

March 20, 1962

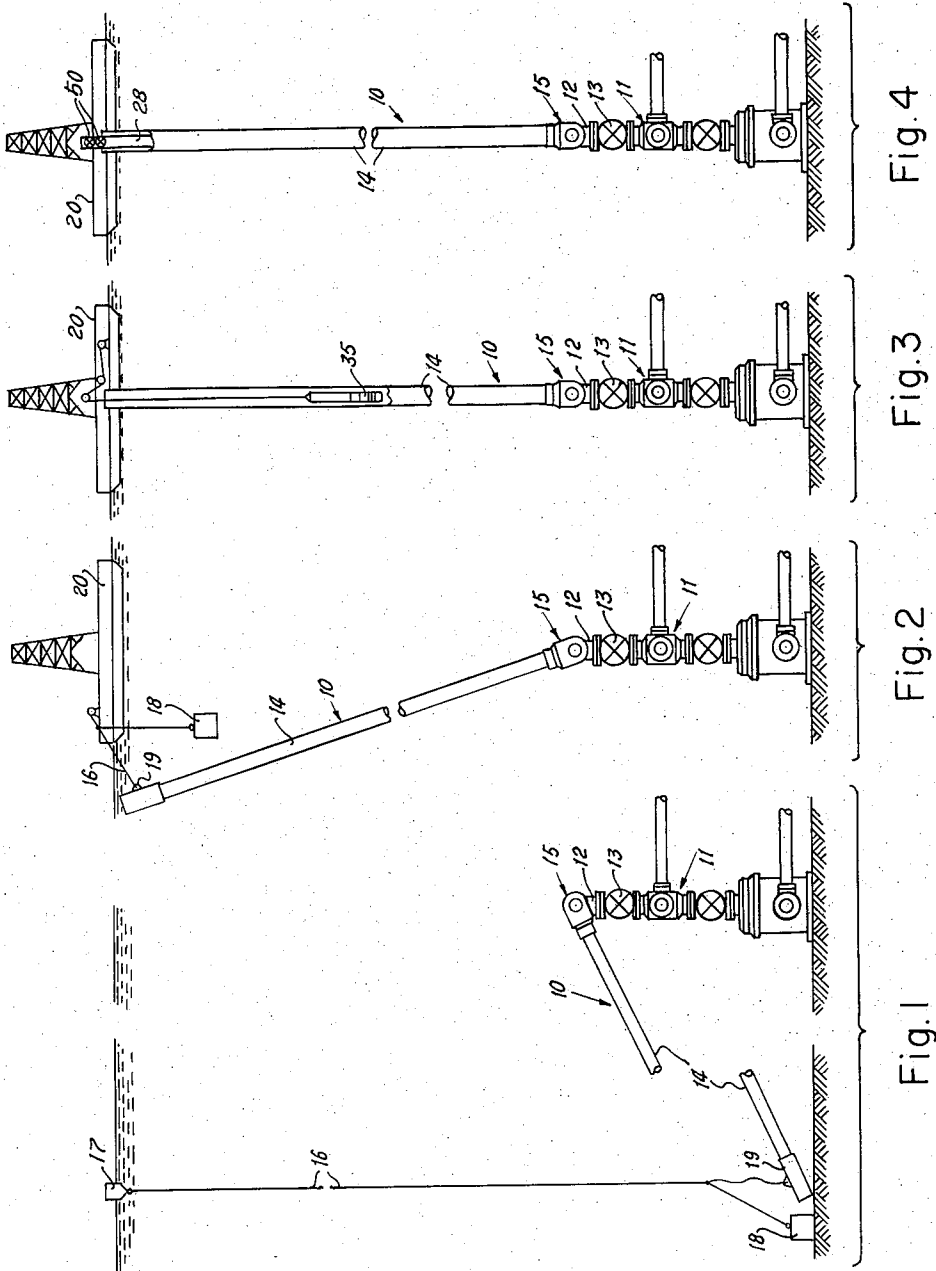
H. B. SCHRAMM ETAL

3,025,912

WELL TOOL HAVING PIVOTALLY CONNECTED TUBULAR SECTIONS

