external recess in which is disposed an O-ring 225 which seals between the lock sleeve and the sleeve 210.

The lock sleeve is movable between upper and lower positions on the body sleeve by fluid under pressure which is admitted to the chamber 216 through the ports 227 and 228 which open into the chamber on opposite sides of the external flange 215 of the body sleeve. The ports communicate with the fittings 230 and 231, respectively, which are secured to the upper section of the lock sleeve by any suitable means as by welds. The conduits 233 and 234 are connected to the fitting 230 and 231, respectively, by any suitable means, such as welds.

It will be apparent that when it is desired to move the lock sleeve 217 upwardly on the body sleeve, the conduit 234 is opened to permit escape of fluids from the chamber 216 below the external flange 215. Fluid under pressure is then introduced into the chamber 216 above the external flange through the conduit 233. The force of the fluid then moves the lock sleeve upwardly on the body sleeve against the resistance of a spring 236 disposed about the body sleeve whose opposite ends abut the lower end of the cap 211 and the upper end of the lock sleeve. The provision of the spring 236 insures a positive holding of the lock sleeve in its lower position on the body sleeve 210 even if the pressure of the fluid in the chamber 216 below the external flange 215 of the body sleeve should drop and also permits the disconnection of the conduit 234 from the source of fluid pressure should it be so desired without freeing the lock sleeve for upward movement on the body sleeve.

When it is desired to move the lock sleeve downwardly on the body sleeve to the lower locking position illustrated in FIGURE 8, the conduit 233 is opened to permit escape

of fluid from the chamber 216 above the external flange 215 of the body sleeve whereupon the spring 236 moves the lock sleeve downwardly.

The body sleeve adjacent its lower end is provided with a plurality of lateral apertures 238 in which are disposed the lock lugs 240 which are identical in all respects with the lock lugs 134 illustrated in FIGURES 6 and 7 and which are biased inwardly by the garter spring 241.

The lock sleeve intermediate its ends is provided with a threaded internal flange 245. An orienting sleeve 246 is secured in the body sleeve by engagement of its external threads with the internally threaded flange 245. The orienting sleeve is provided with a pair of downwardly opening orienting slots 250a in which are receivable the orienting lugs 18 of the latch head. The coaction of the upwardly convergent sides of the slots 250a with the upwardly convergent sides 19 of the orienting lugs positions the lubricator guide in alignment with either one or the other of the bores 21 or 22 of the latch head when the running and pulling tool is telescoped over the latch head. If the lubricator guide is positioned over one of the bores and it is desired to locate it over the other, the running and pulling tool is first lifted upwardly by the lubricator guide which is then rotated through somewhat less than 180 degrees and then again lowered. The camming engagement of the shoulders 19 with the sides of the slots 250a then again orients the lubricator guide in alignment with the other bore 21 or 22 of the latch head, as the case may be.

The body sleeve 210 is also provided with a guide sub 250 whose lower reduced end telescopes into the orienting sleeve 246 and which is secured to the body sleeve by external threads which engage with the threaded internal flange 245 of the body sleeve. The guide sub 250 is provided with a bore 252 which is in alignment with the bore of the lubricator guide.

It will now be apparent that the tubing strings 109 and 110 and hanger 106 may be lowered into the well head by means of the running and pulling tool 113 and that the running and pulling tool 113 may be released from engagement with the latch head for removal therefrom by introducing fluid under pressure into the chamber 216 above the external flange 215 which at the same time opening the conduit 234 to permit escape of fluid from the chamber 216 below the external flange. The force of the fluid introduced into the chamber causes the lock sleeve 217 to move upwardly whereupon the shoulder 255 of the lower section 222 of the lock sleeve is positioned above the lock lugs which are thus freed to move outwardly. An upward pull imparted to the lubricator guide then causes the lugs to move outwardly due to the camming action of their upper shoulders with the lower shoulder 12 of the latch recess 11 to thus free the body sleeve 210 from the latch head.