Filed Nov. 4, 1957

2 Sheets-Sheet 1



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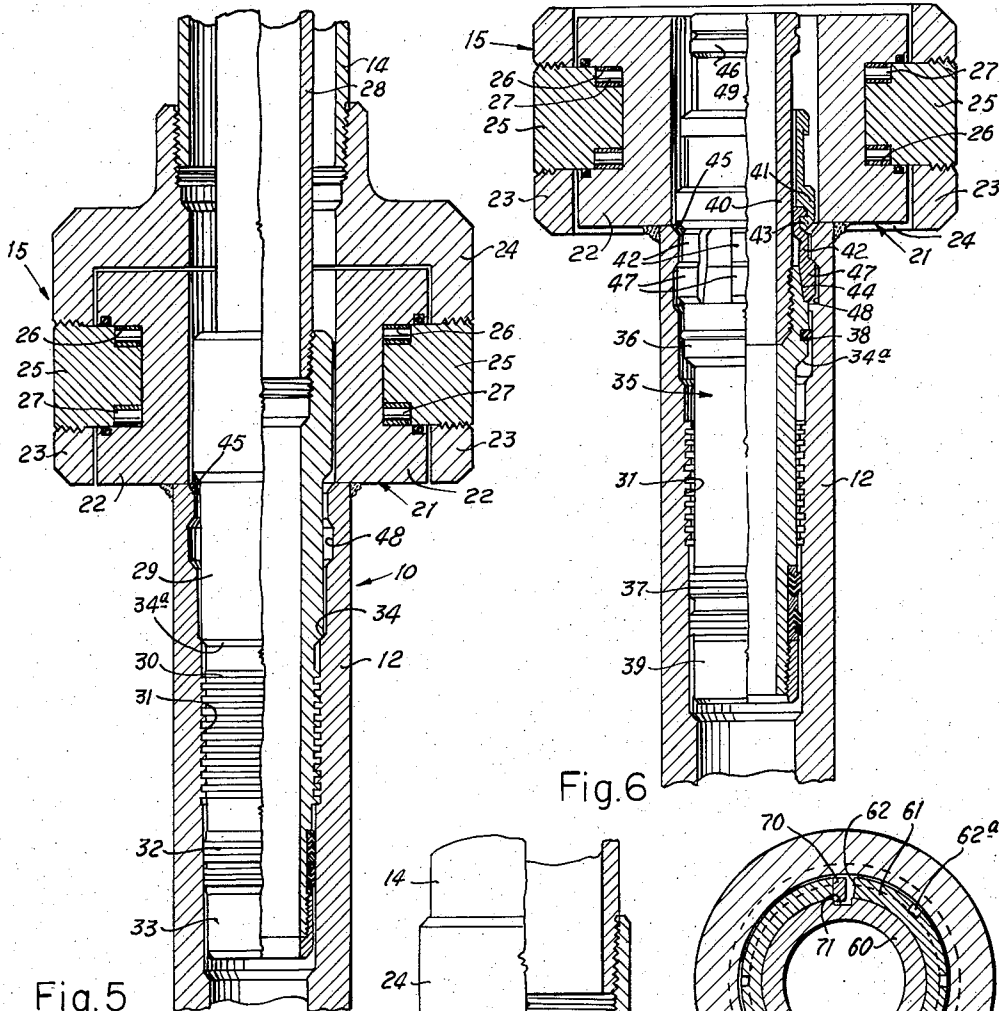