When it is desired to secure the running and pulling tool 113 to the latch head, the lock sleeve is first moved to its raised position on the body sleeve against the resistance of the spring 236 and the running and pulling tool is telescoped over the latch head, the lock lugs 240 moving outwardly upon engaging the stop shoulder 15 due to the camming engagement of their lower upwardly and inwardly extending shoulders with the downwardly and outwardly extending stop shoulder 15. After the lock lugs move into the latch recess upon becoming aligned therewith due to the action of the garter spring 241, the spring forces the lock sleeve to its lower locking position on the body sleeve. If necessary, fluid under pressure may be admitted into the chamber 216 below the external flange 215 and at the same time the conduit 233 may be opened in order to force the lock sleeve to the lower locking position illustrated in FIGURE 8 wherein it prevents outward movement of the lock lugs out of the latch recess if the spring for some reason does not exert sufficient force to do so.

It will be apparent that when it is desired to connect or

install such well devices as the plug 45 or the lubricator 40 in one of the bores 21 or 22 of the latch head or to remove such well devices as the plug 45 from the latch head, the running and pulling tool 113 is lowered to the latch head and is connected thereto in the position illustrated in FIGURE 8. The coaction of the orienting lugs 18 with the sides of the orienting slots 250a positions the lubricator guide in alignment with one or another of the bores 21 or 22 of the latch head, as desired. If it is then desired to install a well device such as the plug 45 in such selected well bore of the latch head, the well device is lowered through the lubricator guide and the bore 252 of its guide sub into the selected bore so that its locking means, such as the lock lugs 71, extend into the lock recess 38 of the bore and its seal means 54 engage the sealing surface 36 of such bore.

If it is desired to secure such well devices as the lubricator 40 in the selected bore of the latch head, the lubricator is lowered through the lubricator guide and the bore 252 of the guide sub 250 into the selected bore until its lower threaded end engages the threads 34 in the lower portion of the selected bore above its flange 29. The lubricator is then rotated to screw it into the position illustrated in FIGURE 5 wherein its threads engage the threads of the bore and the sealing assembly 97 engages the sealing surface 36. With the lubricator in position such well treating operations as swabbing and perforating may be performed.

When it is desired to remove such well devices as the plug 45, a suitable pulling tool is lowered through the lubricator guide 213 to engage the plug and remove it.

Such well devices as the lubricator 40 of course may be easily removed by rotating them in the opposite direction to disengage the threads at their lower ends from the threads 34 of the latch head.

The running and pulling tool 113 may of course be lowered to engage the latch head and raise it and the tubing strings to the surface.

It will now be seen that a new and improved latching means or head has been illustrated and described which is provided with a plurality of longitudinal bores which communicate with the flow passages of tubing strings secured to the latch head and that the latch head is provided with means such as the external latch recess 11 which is engageable by the lock lugs 134 of the running and pulling tool 112 or the lock lugs 240 of the running and pulling tool 113 whereby the latch head may be releasably secured to such running and pulling tools for lowering or raising of the tubing strings by means of such tools to a well head which may be positioned at such remote location as the bottom of a body of water.

It will further be seen that the running and pulling tools are provided with lock means or sleeves which are engageable with the lock lugs of the running and pulling tools to lock them in latching engagement with the latch head and that the movement of such locking sleeves between locking and unlocked positions may be remotely controlled due to the provision of the chambers 170 or 216 of the locking sleeves into which the external flanges 159 and 215, respectively, of the latch heads extend whereby fluid admitted under pressure into the chamber of the selected side of such external flange causes the sleeve to move to a desired locking or unlocked position.

It will further be seen that the running and pulling tools and the latch head are provided with orienting means, such as the lugs 18 of the latch head and the downwardly opening slots of the running and pulling tools, whereby the tools are oriented in desired positions relative to the longitudinal bores of the latch head.

It will further be seen that the running and pulling tool may be provided with a lubricator guide which may be aligned with either of the bores of the latch head, as desired, whereby such tools as the plugs 45 and the lubricator 40 may be selectively installed or removed from either bore.

It will further be seen that the longitudinal bores of the latch head are provided with means engageable by such locking means of well devices as the lugs 78 of the plug 45 to hold the plug in a predetermined position in the longitudinal bores and with sealing surfaces engageable by sealing means such as the sealing means 54 of the plug 45 when such well devices are so positioned in the longitudinal bores of the latch head.

It will further be seen that the bores are also provided with threads whereby such well devices as the lubricator 40 may be threaded into the bores with their sealing means, such as the seal means 97 of the lubricator 40, in engagement with the sealing surface 36 of the well bores.

It will further be noted that the well bores are provided with stop shoulders 35 and 28 for limiting movement of the well devices into the tubing bores.

It will further be apparent that the running and pulling tools, such as the running and pulling tool 112, may be provided with seal means such as the sleeve 123 which is sealingly engageable in the enlarged bore 24 of the latch head to provide an imperforate conduit through which the fluids from both tubing strings may flow upwardly to the surface through the handling string 117 on which the running tool 112 is secured.

It will further be seen that the running and pulling tool 113 is likewise provided with a lubricator guide through which the lubricator 95 may extend to form an imperforate conduit with a selected one of the tubing strings whereby well treating operations may be performed from the surface through the lubricator.

It will further be apparent that both forms of the running and pulling tool are remotely controlled and may be connected or released from the latch head by control means which may be located remote from the latch head, as at the surface of the body of water on whose bottom the latch head is positioned.

It will be apparent that, if desired, the orienting means on the latch head and the running and pulling tool may be omitted, in which case the interior of the latch head may be provided with such means for selectively positioning well devices in a selected one of the bores of the latch head as is disclosed in co-pending application of John V. Fredd, Serial No. 578,498, filed April 16, 1956.

The foregoing description of the invention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A latch head connectable to a plurality of flow conductors for use with well devices having locking means and sealing means including: a body having a plurality of longitudinal bores, said body having means at one end of each of said longitudinal bores for receiving and connecting a well flow conductor thereto with the well flow conductors opening into said bores when said latch head is connected to the flow conductors, each of said bores being provided with internal groove latch means engageable by locking means of well devices for releasably securing well devices in said bore; and an internal annular seal surface provided in each of said bores engageable by sealing means of well devices, said latch head body being provided with an external shoulder latch means engageable by running and pulling tools whereby the latch head and the flow conductors connected therewith may be lowered and raised by said tools.

2. A latch head connectable to a plurality of flow conductors for use with well devices having locking means and sealing means including: a body having a plurality of separate longitudinal bores therein; means on said body at one end of each of said longitudinal bores disposed to receive a well flow conductor whereby the well

flow conductor may be connected to said body with the flow passage thereof opening into said bores when said latch head is connected to the flow conductors, each of said bores being provided with internal shoulder and groove latch means engageable by locking means of well devices for releasably securing well devices in said bore; an internal annular seal surface provided in each of said bores adjacent the latch means and engageable by sealing means of well devices; and internal thread means in at least one of said bores for releasably engaging well devices having external threads, said latch head body being provided with an external shoulder stop latch means engageable by running and pulling tools whereby the latch head and the flow conductors connected thereto may be lowered and raised by said tools.

3. A latch head connectable to a plurality of flow conductors for use with well devices having locking means and sealing means including: a body having a plurality of laterally spaced separate longitudinal bores, said body having means at one end of each of said separate longitudinal bores for receiving and connecting a well flow conductor thereto with the flow conductors opening into said bores when said latch head is connected to the flow conductors, each of said bores being provided with internal shoulder and groove latch means engageable by locking means of well devices for releasably securing well devices in said bore; and an internal annular seal surface provided in each of said bores adjacent said latch means and engageable by sealing means of well devices, said latch head body being provided with an external annular shoulder and groove latch means engageable by running and pulling tools whereby the latch head and its flow conductor may be lowered and raised by said tools, said latch head body having an upwardly facing stop shoulder engageable by running and pulling tools to limit downward movement of the running and pulling tools relative to said latch head.

4. A latch head connectable to a plurality of flow conductors for use with well devices having locking means and sealing means including: a body having a plurality of laterally spaced separate longitudinal bores, said body having means at one end of each of said separate longitudinal bores for receiving and connecting a well flow conductor thereto with the flow conductors opening into said bores when said latch head is connected to the flow conductors, each of said bores being provided with internal annular shoulder and groove latch means engageable by locking means of well devices for releasably securing well devices in said bore; an internal annular seal surface provided in each of said bores adjacent the latch means therein and engageable by sealing means of well devices; and lateral thread means in at least one of said bores for releasably engaging well devices having external threads, said latch head body being provided with an external annular groove latch means engageable by running and pulling tools whereby the latch head and the flow conductors connected therewith may be lowered and raised by said tools, said latch head having an upwardly facing stop shoulder spaced longitudinally externally of said body from said groove latch means and engageable by running and pulling tools to limit downward movement of the running and pulling tools relative to said latch head.