Fig. 6

Fig. 5

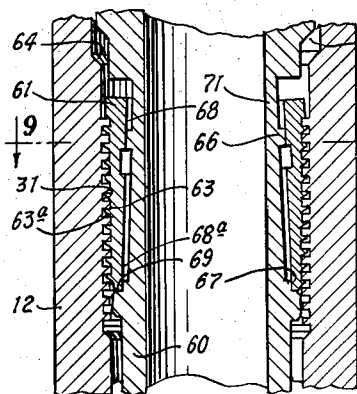


Fig. 8

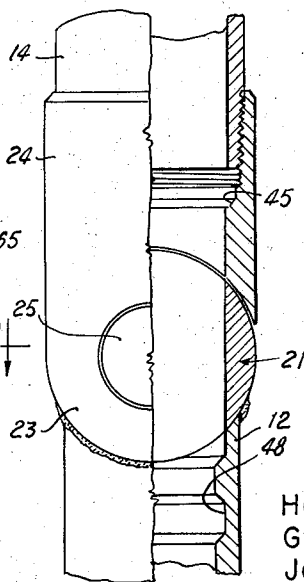


Fig. 7

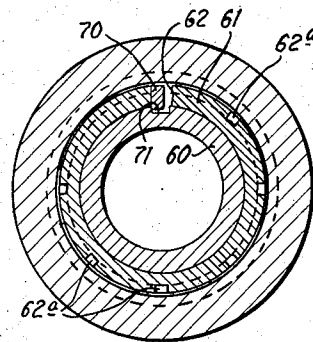


Fig. 9

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WELL TOOL HAVING PIVOTALLY CONNECTED TUBULAR SECTIONS

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12 Claims. (Cl. 166-85)

This invention relates to well tools and more particularly to a tubular member for providing a fluid connection from a wellhead to a point spaced vertically above said wellhead and for disestablishing said connection.

In the operation of submerged wells in deep waters in which the wellhead is located at or near the floor of a body of water, such as an ocean, it is necessary to provide a tubular device or lubricator having a fluid-tight flow passage therethrough from the wellhead to the water surface. It is further desirable to remove the tubular device from position extending from the wellhead to the water surface and to store or lay the device along the ocean floor to leave the water surface unobstructed.

An object of this invention is thus to provide a wellhead with a tubular device or lubricator guide which can be raised to a vertical position and which can be lowered to a position approaching the horizontal or along the ocean floor.

Another object is to provide an imperforate tube or lubricator which can be installed in and locked in the tubular device or lubricator guide when said device is in the vertical position to establish a fluid-tight conduit from the wellhead to the water surface, the tube sealing with the tubular device to establish such fluid-tight conduit.

A further object is to provide an imperforate tube of the character described to hold the tubular device in the vertical position when the tube is installed therein, the tube being readily removable from the tubular device.

A still further object is to provide a shielding means which is installed in the tubular device when the imperforate tube is removed therefrom to protect the locking and sealing surfaces of the tubular device from damage by corrosion or foreign deposits.

Additional objects and advantages of the invention will be readily apparent from the reading of the following description of devices constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

FIGURE 1 is a schematic view showing a subsurface or submarine wellhead with a tubular device or lubricator guide installed thereon, the guide being in the inoperative position and extending from the wellhead along the floor of the body of water or ocean;

FIGURE 2 is a view, similar to FIGURE 1, showing a barge in place over the wellhead and the lubricator guide being raised to the vertical position;

FIGURE 3 is a view, similar to FIGURE 2 but partly in section, showing the lubricator guide in the vertical position and the shielding device being removed from the guide;

FIGURE 4 is a view, similar to FIGURE 3, showing the imperforate tube or lubricator installed in the lubricator guide;

FIGURE 5 is a view, partly in section and partly in elevation, of the lower part of a lubricator guide showing the same in the extended or vertical position and showing the lubricator installed therein;

FIGURE 6 is a view similar to FIGURE 5 but showing

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the lubricator removed from the guide and the shielding plug or tool installed therein and the upper end of the lubricator guide swung to a horizontal position;

FIGURE 7 is a view similar to FIGURE 5 but taken at right angles thereto and with the lubricator removed from the guide;

FIGURE 8 is a sectional view of the lower portion of a modified form of the lubricator showing the same engaged in the housing of the lubricator guide; and

FIGURE 9 is a cross-section taken on the line 9-9 of FIGURE 8.

Referring now particularly to FIGURES 1 through 7 of the drawings, a lubricator guide 10 is shown atop the tubing control fittings or Christmas tree 11 of a well. The well is shown as being located on the floor of the ocean or a body of water.