5. A latch head connectable to a plurality of flow conductors for use with well devices having locking means and sealing means including: a body having a plurality of separate laterally spaced longitudinal bores, said body having means thereon at one end of each of said longitudinal bores for receiving and connecting a well flow conductor thereto with the flow conductors opening into said bores when said latch head is connected to the flow conductors, each of said bores being provided with internal annular groove and shoulder latch means engageable by locking means of well devices for releasably securing well devices in said bore; and an

internal annular seal surface provided in each of said bores engageable by a sealing means of the well device, said latch head body being provided with an external shoulder and groove latch means engageable by running and pulling tools whereby the latch head and the flow conductors connected thereto may be lowered and raised by said tools, said latch head body being provided on its exterior with orienting means engageable with running and pulling tools for orienting said running tools relative to said bores.

6. A latch head connectable to a plurality of flow conductors for use with well devices having locking means and sealing means including: a body having a plurality of laterally spaced separate longitudinal bores, said body having means at one end of each of said bores for receiving and connecting a well flow conductor thereto with the flow conductors opening into said bores when said latch head is connected to the flow conductors, each of said bores being provided with an internal annular groove and an upwardly facing stop shoulder therein spaced longitudinally from said groove and providing with said groove latch means engageable by locking means of well devices for releasably securing well devices in said bore; an internal annular seal surface provided in each of said bores engageable by sealing means of well devices; and internal thread means in at least one of said bores for releasably engaging well devices having external threads, said latch head body being provided with an external annular groove and shoulder latch means engageable by running and pulling tools whereby the latch head and the flow conductors connected thereto may be lowered and raised by said tools, said latch head body being provided on its exterior with orienting means engageable with running and pulling tools for orienting said running tools relative to said bores.

7. A latch head connectable to a plurality of flow conductors for use with well devices having locking means and sealing means including: a body having a plurality of laterally spaced separate longitudinal bores, said body having means at one end of each of said bores for receiving and connecting a well flow conductor thereto with the flow conductors opening into said bores when said latch head is connected to the flow conductors, each of said bores being provided with internal annular groove and shoulder latch means engageable by locking means of well devices for releasably securing well devices in said bore; and an internal annular seal surface provided in each of said bores adjacent the latch means thereof engageable by sealing means of well devices, said latch head having an upper bore providing an internal annular seal surface above said longitudinal bores, said longitudinal bores opening upwardly into said upper bore and downwardly to the exterior of said body.

8. A latch head connectable to a plurality of flow conductors for use with well devices having locking means and sealing means including: a body having a plurality of laterally spaced separate longitudinal bores, said body having means at one end of each of said bores for receiving and connecting a well flow conductor thereto with the flow conductors opening into said bores when said latch head is connected to a well flow conductor, each of said bores being provided with an internal annular groove and an upwardly facing stop shoulder therein spaced longitudinally from said groove and providing with said groove latch means engageable by locking means of well devices for releasably securing well devices in said bore; and an internal annular seal surface provided in each of said bores adjacent the latch means thereof engageable by sealing means of well devices, said latch head having an upper bore providing an internal annular seal surface above said longitudinal bores, said longitudinal bores opening upwardly into said upper bore and downwardly to the exterior of said body, said

latch head being provided with an external annular shoulder and groove latch means.

9. In combination with the latch head of claim 1 means for connecting an operating member and flow conduit with said latch head including: a tubular body telescopable relative to said latch head and having a first means engageable with said external shoulder latch means of said latch head for releasably securing said tubular body to said latch head; lock means carried by said tubular body and movable between a first locking position wherein said first means is engaged and locked by said lock means against movement out of engagement with said external shoulder latch means and a second position wherein said lock means is out of locking engagement with said first means and said first means is free to move out of engagement with said external shoulder latch means upon movement of the tubular body from said latch head; and means operable from a remote point for moving said lock means between said first position and said second position.

10. In combination with the latch head of claim 8 means for connecting an operating member with said latch head and including: a tubular body telescopable relative to said latch head and having first means engageable with said external latch means of said latch head for releasably securing said tubular body to said latch head; lock means carried by said tubular body and movable between a first locking position wherein said first means is engaged and locked by said lock means against movement out of engagement with said external latch means and a second position wherein said lock means is disengaged from said first means and said first means is free to move out of engagement with said external latch means upon movement of the tubular body from said latch head; means biasing said lock means to said first locking position; said tubular body having means telescopable into said upper bore of said latch head for engaging said seal surface to provide an imperforate conduit extending from said flow conductors into said tubular body.