The lubricator guide includes a lower tubular housing 12 which is vertically mounted on the uppermost valve or fitting 13 of the Christmas tree and an upper tubular member 14 which is pivotally attached to the lower member by means of a swivel 15. A cable 16 is supported at the water surface by means of a marker buoy 17 and is anchored to the ocean floor by means of an anchor or weight 18. The cable is secured to a lifting eye 19 attached to the upper free end of the upper tubular member so that the free end may be raised to the vertical position from a barge 20 which is positioned and anchored in place over the well.

A journal box 21 welded on the upper end of the housing is provided with opposed laterally extending ears 22, and the ears are positioned between the bifurcated downwardly extending legs 23 of a yoke 24 at the lower end of the upper tubular member. A plug 25 is threaded into each leg and extends into a bore 26 in the corresponding ear to secure the upper tubular member to the housing 12. Anti-friction bearings or bushings 27 on the inner ends of the plugs engage the walls of the bores 26 to allow ready pivotal motion of the yoke about the journal of the housing, the journal and the yoke having adjacent cylindrical surfaces to permit such motion.

An imperforate tube or lubricator 28 has threaded on its lower end a foot piece 29 provided with external threads 30 engageable with corresponding internal threads 31 in the housing 12. A packing assembly 32 is retained on the lower outer surface of the foot piece below the threads 30 by a retainer cap 33 threaded on the lower end of the foot piece. The packing assembly seals between the foot piece and the housing. The foot piece is provided with a downwardly facing stop shoulder 34a which engages an upwardly facing shoulder 34 in the housing to limit the threaded engagement in the housing.

Manifestly, when the upper tubular member 14 is aligned vertically with the housing 12, the imperforate tube lubricator 28 may be inserted into the upper member and its foot piece 29 threaded into the housing, the packing assembly 32 sealing with the housing to provide a fluid-tight connection therewith. The lubricator thus provides a conduit in fluid communication with the interior of the housing.

The lubricator is readily removable from the lubricator guide by rotation in a direction to release the threads on the foot piece and in the housing from one another. The threads 30 and 31 forming the connection between the foot piece and the housing are preferably of a low-friction type such as a square or "Acme" type so that the connection can readily be disengaged without danger of

disconnecting any other threaded joints which secure the various parts of the lubricator together.

When the lubricator is removed from the lubricator guide 14, a shielding plug 35 is installed in the housing to protect the threads 31 of said housing from corrosion or fouling by foreign deposits or matter. The shielding plug may be of any well-known type and may be similar to that shown in the H. C. Otis Patent No. 2,571,478.

The shielding plug includes a tubular body 36 provided with a packing assembly 37 near its lower end for sealingly engaging the wall of the housing below the threads 31. A retainer cap 39 threaded on the plug body holds the packing assembly on the plug body. An O-ring seal means 38 is spaced above the packing assembly for sealingly engaging the wall of the housing above the threads 31.

A tubular mandrel 40 is threaded into the upper end of the body and is provided with a dog carrier 41 longitudinally slidable thereon. A plurality of locking dogs 42 are suspended by their upper ends from an interned flange 43 in the lower end of the carrier for lateral swinging movement between an inner retracted position and an outer projecting position. The upper end of the plug body 36 is upwardly and inwardly tapered to form an expander surface 44 which engages the inner surfaces of the dogs to move the dogs to projecting positions when the said dogs are moved downwardly on the plug body.

The lower face of the dog carrier 41 engages an upwardly facing support shoulder 45 in the housing to support the plug in position in the housing, the dog carrier being retained on the mandrel by an enlarged running head 46 on the upper end of said mandrel. Outwardly extending locking bosses 47 on the lower ends of the dogs are engageable in an internal annular locking groove or recess 48 in the housing 12 to hold the shielding plug in position in the housing when the dogs are moved to projecting positions.

The shielding plug is installed through the upper tubular member when it is in vertical alignment with the housing 12 by means of the customary flexible line means and methods, being lowered into the housing by means of a running tool, such as that shown and described in patent to H. C. Otis, No. 2,571,478, which is releasably attached to the running head 46. As the dog carrier is free to move longitudinally on the mandrel, the dogs momentarily engage the support shoulder 45 and are stopped from downward movement so that the expander surface 44 moves below the dogs, freeing the dogs for movement to retracted positions. The carrier and the dogs then move downwardly until the dog carrier engages the shoulder 45, the dogs then being aligned with the locking recess 48 and able to move laterally thereinto. An upward pull on the mandrel 40 now moves the expander surface between the dogs and moves them to projecting positions engaging the upper shoulder of the recess. A further upward pull on the running tool releases the running tool from the running head, leaving the plug locked in position in the housing, the packing assembly and the O-ring seal means sealing on either side of the threads 31.

The plug is removed by a pulling or retrieving tool (not shown) having a means to grasp the undercut fishing neck 49 of the dog carrier and a means to deliver a downward blow to the mandrel. The mandrel 40 and the body 36 are thus outwardly moved downwardly relative to the dog carrier, the expander surface being moved from between the dogs to permit the dogs to move to retracted positions. An upward pull on the carrier then moves the dogs upwardly from the locking recess, the dogs being cammed to retracted positions by the engagement of their upper beveled shoulders with the upper shoulder of the recess. A further upward pull on the carrier then removes the shielding plug from the housing and the lubricator guide.

When the shielding plug is in position in the housing, the upper tubular member 14 of the lubricator guide 10 may be swung from the vertical position shown in FIGURES 3 and 4 to a position shown in FIGURE 1 wherein it lies along the ocean floor, the tubular member pivoting about the journal on the housing. When the lubricator guide is raised to the vertical position and the lubricator 28 is installed therein, the valves of the Christmas tree may be opened as desired to open the well to communication with the lubricator. Manifestly, a suitable valve or valves 50 (FIGURE 4) may be installed in the upper end of the lubricator whereby any of the tools or devices customarily inserted into a well by means of a flexible line may be introduced into the well.

It will be seen that a tubular device or lubricator guide has been shown and described which can be installed on a well and which can be moved between a vertical position extending above the well and an approximately horizontal position where it extends laterally from the well.

It will further be seen that an imperforate tube or lubricator 28 has been shown and described for use in a lubricator guide of the type described above when the lubricator guide is in the vertical position whereby a fluid-tight conduit is provided from the well to a point thereabove. It will be seen that the lubricator is provided with a means which seals with the lubricator guide to establish such a fluid-tight conduit.

It will further be seen that the imperforate tube or lubricator 28 holds the lubricator guide in the vertical position when it is installed therein and the lubricator extends through the upper tubular member 14 into the housing 12 and thus prevents pivotal movement of the upper member about the journal 21.

It will also be seen that the lubricator is readily installed in and removed from the lubricator guide and that, when so installed it is releasably locked in position by means of the threads 30 and 31.

It will also be seen that a shielding means 35 is provided for installation in the lower part of the lubricator guide when the lubricator is removed from the guide, the shielding means protecting the locking and sealing surfaces of the lubricator guide against damage by corrosion, fouling or the like. It will be seen that the shielding means is releasably locked in position and that it does not interfere with the lowering of the lubricator guide from the vertical position being wholly contained or disposed in the housing 12.

In FIGURES 8 and 9 is shown a modified form of thread coupling means connecting the lower end of the lubricator to the lower housing of the lubricator guide. This form of the coupling means may be similar to that shown in the R. C. Baker Patent No. 2,737,248 and provides a means whereby the foot piece 60 of the lubricator may be engaged with the threads 31 of the lower housing 12 of the lubricator guide by means of a direct longitudinal movement and whereby the foot piece may be disconnected from the housing by means of a rotational movement imparted to the lubricator. More particularly, the threads 31 of the housing are of left-hand lead so that the disconnecting rotary motion of the lubricator is clockwise (when viewed from above); that is, so that the usual right-hand threads which join the sections of the lubricator will be tightened rather than loosened as the lubricator is disconnected from the housing.