11. In combination with the latch head of claim 1 means for connecting an operating member with said latch head and including: a tubular body telescopable relative to said latch head and having first means engageable with said external shoulder latch means of said latch head for releasably securing said tubular body to said head; lock means carried by said tubular body and movable between a first locking position wherein said first means is engaged and locked by said lock means against movement out of engagement with said external shoulder latch means and a second position wherein said lock means is out of locking engagement with said first means and said first means is free to move out of engagement with said external shoulder latch means upon movement of the tubular body from said latch head; means operable from a remote point for moving said lock means between said first position and said second position and a conduit secured to said tubular body and communicating with said bores when said tool is secured to said latch head.

12. In combination with the latch head of claim 8 means for connecting an operating member and flow conduit with said latch head and including: a tubular body telescopable relative to said latch head and having first means engageable with said external latch means of said latch head for releasably securing said tubular body to said head; lock means carried by said tubular body and movable between a first locking position wherein said first means is engaged and locked by said lock means against movement out of engagement with said external latch means and a second position wherein said lock means is out of locking engagement with said first means and said first means is free to move out of engagement with said external latch means to permit disengaging movement of the tubular body from said latch head;

means on said body movable into and out of engagement with said lock means for holding said lock means in said locking position; and a conduit secured to said tubular body and communicating with said bores when said tool is secured to said latch head, said tubular body having means telescopable into said upper bore of said latch head for engaging said seal surface to provide an imperforate flow passage between said longitudinal bores of said latch head and said conduit.

13. In combination with the latch head of claim 5 a running and pulling tool including: a tubular body telescopable over said latch head and having first means engageable with said external shoulder and groove latch means of said latch head for releasably securing said tubular body to said head; lock means carried by said tubular body and movable between a first locking position wherein said first means is engaged and locked by said lock means against movement out of engagement with said external shoulder and groove latch means and a second position wherein said lock means is out of locking engagement with said first means and said first means is free to move out of engagement with said external shoulder and groove latch means upon movement of said lock means from said first position to said second position to permit said first means to be disengaged from said external shoulder and groove latch means of said latch head to free the tubular body from said latch head; and a conduit secured to said tubular body and communicating with the interior of said tubular body and with said longitudinal bores of said latch head when said tubular body is secured to said latch head, said conduit being disposed eccentrically of the longitudinal axis of said tubular body and alignable with each of said longitudinal bores of said latch head; said body having orienting slot means thereon engageable with said external orienting means on said latch head for positioning said conduit in alignment with one of said longitudinal bores in said latch head.

14. In combination with the latch head of claim 5 a running and pulling tool including: a tubular body telescopable over said latch head and having first means engageable with said external shoulder and groove latch means of said latch head for releasably securing said tubular body to said head; lock means carried by said tubular body and movable between a first locking position wherein said first means is engaged and locked by said lock means against movement out of engagement with said external shoulder and groove means and a second position wherein said lock means is out of locking engagement with said first means and said first means is free to move out of engagement with said external shoulder and groove latch means upon movement of said lock means from said first position to said second position to permit said first means to be disengaged from said external shoulder and groove latch means of said latch head to free the tubular body from said latch head; means biasing said lock means to said first locking position; a conduit secured to said tubular body and communicating with the interior of said tubular body and with said longitudinal bores of said latch head when said tubular body is secured to said latch head, said conduit being disposed eccentrically of the longitudinal axis of said tubular body and alignable with each of said longitudinal bores of said latch head; said body having orienting slot means thereon engageable with said external orienting means on said latch head for positioning said conduit in alignment with one of said longitudinal bores in said latch head; and guide means in said tubular body providing a guide bore between said conduit and the longitudinal bore of the latch head with which said conduit is aligned.

15. In combination with the latch head of claim 1 a protector housing including: a second body closed at its upper end and open at its lower end telescopable over the latch head; internal annular sealing means in the lower open end of said body sealingly engaging said latch head

for containing a protective fluid within the body and about the latch head; and means carried by said second body engageable with said external shoulder latch means of the latch head for releasably securing said second body in telescoped position on said latch head.

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