The foot piece 60 is provided with a latch ring 61 having a longitudinal slot 62 severing the ring and having external left-hand threads 63 thereon for engagement with the threads of the housing. The slot enables the ring to expand and contract relative to the foot piece, the threads of the ring passing the internal threads 31 of the housing when the ring is contracted and engaging the internal threads when expanded. Additional longitudinal slots 62a are provided in the outer surface

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of the ring to provide the necessary flexibility to the ring. The lower faces 63a of the threads 63 are downwardly and inwardly beveled so that, as the foot piece is lowered into the housing, the lower thread faces engage the housing threads 31 and cam the ring inwardly to contracted position. The ring expands resiliently into threaded engagement with the housing as the foot piece enters the housing, the downward movement of the foot piece being limited by the engagement of a downwardly facing shoulder 64 on the foot piece with a corresponding upwardly facing shoulder 65 in the housing.

Upward movement of the foot piece engages the downwardly and outwardly tapered expander surfaces 66 and 67 thereon with the correspondingly tapered inner surfaces 68 and 68a, respectively, of the ring which firmly urge the ring into expanded thread-engaging position. An internal groove 69a is provided between the tapered inner surfaces 68 and 68a of the ring in which is receivable the annular member of the foot piece which provides the expander surface 66. When the latch ring expands so that its internal thread mates with the internal thread of the housing, the expander surface 66 is disposed inwardly of the recess 69 so that upward movement of the foot piece may take place relative to the expander ring which causes the expander surface 66 to engage the tapered inner surface 68 of the latch ring. An upwardly facing abrupt shoulder 69 on the foot piece engages the lower end of the ring to limit upward movement of the foot piece relative to the ring and thus prevent overexpansion of the ring and to positively limit upward movement of the lubricator in the housing.

A key 70 is welded to the leading edge of the ring at the slot 62 and extends inwardly into a longitudinal groove 71 in the foot piece 60 so that, as the foot piece is rotated in a clockwise rotation, the ring is turned with the foot piece. Manifestly, the clockwise rotation of the ring unthreads the ring from engagement with the housing.

Thus it will be seen that, with the modified form of the invention, the lubricator may be installed in the vertical lubricator guide and be locked therein by a simple downward movement, the latch ring being cammed inwardly upon engaging the threads of the lubricator guide housing during downward movement in the housing. The lubricator may be removed from the lubricator guide by clockwise rotation, the latch ring being threadedly disengaged from the housing by virtue of the left hand lead of the threads 31 and 63. The clockwise rotation of the lubricator is in a direction such as to tighten rather than loosen any threaded joints in said lubricator.

It will be seen that with the use of the modified form of threaded coupling, the lubricator and the lubricator guide have all the advantages set forth with the first form of threaded coupling.

In addition it will be seen that the modified form of threaded coupling provides for the coupling and uncoupling of the lubricator in the lubricator guide with rotation of the lubricator in one direction only.

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

1. A well tool including: an elongate body having locking means; a housing having an upper and a lower section; means pivotally connecting said upper section to said lower section to permit pivotal movement of said upper section relative to said lower section, said upper and said lower sections having bores, said bores being aligned when the upper and lower sections are in alignment, said bores being adapted to receive said elongate body when said sections are in alignment; shielding means removably positionable in said lower section when said body is removed from said bores, said lower section having locking means cooperable with said locking means of said elongate body for releasably holding said elongate body when said elongate body is positioned in said bores; seal means on said shielding means sealing with said lower section above and below the locking means in

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said lower section; and holding means on said shielding means and said lower section releasably holding said shielding means in said lower section.

2. A well tool including: an elongate body having a locking means; a tubular housing having an upper and a lower section; means pivotally connecting said upper section to said lower section to permit pivotal movement of said upper section relative to said lower section, said upper and said lower sections having bores, said bores being aligned when the upper and lower sections are in alignment, said bores when said sections are in alignment being adapted to receive said elongate body, said lower section having locking means cooperable with said locking means of said elongate body for releasably holding the elongate body when said body is positioned in said bores; shielding means removably positionable in said lower section when said body is removed from said bore; seal means on said shielding means sealing with said lower section above and below the locking means in said lower section; and holding means on said shielding means and said lower section releasably holding said shielding means in said lower section; said shielding means allowing said upper section to be moved from alignment with said lower section.

3. A well tool including: a vertical lower housing section having a longitudinal bore therethrough and having a journal on its upper end; an upper housing section having a longitudinal bore therethrough and being pivotally connected to said journal, said upper section being swingable to and from a vertical position wherein said bores are in alignment; tubular body extending through the bore of said upper section and into the bore of said lower section when said bores are in alignment; said body being removably positioned in said upper and lower sections, said body maintaining said upper section in alignment with said lower section when said body is positioned in said sections; sealing means on said body sealingly engaging said lower section; and threaded means on said body engaging corresponding threads in said lower section to removably secure said body in said housing sections.

4. A well tool including: a lower housing section having a bore therethrough and pivotally connected to said lower section, said upper section being movable into and from a position wherein said bores are aligned; an internal thread in said lower housing section; a tubular body positionable in said bores; a contractable sleeve mounted on said body and having an external thread adapted to mesh with said internal thread; one of said threads having a cam surface engageable with the other of said threads to contract said sleeve upon engagement of said external thread with said internal thread when said sleeve is moved longitudinally and without rotation downwardly in said lower section; means on said body engaging said sleeve to rotatably move said sleeve with said body; and sealing means on said body sealingly engaging said lower housing section below said threads.

5. A well tool including: a housing having a bore, an elongate upper guide member pivotally secured to the upper end of said housing and having a bore, said guide member being movable into longitudinal alignment with said housing, said housing having locking means in said bore for securing well tools in said bore, said housing having seal surfaces disposed on both ends of said locking means, and an imperforate shield means, said shield means and said housing having cooperable means for removably positioning said shield means in said bore to extend past and not engage said locking means, said shield means having means sealingly engaging said seal surfaces on both ends of said locking means whereby said locking means is protected, said upper guide member being pivotable from a position in alignment with said housing to a position pivotally offset therefrom while said shield means is positioned in said housing.

6. A well tool including: an elongate body having

locking means on its lower end; a housing having an upper section and a lower section; means pivotally connecting said upper section to said lower section to permit pivotal movement of said upper section relative to said lower section between a position in which said upper section is in longitudinal alignment with said lower section and a position in which said upper section is laterally displaced out of alignment with said lower section; said upper section and said lower section each having a bore therethrough, said bores of said sections being aligned and adapted to receive said elongate body when said sections are in alignment; said lower section having locking means in its bore adapted to coact with the locking means on the lower end of said body for releasably holding the body against longitudinal movement with respect to said sections when the body is positioned in said bores; shielding means removably positionable in said lower section when said elongate body is not in said bores; and seal means on said shielding means sealing between said shielding means and said lower section above and below the locking means in the bore of said lower section when said sealing means is disposed in said lower section.

7. A well tool adapted for use in submarine wells to provide a communication between the well flow conductor and the surface of the body of water in which the well is located, wherein the upper end of the flow conductor is normally terminated at a point adjacent earth forming the bottom of the body of water, said tool including: a lower tubular housing having means for connecting it to the upper end of a well flow conductor and having a bore adapted to communicate in longitudinal alignment with said well flow conductor; an upper tubular housing; means connecting said upper housing to said lower housing for pivotal movement of said upper tubular housing relative to said lower tubular housing, whereby said upper tubular housing may be moved into alignment with the well flow conductor and laterally pivoted out of alignment with said well flow conductor; and a tubular body of a length sufficient to extend from said lower housing to a point above the surface of the water and having means at its lower end engageable with the lower housing to provide a continuation of the well flow conductor from the housing upwardly to a point above the surface of the water, said tubular body being inserted through said upper tubular housing into said lower tubular housing when said housings are in alignment; and means in said lower tubular housings for releasably securing the lower end of said tubular body to said lower housing.

8. A lubricator guide assembly for a submarine well having a well flow conductor therein and with wellhead connections disposed subsurface adjacent the bottom of the body of water and including: a lower tubular housing having means at its lower end for connecting the same with a wellhead connection in longitudinal alignment with the well flow conductor so as to form a continuation thereof; an upper tubular housing having a bore therethrough and being of a length sufficient to reach to the surface of the body of water when moved into alignment with the lower tubular housing; means pivotally connecting said upper housing with said lower housing for movement about said pivotal connection between a first position in which the upper housing is disposed in alignment with the lower housing and the well flow conductor therebelow and a second position in which the upper housing is pivoted to a laterally displaced position with its outer end disposed adjacent the bottom of the body of water; a connecting and sealing surface area in the bore of the lower housing; a removable shielding member having means thereon engageable with the bore wall of the lower housing for releasably anchoring the said shielding means in place in said lower housing; means on said shielding means sealing off said connecting and sealing surface area of the bore wall of said lower housing when said shielding means is disposed therein, said shielding means being insertable through said upper hous-

ing downwardly into said lower housing to be anchored therein in shielding position, said upper housing being pivotable about said pivotal mounting while said shielding means is positioned in said lower housing, said shielding means being removable from said lower housing when said upper housing is moved into alignment with said lower housing; and an elongate tubular body of a length adapted to extend from the lower housing to a point above the surface of the water having means at its lower end for connecting the same in sealed flow communication with the connecting and sealing surface of said lower housing in longitudinal alignment therewith and in longitudinal alignment with the flow conductor therebelow, said tubular body being insertable through said upper housing into said lower housing when said housings are in alignment, said upper housing providing a guide for said tubular body into said lower housing.

9. A device of the character set forth in claim 8 wherein said connecting and sealing surface area of the bore wall of said lower housing comprises screw threads and sealing surfaces disposed at opposite longitudinal ends of said threaded section, and said elongate tubular body is provided with threads adjacent its lower end for engagement with the threads in said lower housing and with seal means on its exterior engageable with at least one of the sealing surfaces of said lower housing to provide a seal between said body and said housing whereby fluids from the housing are directed into and through the bore of said tubular body.

10. A device of the character set forth in claim 9 wherein: said lower housing is provided with a annular locking recess in its bore above the upper sealing surface above said screw threads in the bore of said lower housing, and said shielding means is provided with expansible and retractible locking means movable into locking engagement in said recess in said housing for releasably locking said shielding means in place in said housing.

11. A well tool including: a first housing member having a bore, a second housing member having a bore, a pivotal connection between said first and second housing members whereby said second housing member is pivotally connected with said first housing member and swingable by means of said pivotal connection between a position in longitudinal alignment with said first housing member and a position offset from said first housing member, said first housing member having first locking means in its bore for securing well tools in said bore, said first housing member having seal surfaces in its bore at both ends of said first locking means, said first housing member also having second locking means in its bore spaced longitudinally from said first locking means, and an imperforate shield means having locking means thereon engageable with said second locking means in the bore of said first housing member for removably positioning said shield means in said first housing member in a position extending at both ends longitudinally beyond said first locking means in said bore of said first housing member, said shield means having sealing means thereon engaging said first housing member at said seal surfaces at both ends of said locking means in said bore of said first housing member, whereby said locking means is protected.

12. A well tool of the character set forth in claim 11 including: said first locking means in the bore of said first housing member comprises threads, an elongate member insertable through said pivotal upper housing member into the bore of said first housing member after said shield means has been removed from within said first housing member, said elongate tubular member having external screw threads on its lower end engageable with the screw threads in the bore of said first housing for securing said tubular member in position therein in longitudinal alignment with the bore thereof, and sealing means on the exterior of said elongate tubular member engageable with one of said seal surfaces in the bore of

said first member for sealing between said elongate tubular member and said first housing member whereby fluids flowing through said first housing member will be directed into said elongate tubular member.

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**UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION**

Patent No. 3,025,912

March 20, 1962

Harry B. Schramm et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 43, after "therethrough" insert -- ; an upper housing section having a bore therethrough--.

Signed and sealed this 10th day of July 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents