United States Patent

Carroll

[15] **3,638,723**

[45] **Feb. 1, 1972**

[54] LOCATOR DEVICES

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[73] Assignee: **Otis Engineering Corporation**, Dallas, Tex.

[22] Filed: **June 22, 1970**

[21] Appl. No.: **48,264**

[52] **U.S. Cl.** **166/215**

[51] **Int. Cl.** **E21b 23/00**

[58] **Field of Search** 166/214, 215, 216, 217, 206

[56] **References Cited**

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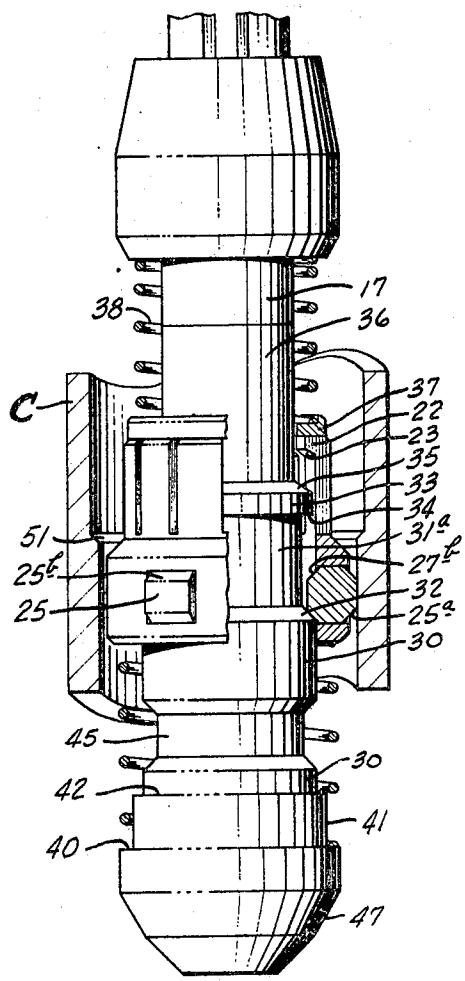
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Primary Examiner—James A. Leppink
Attorney—E. Hastings Ackley

[57] **ABSTRACT**

A locating tool for use in a well flow conductor for locating each or any one of a plurality of oppositely facing shoulders in said conductor and usable with well tools for locating said tools at predetermined positions with respect to selected ones of said shoulders, and more particularly usable in connection with a running tool and a well locking and sealing mandrel device for locating said locking and sealing mandrel device in registry with any one of a plurality of receptacles in said conductor for supporting a well tool therein. The running tool is operable to set the locking and sealing mandrel device in the selected receptacle only after the locator device has located the receptacle and is releasable from the mandrel device only after the same has been locked in place in the receptacle. The locking device is also operable to engage and shift any one of a plurality of sliding sleeve side opening valves in a flow conductor. The locator device is adapted to be operated by either flexible line mechanism or by through flow line pumpdown operating mechanisms.

24 Claims, 21 Drawing Figures



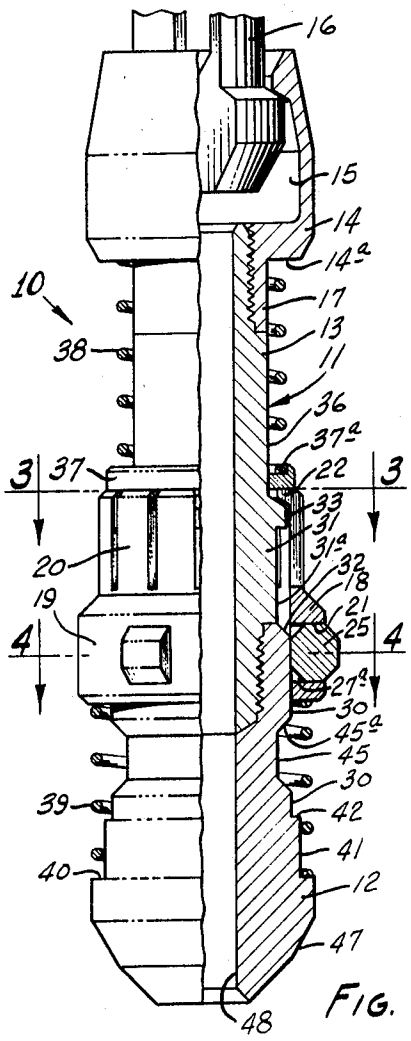


FIG. 1

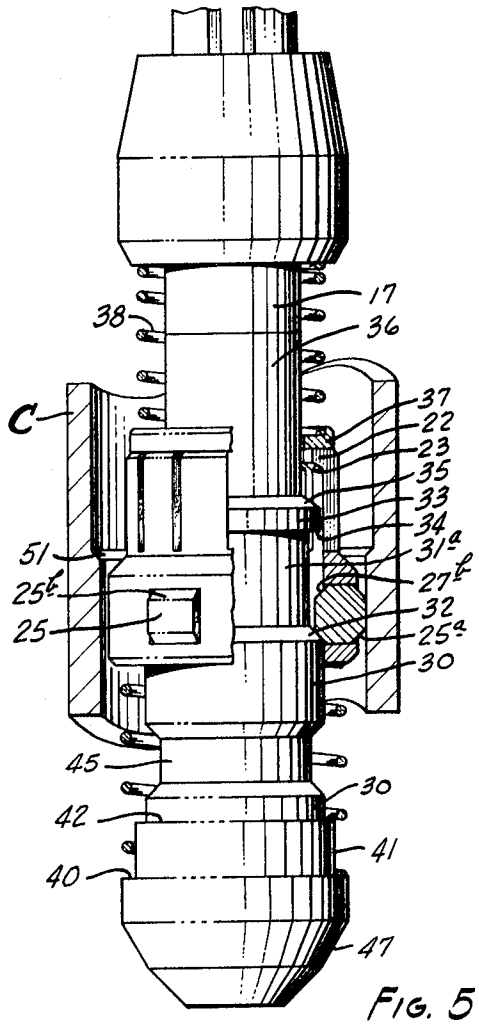


FIG. 5

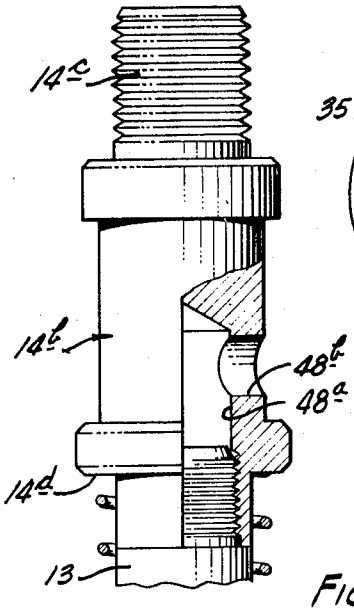


FIG. 2

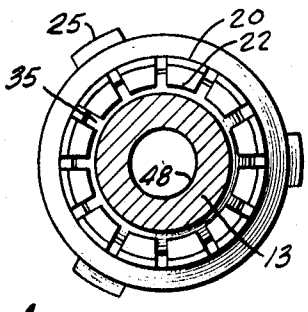


FIG. 3

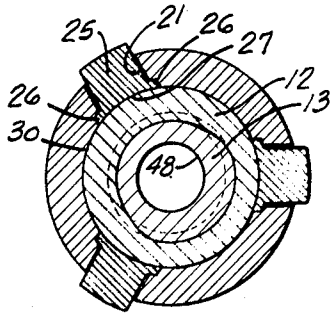


FIG. 4

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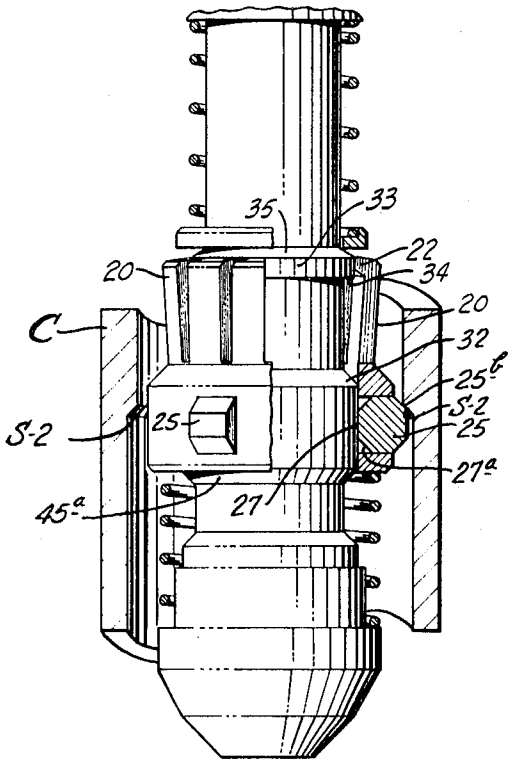


FIG. 6

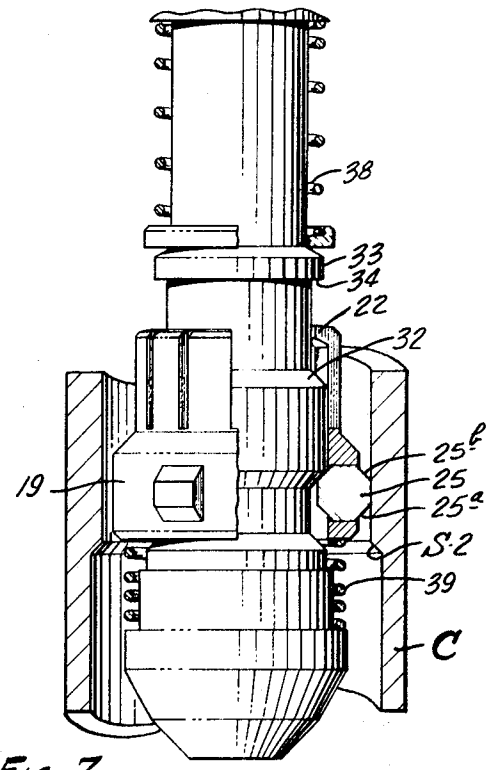


FIG. 7

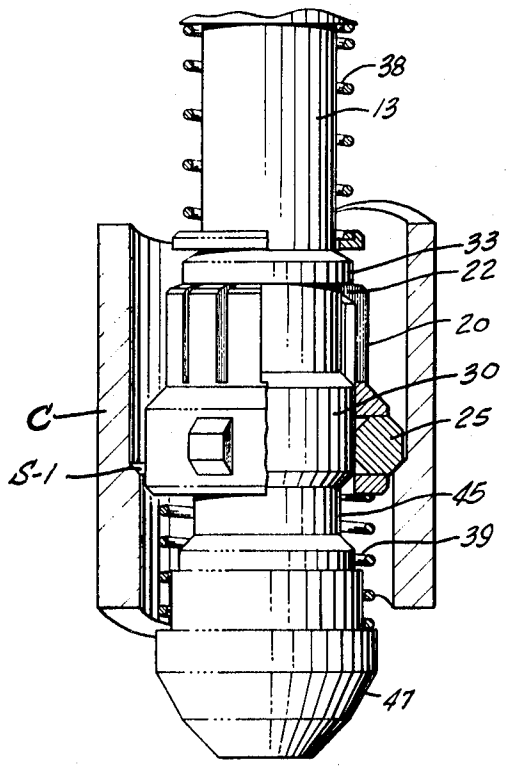


FIG. 8

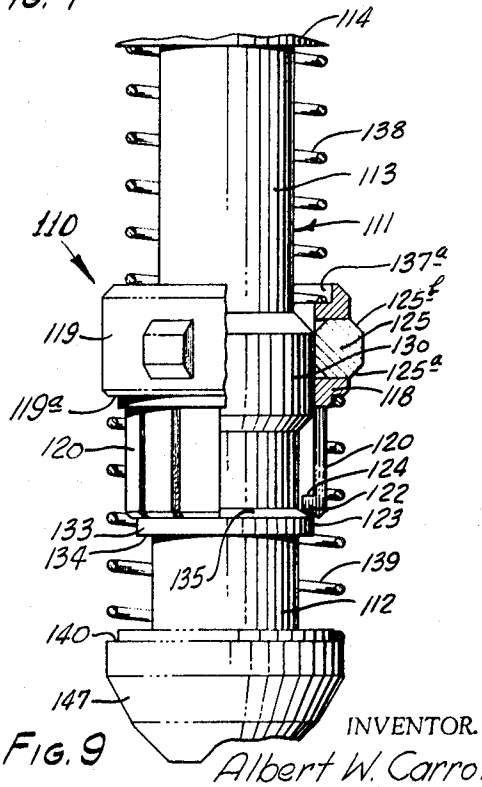


FIG. 9

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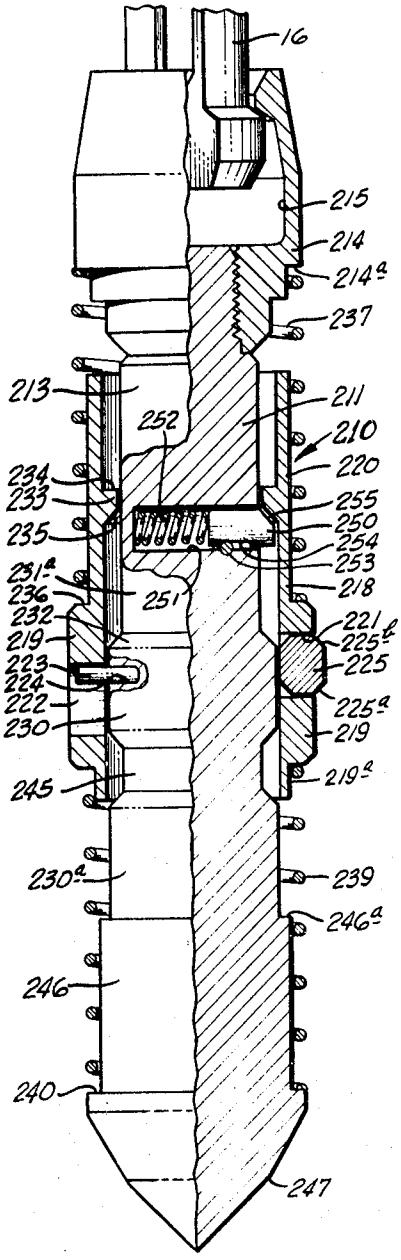


FIG. 10

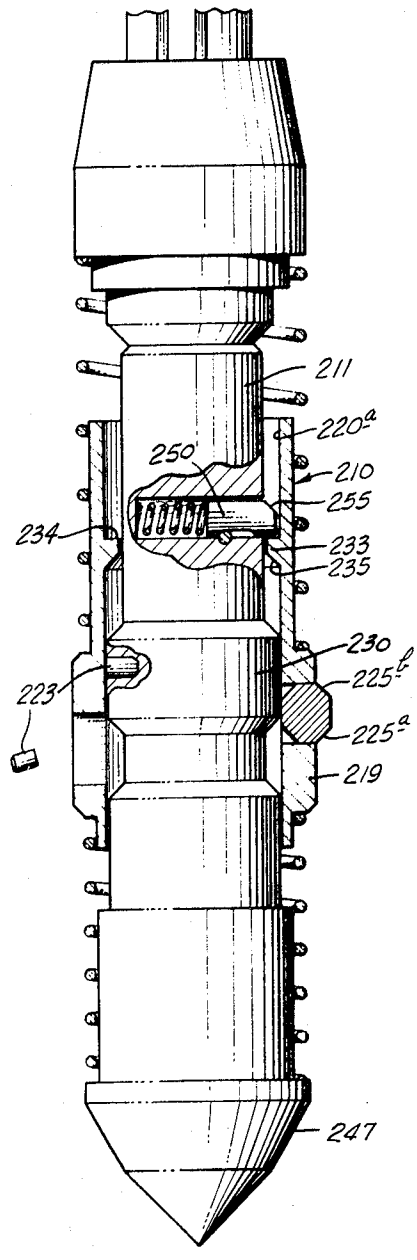


FIG. 11

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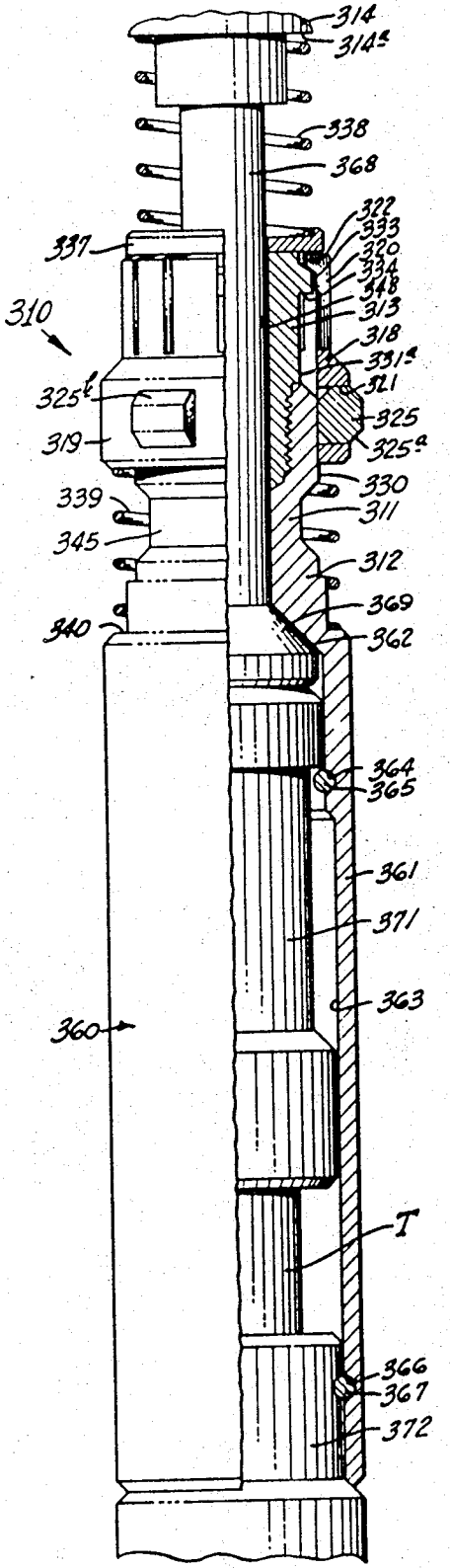


FIG. 12

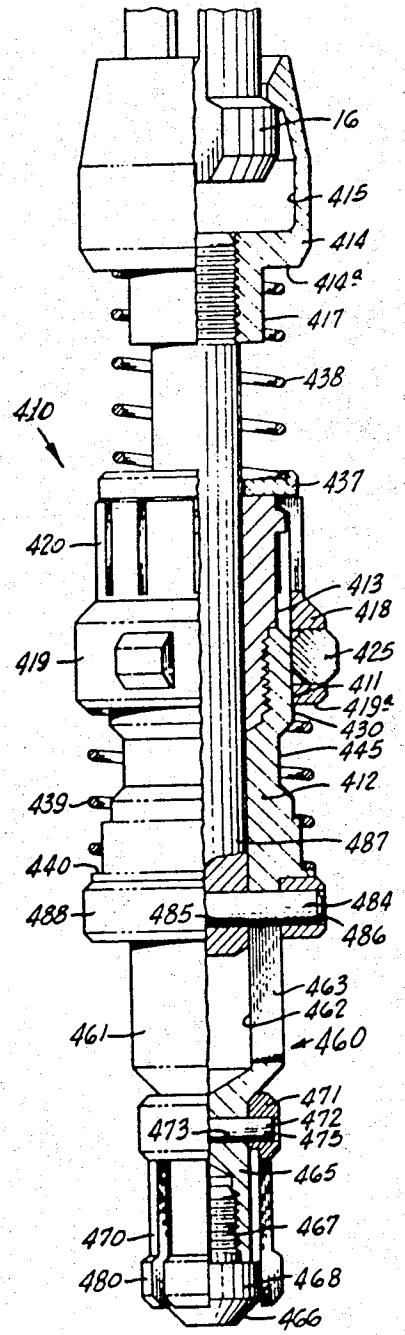


FIG. 13

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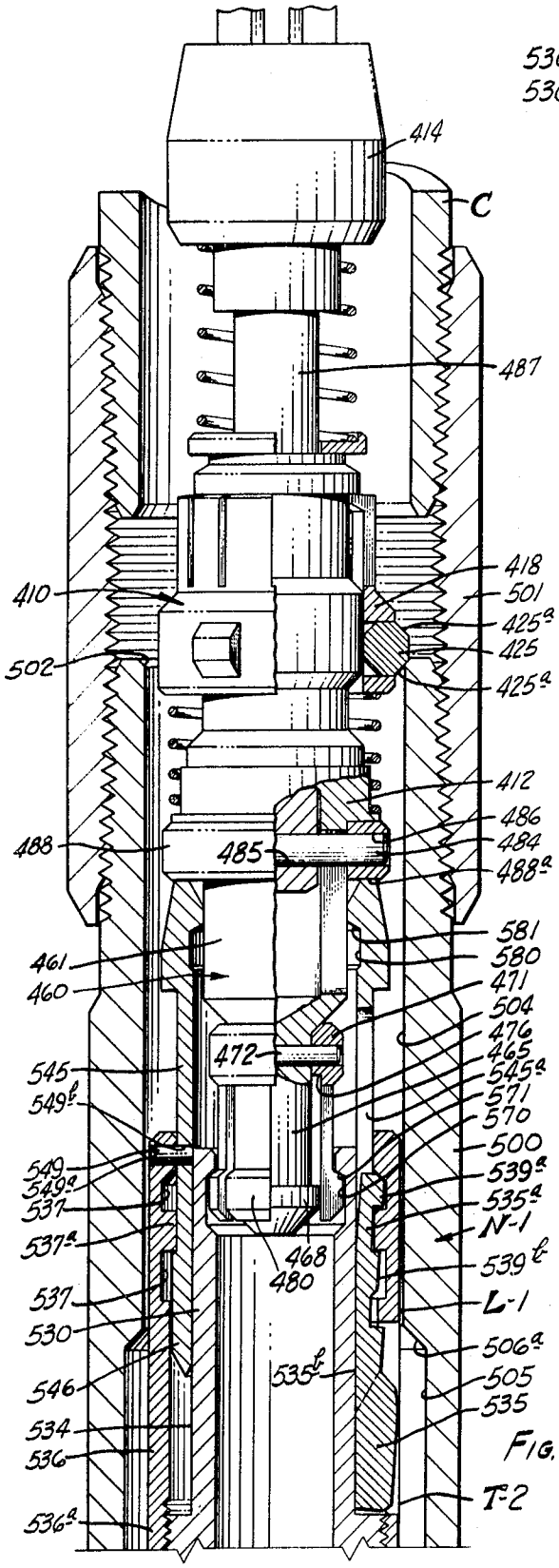


FIG. 14-A

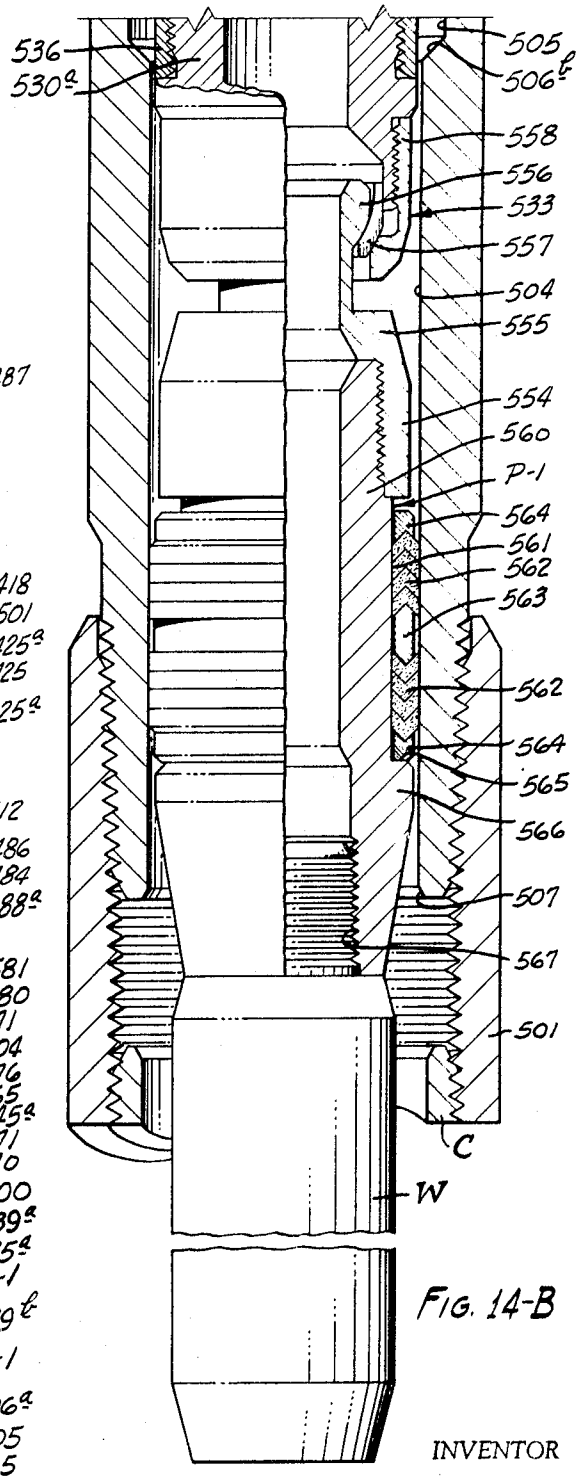


FIG. 14-B

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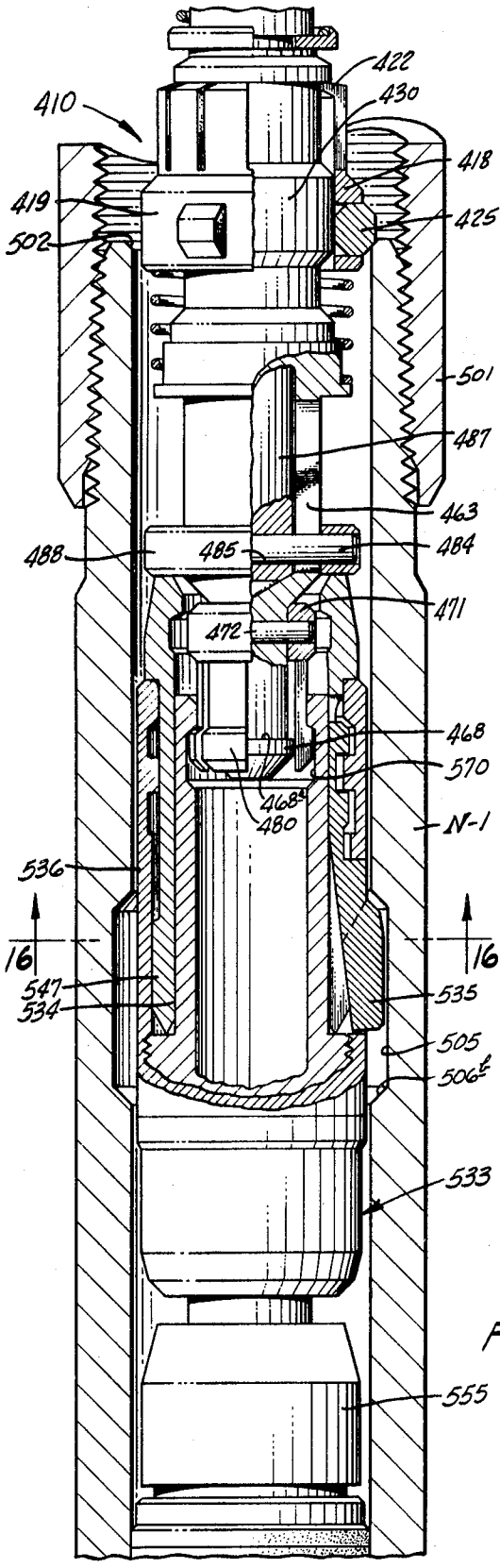


FIG. 15

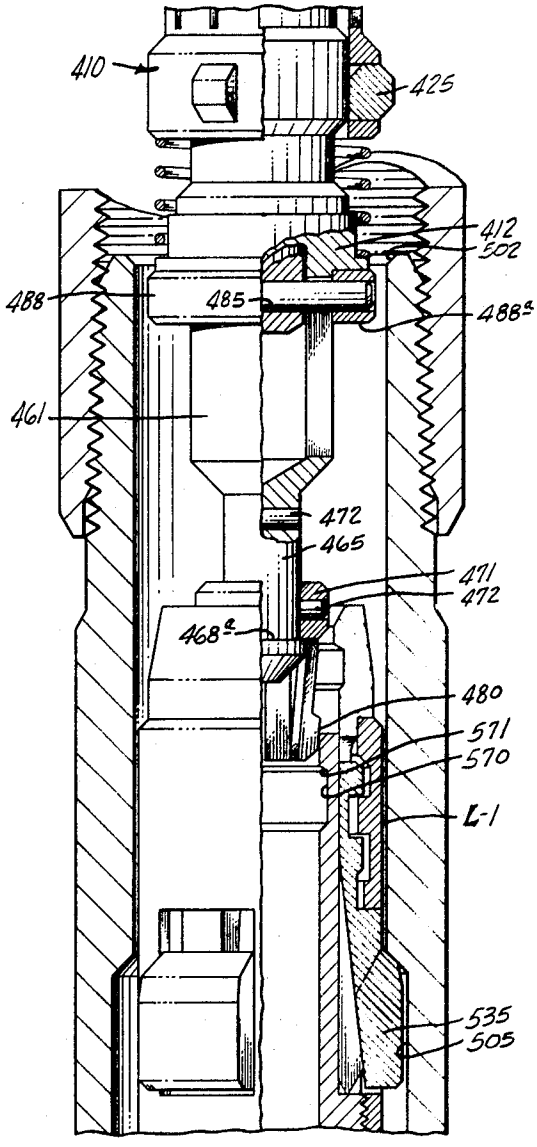


FIG. 17

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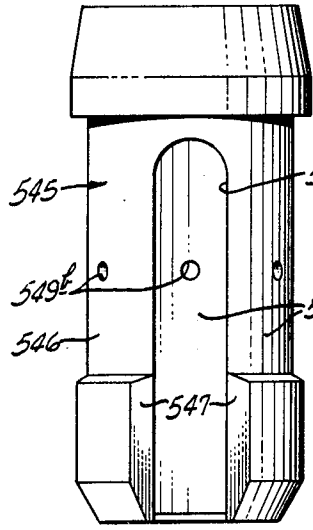


FIG. 18

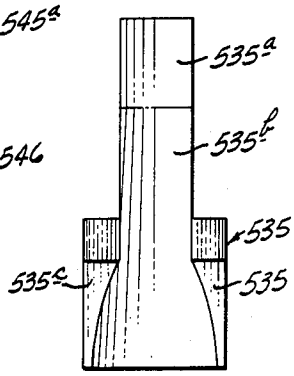


FIG. 19

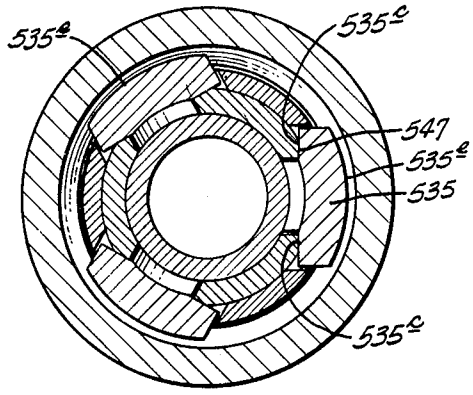


FIG. 16

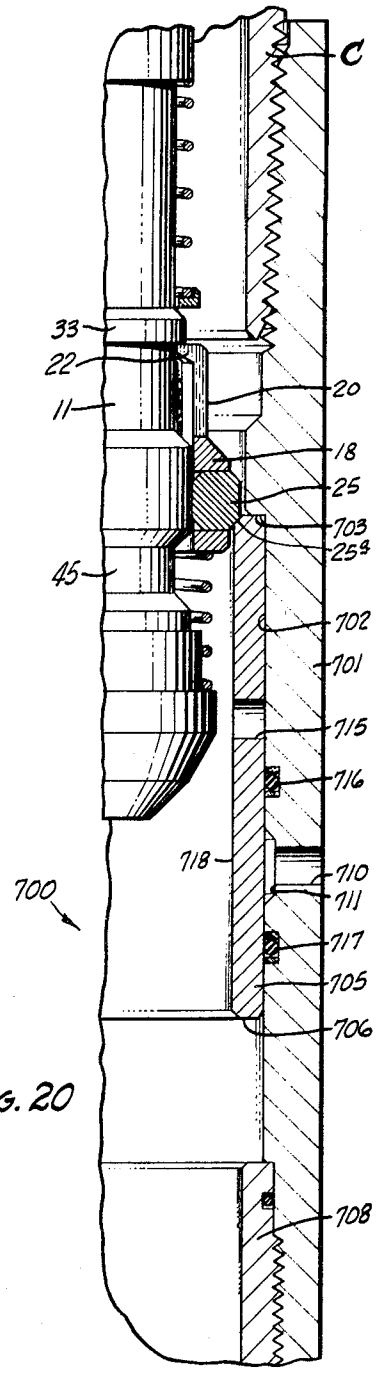


FIG. 20

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LOCATOR DEVICES

This invention relates to new and useful improvements in well tools, and more particularly to locator tools for locating the position of lock or stop shoulders or means in the bore of a well flow conductor, and to locking devices and landing nipples for use in connection therewith.

One object of this invention is to provide improved means for locating and engaging lock or stop shoulders in a well flow conductor.

A particular object of the invention is to provide a locating device for positioning a well tool in a well flow conductor at a predetermined position with respect to a stop or lock shoulder in said conductor.

Another object is to provide a device for locating and engaging each or any one of a plurality of spaced upwardly and downwardly facing shoulders in a well flow conductor.

A particular object of the invention is to provide a device which is provided with means for locating both upwardly and downwardly facing shoulders in a well flow conductor, and which is operable to engage the ones of said shoulders facing in one direction to positively arrest movement of said locating device in a direction opposite the direction in which the shoulders face.

A particular object of the invention is to provide a locator device for use in a flow conductor having a plurality of oppositely facing spaced stop or lock shoulders therein and having expansible and retractible engaging or locating and stop means thereon yieldably held in position to engage the ones of said stop or lock shoulders facing in one direction in said conductor and to be movable thereby to retracted position to pass said shoulders when said device is moved in one direction in said flow conductor, and wherein said engaging means is movable to another position on said device in which said engaging means will engage the oppositely facing shoulders in said conductor and be moved thereby to retracted position when said locator device is moved in the opposite direction in the conductor but will be held against movement to retracted position upon engaging any one of said shoulders facing in said one direction when the locator device is subsequently moved in said one direction in the conductor, whereby movement of the locator device in said one direction in said conductor is prevented and the locator device is positively located in said conductor by the engagement of the engaging means with said one of said stop or lock shoulders facing in said one direction.

Another object is to provide a locating device having engaging means adapted to locate and engage one of oppositely facing stop or lock shoulders in a well flow conductor, and control means in a first position on said device resiliently holding said engaging means in engaging position and movable to permit said engaging means to retract from such engaging position upon contacting one of said stop and lock shoulders to permit said device to pass said shoulder during movement of the locating device in one direction in said flow conductor, said control means being responsive to a predetermined longitudinal force applied thereto when said engaging means is engaged with the other of said oppositely facing shoulders to be moved to a second position on said device permitting said engaging means to move to retracted position to pass said other shoulder upon movement of said device in the opposite direction in said conductor, said control means positively holding said engaging means against movement to retracted position to prevent movement of said engaging means past said one stop or lock shoulder upon subsequent movement of said device in said one direction in said conductor to prevent movement of said device past said one shoulder and thereby locate said device in said flow conductor by means of said one shoulder.

Still another important object of the invention is to provide a locating device of the character described which is constructed to be operable to position said device at any one of a plurality of longitudinally spaced positions in said well flow conductor in operative relationship to a stop or lock shoulder at such position.

A still further object of the invention is to provide a locating tool which is provided with means for engaging and locating oppositely facing shoulders projecting into a well flow conductor in combination with a well tool, and wherein said locating device is operable to engage one of the shoulders facing in one direction in said flow conductor to positively arrest movement of said locating device and well tool in a direction opposite the direction in which said shoulder faces for locating said well tool at a desired position with respect to said shoulders.

A particular object of the invention is to provide a locator device for use in a well flow conductor having a plurality of longitudinally spaced stop or lock shoulders therein and having engaging or locating and stop means thereon movable in one direction in said conductor past said shoulders, and wherein said engaging means is movable to a position on said device in which said engaging means is movable past said shoulders when said device is moved in the opposite direction in said flow conductor, but wherein said engaging means will engage and prevent movement of said device past any one of said shoulders facing in said opposite direction in the conductor to locate the position of said shoulder in the conductor, to locate well tools connected with said locator device at the position in said conductor determined by the shoulder engaged by said locator device, or to locate the deposition of each of said shoulders in said conductors facing in said opposite direction in said conductor.

Another object of the invention is to provide, in combination, a locating tool and a running or inserting tool for a well device having means for positioning said running tool and said well device in a predetermined relationship with respect to a stop or lock shoulder in a well flow conductor.

A still further object of the invention is to provide a device of the character described wherein the locating device and inserting or running tool are provided with means for selectively positioning said locating tool and said inserting tool and the well tool connected therewith in a predetermined relationship with any selected one of a plurality of longitudinally spaced stop or lock shoulders in said well flow conductor.

A particular object of the invention is to provide in a locating device of the character set forth means for locating a plurality of stop means or shoulders in a well flow conductor while moving past said longitudinally spaced stop shoulders in one direction, and which is operable to engage and locate oppositely facing stop shoulders or stop means in said well flow conductor successively during movement of said locating device in the opposite direction in said well flow conductor.

A still further object of the invention is to provide in a device of the character described means for positioning said locating tool at any one of said plurality of longitudinally spaced shoulders in said well conductor and holding said device against movement in one direction in said flow conductor while in engagement with said stop shoulder, whereby said well tool may be operated at said position in said well flow conductor while said locating device is in engagement with said stop shoulder.

Still another object of the invention is to provide a running tool for inserting a well tool in a well flow conductor at any one of a plurality of longitudinally spaced receiving members or landing nipples having identical locking configurations, wherein said running tool includes positioning means engageable with a stop shoulder of said secondary member to hold said running tool in operative position with respect to said landing nipple to permit said running tool to be actuated to dispose said well tool in said landing nipple.

Still another object of the invention is to provide a running tool of the character described wherein the locating member holds said running tool against movement longitudinally in one direction while permitting a section of said running tool to move in the opposite direction to dispose said well tool in said landing nipple or to anchor the well tool in said landing nipple.

Still another object of the invention is to provide a locating device of the character set forth having means for connecting the same to a pumpdown tool string for actuation by fluid pressure for movement in a pumpdown well installation.

A still further object of the invention is to provide a device of the character described wherein the locating tool is provided with means for connection with a flexible line operating mechanism for actuation by such mechanism in a well flow conductor.

Still another object of the invention is to provide a device of the character described which is adapted for interchangeable use with pumpdown tool assemblies and a flexible line operating assembly by substitution of a connector element.

Still another object is to provide a running tool of the character described which is interchangeably connectable to a pumpdown tool operating assembly or to a flexible line operating assembly, as desired.

Another object of this invention is to provide a landing nipple for use in a well flow conductor and a locking and sealing mandrel for locating, anchoring and sealing in said landing nipple to support a flow control device in said flow conductor for controlling fluids flowing through said flow conductor.

Another object is to provide a landing nipple having means for connecting it in a well flow conduit, a flow passage therethrough in substantial axial alignment with the flow passage through the flow conduit, the nipple flow passage being sufficiently large to pass conventional wire line and pumpdown tools yet being sufficiently small to provide an internal shoulder at each end of the landing nipple, said landing nipple having internal annular lock recess means intermediate the ends of the nipple and spaced a predetermined distance from the shoulder at the upper end of the nipple, and a locking device for use with the landing nipple, said locking device having expansible locking means engageable in the internal annular lock recess means and external annular seal means for sealingly engaging the inner wall of said landing nipple adjacent said lock recess means.

A particular object of the invention is to provide a landing nipple and a locking and sealing device adapted to be anchored in said landing nipple in sealing relation therein, and having locking means operable to hold said locking and sealing device against movement in either direction with respect to said landing nipple, and wherein said landing nipple is provided with a shoulder spaced longitudinally with respect to the locking recess of said mandrel for positioning a locating and setting device in position with respect to said landing nipple to dispose the locking elements of said locking device in registry with the locking recess in said nipple for actuation of said locking elements to locking engagement in said locking recess.

Still another object of the invention is to provide a landing nipple for connection into a well flow conductor and having a locking recess and locating shoulder formed thereon and providing means for locating a well tool locking device in position to be locked in place in said nipple.

Another object is to provide a running tool for use with the locking device and landing nipple of the character set forth, having releasable means thereon for attachment to said lock mandrel, means engageable with the shoulder at the upper end of the landing nipple to position the expansible lock means of said mandrel in registry with the lock recess of said nipple, means for expanding said lock means into locking engagement with said recess and means for releasing the running tool from the lock mandrel after the lock means is locked to permit withdrawal of the running tool from the flow conduit.

A further object of the invention is to provide a locator device which is adapted for use to engage and operate any selected one of a plurality of spaced longitudinally movable side opening sleeve valve assemblies in a well flow conductor for opening and closing the lateral flow port of such assembly.

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

FIG. 1 is a view partly in elevation and partly in section of a locating device constructed in accordance with the invention and showing the device operatively connected to a pumpdown operator mechanism;

FIG. 2 is a fragmentary view, partly in elevation and partly in section, of the upper end of the device of FIG. 1 showing a flexible line operating mechanism connector member connected thereto;

FIG. 3 is a horizontal cross-sectional view taken on the line 3—3 of FIG. 1;

FIG. 4 is a horizontal cross-sectional view taken on the line 4—4 of FIG. 1;

FIG. 5 is a view similar to FIG. 1 showing the locating device passing an upwardly facing stop or lock shoulder in a well bore;

FIG. 6 is a fragmentary view of the device of FIG. 1 showing the locating and stop dogs of the device engaged with a downwardly facing stop shoulder for reversing the direction of operation of the locating device in the well flow conductor;

FIG. 7 is a view similar to FIG. 6 showing the locating dogs of the locator device passing upwardly past the downwardly facing stop shoulder of FIG. 6;

FIG. 8 is a view, similar to FIG. 7, showing the locator device with the locating and stop dogs engaged with the upwardly facing stop shoulder of the well flow conductor to locate and prevent downward movement of the locating device past said shoulder;

FIG. 9 is a view similar to FIG. 1 showing a slightly modified form of the locating device of FIG. 1;

FIG. 10 is a view, partly in elevation and partly in section, of a further modified form of the locator device of the invention, showing the same connected to a pumpdown operating mechanism;

FIG. 11 is a view similar to FIG. 10 showing the locating device with the locating and stop dogs thereon moved to a position to permit movement of said device in the opposite direction to that of FIG. 10 and providing a locating or stopping support against an upwardly facing shoulder passed by the device in the condition shown in FIG. 10;

FIG. 12 is a view, partly in elevation and partly in section, of a running tool or a well device having a locator mechanism connected with the running tool for locating the well device in a predetermined position, as in registry with a selected one of a plurality of longitudinally spaced receptacles in a well flow conductor;

FIG. 13 is a view, partly in elevation and partly in section, of a modified form of running tool and locator mechanism for locating a well device in position to be disposed in a predetermined one of a plurality of longitudinally spaced receptacles in a well flow conductor;

FIGS. 14–A and 14–B are views, partly in elevation and partly in section, showing the combined locator and setting tool of FIG. 13 in operation for locating and setting a locking and sealing mechanism of a well tool in a landing nipple or receptacle in a well conductor;

FIG. 15 is a view, partly in elevation and partly in section, showing the locator and setting tool of FIG. 14–A actuating the locking mechanism of the well tool to anchored position;

FIG. 16 is a horizontal cross-sectional view taken on the line 16—16 of FIG. 15;

FIG. 17 is a fragmentary view, partly in elevation and partly in section, similar to FIG. 15, showing the locator and setting tool combination released from and moving out of the locking mechanism leaving the same locked in the landing nipple;

FIG. 18 is a side elevation of the locking or expander sleeve of the locking mechanism of the well tool of FIG. 15;

FIG. 19 is a view in elevation of the rear face of one of the locking dogs of the well tool of FIG. 15, which is used in combination with the expander of FIG. 18; and,

FIG. 20 is a fragmentary view, partly in elevation and partly in section, showing the locator device being used to move the sliding sleeve of a sliding side port valve device to open the same.

In the drawings, FIGS. 1 through 8, the numeral 10 designates generally a locator device constructed in accordance with the invention. The locator device includes an elongate mandrel or body 11 shown to be tubular and formed

of a lower section 12 having a central section 13 threaded into its upper end and an upper connector member 14 threaded onto the upper end of the central section 13. The upper connector section has a coupler socket 15 formed therein for receiving coupler members 16 of fluid operated pump down tool locomotive and operator mechanisms of the type shown and described in the patent to John V. Fredd, U.S. Pat. No. 3,428,346, issued Feb. 18, 1969, whereby the tool is adapted for operation in the well by through the flow line pump down locomotive and operator mechanisms.

Slidably mounted on the central mandrel section 13 and on the lower mandrel section 12 is a control sleeve or member 18, having an enlarged lower portion 19 and upwardly projecting collet detent fingers 20 formed thereon. A plurality of lateral apertures 21 are formed in the enlarged lower portion of the control member or sleeve and a radially expansible and retractable locating and stop dog 25 is slidable in each of the apertures 21. As shown in FIG. 4, each of the dogs 25 has laterally projecting flanges 26 at its inner end which limit outward movement of the dogs through the apertures 21. The inner surface 27 of each of the dogs is arcuate to conform to the cylindrical surface of an expander member or surface 30 formed on the upper end of the lower mandrel section 12. The lower external portion 31 of the central mandrel section 13 is reduced in diameter to be smaller than the expander section 30, and a tapered surface 32 at the upper end of the expander section merges with the cylindrical section 31 of the central mandrel section and provides a recess for the locating stop dogs 25 to retract inwardly of the lateral apertures 21 when the control sleeve 18 is moved upwardly on the mandrel to position the dogs above the expander surface 30. Spaced above the upper end of the lower mandrel section 12 and formed integral with the medial portion of the central mandrel section 13 is an external annular stop and restraining flange 33 which has an abrupt 90° lower face 34 and a tapered or beveled or upper face 35 which merges inwardly and upwardly into the reduced upper cylindrical surface 36 of the central mandrel section 13. The lower portion of the upper mandrel or coupler section 14 is reduced in diameter to provide a shank 17 which is of the same external diameter as the upper reduced cylindrical portion 36 of the central mandrel section so as to form a continuation of said cylindrical section, as clearly shown in FIGS. 1 and 5.

The collet spring detent fingers 20 in the upper end of the control sleeve 18 have inwardly projecting hooks 22 which extend inwardly to overlie the upper beveled surface 35 of the flange 33, as clearly shown in FIG. 1 and 5. The lower inner surface 23 of each of the hooks 22 is beveled for a purpose which will be hereinafter more fully explained. A spring biasing follower ring 37 is slidable upon the upper reduced portion 36 of the central mandrel section 13 and has an internal annular recess 37*a* formed in its upper surface in which the lower end of the helical coil spring 38 is engaged. The upper end of the spring 38 abuts the downwardly facing shoulder 14*a* formed on the coupling member above the reduced lower cylindrical section 17 thereof, so that the spring is confined between the shoulder 14*a* and the ring 37 and biases the control sleeve 18 downwardly on the central and lower mandrel sections until the inturned hooks 22 on the upper ends of the spring collet fingers 20 engage the tapered or beveled surface 35 at the upper end of the flange 33, as shown in FIG. 1. A second helical coil spring 39 is confined between the lower end of the control sleeve 18 and an upwardly facing annular shoulder 40 formed on the lower portion of the lower mandrel section 12 at the lower end of the lower cylindrical section 41 extending downwardly from the lower end of the expander surface 30 and providing therewith an upwardly facing stop shoulder 42 for limiting downward movement of the control member 18 on the mandrel. The spring is therefore held centered with respect to the lower mandrel section and the lower end of the control sleeve by the lower cylindrical section 41. The cylindrical expander section 30 has a reduced or relieved annular retracting recess 45 formed in its exterior near the lower end thereof and spaced above the shoulder 42 a distance proper to receive the inner ends of the dogs 25 when the lower end of the control sleeve 18 is seated on such shoulder. The recess 45 is of a sufficient longitudinal dimension to readily receive the locating and stop dogs 25 when dogs are in retracted position, as shown in FIG. 7. The lower end of the lower section 12 of the mandrel 11 is tapered inwardly to serve as a guide for movement of the device through a well flow conductor, as shown at 47, and the bore 48 through the mandrel permits fluids to pass therethrough as the device is moved in the flow conductor.

If desired, the pump down coupler member 14 may be removed and replaced by a wire line connector sub 14*b* which is threaded onto the upper end of the central mandrel section 13 as shown in FIG. 2. The connector sub has a bore 48*a* communicating with the bore of the mandrel sections therebelow and lateral openings 48*b* providing communication between the bore and the exterior thereof. The upper end of the connector sub is formed with a screw-threaded pin 14*c* by means of which the sub may be connected to the usual flexible line operating mechanism of jars, stem, etc., (not shown) for actuation of the locator device by means of such wire line operating mechanism rather than the pumpdown mechanism used with the upper mandrel coupler section 14.

In use, the locator device 10 is moved into a well flow conductor C, such as is shown in FIGS. 5 through 8, either by the pump down operator mechanism or by the flexible line operator mechanism connected thereto by means of the sub 14*b* shown in FIG. 2. As the device moves through the flow conductor or tubing string C, it will encounter upwardly facing shoulders S–1 and downwardly facing shoulders S–2 formed in said conductor. Obviously, the shoulders may be at spaced points in the conductor and the locating and stop dogs 25 will engage said shoulders as the device moves through the conductor.

As shown in FIG. 5, when the locator device has moved to a position above an upwardly facing shoulder S–1, the lower beveled edges 25*a* of the dogs will engage the shoulder S–1 and move the control sleeve 18 upwardly with respect to the expander or locking surface 30 on the lower mandrel section until the dogs may move inwardly above the beveled upper end 32 of the lower mandrel section and enter the annular upper retracting recess 31*a* provided by the reduced lower end portion 31 of the central mandrel section. The dogs are then cammed to a retracted position to permit the outer surfaces of the dogs to pass the shoulder S–1 and move through the restricted bore in the flow conductor below the shoulder. The spring 38 will yield to permit the ring 37 and control sleeve 18 to move upwardly on the mandrel 11 as the dogs are moved upwardly toward the upper recess 31*a*. When the locator and stop dogs 25 have moved below the downwardly facing shoulder S–2, shown in FIG. 6, the spring 38 will move the control sleeve 18 downwardly and the dogs will be moved outwardly to full expanded position by the engagement of lower surfaces 27*a* of the dogs with the beveled upper end 32 of the lower mandrel section 12 until their inner ends 27 again ride upon the expander surface 30. In the expanded position, the dogs are spaced slightly from the bore wall of the flow conductor C, as shown in FIGS. 6 and 8, but will interfere with either the upwardly facing shoulders S–1 or the downwardly facing shoulders S–2 formed in the conductor C. The dogs will then be in the position shown in FIG. 1, and upward movement of the locator device 10 in the flow conductor will move the upper end beveled ends 25*b* of the dogs into engagement with the downwardly facing shoulders S–2 next above and provide means for locating the depth of such shoulder in the flow conductor, either by the length of the flexible line in the well, or by means of the fluid volume in the well flow conductor above the operating mechanism, as is well known in this art.

Obviously, the operation of moving the locator device through the well flow conductor downwardly in the well bore may be continued, and the locator and stop dogs will engage and be moved upwardly to retracted position on the upper

mandrel on the central mandrel section as they encounter other upwardly facing shoulders S–1 in the flow conductor C. Also, when the locator device has moved below a flange or downwardly facing shoulder S–2, the device may be lifted by means of the flexible line lowering mechanism, or the pump mechanism may be reversed, to engage the dogs with the downwardly facing shoulder S–2 while in the expanded position shown in FIG. 1 to provide an indication of the location of the downwardly facing shoulders in the conductor.

When the locator device has been moved to the desired depth in the well bore and it is desired to move it in the opposite direction out of the well flow conductor, the locator device is moved upwardly until the dogs **25** engage the nearest downwardly facing shoulder S–2. Continued upward force applied to the mandrel **11** of the locator device will move the mandrel upwardly relative to the control sleeve **18** and the dogs **25**, as shown in FIG. **6**, to cause the inwardly extending hooks **22** at the upper ends of the spring fingers **20** on the upper portion of the control sleeve **18** to be cammed outwardly to move past the flange **33** to the position shown in FIG. **7**. The upper ends of the fingers are now disposed below the right angled lower shoulder surface **34** of the flange **33**, and the locating and stop dogs **25** are moved downwardly below the upper portion of the expander surface **30** on the lower mandrel section **12** to permit the dogs to cam inwardly into the lower annular retracting recess **45** formed in the lower portion of the expander section, as shown in FIG. **7**. When the hooks at the upper ends of the fingers **20** move below the flange **33**, the spring follower ring **37** engages the upper beveled surface **35** of the flange **33** and downward movement of the spring ring by the upper spring **38** is terminated by such engagement. The control sleeve **18** is therefore free to move upwardly on the lower mandrel section without resistance to such movement by the spring **38**. Downward movement of the control sleeve is resisted by the lower helical coil spring **39**, which biases the control sleeve upwardly on the mandrel to a position in which the upper ends of the hooks **22** of the fingers **20** engage the lower shoulder **34** of the flange **33** on the central mandrel section to stop further upward movement of the control sleeve and position the locating and stop dogs **25** in registry with the upper expander surface **30** on the lower mandrel section.

After the control sleeve has been moved to the position shown in FIG. **7**, the locating and stop dogs **25** will move inwardly in the lower retracting recess **45** to the retracted position shown in FIG. **7**, the engagement of the beveled upper surfaces **25***b* of the dogs with the downwardly facing shoulders S–2 moving the dogs inwardly to the retracted position, in which they will pass through the restriction formed in the bore of the flow conductor C above the downwardly facing shoulder S–2 and will pass through such restriction to a position above the upwardly facing shoulder S–1 next above the restriction through which the dogs have just passed. As the dogs move out of the restriction, they will be cammed outwardly to expanded position by the engagement of the beveled inner upper ends surfaces **27***b* with the beveled shoulder **45***a* at the upper end of the annular lower retracting recess **45**, and the inner surfaces **27** will then ride on the upper expander surface **30** in fully expanded position, as shown in FIG. **8**. In this position, the lower beveled surface **25***a* of the projecting ends of the locating and stop dogs are disposed to interfere with the upwardly facing shoulder S–1 next therebelow in the flow conductor upon downward movement of the locator device in the flow conductor. Upon the occurrence of such engagement, the downward movement of the locator device is stopped or further downward movement is prevented and the location of the upwardly facing shoulder S–1 may then be determined by means of measurements made with the wire line operating mechanism or by the fluid contained in the flow conductor above the pump down operating mechanism, in the well known manner.

It will further be seen that the engagement of the upper ends of the hooks **22** on the upper ends of the spring fingers **20** of the control sleeve with the abrupt 90° lower shoulder surface **34** of the flange **33** will prevent upward movement of the control sleeve **18** on the mandrel and downward movement of the mandrel with respect to the upwardly facing shoulder S–1 will be positively prohibited or prevented by the engagement of the dogs with the shoulder. The dogs carried by the control sleeve **18** which is held against further upward movement by the engagement of the upper ends of the fingers with the downwardly facing shoulder **34** of the flange **33** on the central mandrel section **13** thus provide a stop against downward movement of the locator device in the flow conductor at the location of the upwardly facing shoulder S–1 with which the dogs are in engagement. Also, this stopping or locating engagement of the dogs with the upwardly facing shoulder S–1 provides means for locating well tools at predetermined positions with respect to such shoulder, as will be hereinafter more fully explained.

Subsequent upward movement of the locator device in the flow conductor C will cause the dogs to cam inwardly to a retracted position as they engage downwardly facing shoulders S–2 to pass through the restrictions above the downwardly facing shoulders. As the dogs pass above the restrictions, they will be cammed outwardly by the cam surface **45***a* engaging the inner beveled surfaces **27***b* of the dogs, the spring **39** biasing the sleeve upwardly to cause the dogs to be cammed outwardly to the expanded position. After the dogs have passed through the restriction below the next upwardly facing shoulder S–1, the locator device may be moved downwardly to move the dogs into engagement with the upwardly facing shoulder to provide a measure for locating such shoulder in the well flow conductor. This process may be repeated until the locator device is moved completely upwardly through the conductor out of the well, and the location of all upwardly facing shoulders determined in the manner just described.

It will, therefore, be seen that a locator device has been provided which may be utilized to locate each of a plurality of upwardly and downwardly facing shoulders in a well flow conductor as the device is moved through the flow conductor. The device may be utilized to locate downwardly facing shoulders as it is moved into the flow conductor and may be utilized to locate and detect and locate the position of upwardly facing shoulders in the flow conductor as it is moved upwardly in the opposite direction out of the well flow conductor.

Also, it will be seen that the device provides a positive stop against downward movement when in engagement with any one of the upwardly facing shoulders in the well flow conductor after the control sleeve of the locating device has been moved to its lower position on the mandrel shown in FIGS. **7** and **8**.

A slightly modified form of locator device **110** is shown in FIG. **9**. In this device the central mandrel section **113** is shortened and is threaded into the lower mandrel section **112** above the expander surface **130** formed on the upper end thereof. The flange **133** is formed on the lower mandrel section intermediate the ends of the externally reduced cylindrical portion **145** of said lower mandrel section between the expander surface **130** and the base or head **147** of the lower end thereof. The flange has a beveled upper surface **135** and an abrupt or right-angle lower surface **134** corresponding to those of the form first described.

A control sleeve or member **118** has an enlarged portion **119** at its upper end and is provided with downwardly extending resilient spring fingers or collet members **120** having inwardly facing hook members **122** on their lower ends. The extreme lower ends **123** of the hook members are beveled inwardly and upwardly to correspond substantially to and coact with the beveled upper surface **135** of the flange **133**, and the upper surfaces **124** of the hooks **122** extend inwardly at right angles to provide an abrupt surface which will engage beneath the lower right-angle surface **134** of the flange to limit upward movement of the control sleeve **118** with respect to the mandrel, as will be explained. The upper spring **138** is confined

between the shoulder 14*a* at the lower end of the upper mandrel section 14 or the corresponding shoulder 14*d* on the connector sub 14*b* while its lower end is disposed in an internal annular recess 137*a* formed in the upper inner end surface of the large upper section 119 of the control sleeve 118, whereby the spring is confined between the shoulders 14*a* or 14*b* and the shoulder 137*a* to bias the control sleeve downwardly on the mandrel. In FIG. 9 the control sleeve is shown in position for movement of the locating device into the well conductor, the control sleeve 118 being movable upwardly relative to the expander surface 130 to permit the dogs 125 to move inwardly to retracted position to pass through the restrictions below the upwardly facing shoulders in the flow conductor. The lower spring 139 surrounds the collet or spring fingers 120 and is confined between an upwardly facing shoulder 140 at the lower end of the lower mandrel section 112 and a downwardly facing shoulder 119*a* at the junction of the upper ends of the spring fingers and the lower end of the enlarged portion 119 of the control sleeve. The spring 139 biases the control sleeve upwardly.

When the locator device 110 has been moved to the lowermost position in the well bore to which it is desired to be inserted, it is then moved upwardly until the beveled upper ends 125*b* at the upper outer ends of the dogs engage a downwardly facing shoulder S–2 in the flow conductor, whereupon further upward movement of the mandrel 111 with respect to the dogs will move the control sleeve 118 downwardly, camming the hooks 122 at the lower ends of the spring or collet fingers outwardly to pass the flange 133 and move the hooks below the lower shoulder surface 134 of the flange. In this position, upward movement of the control sleeve 118 is prevented by the engagement of right-angle upper surfaces 124 the hooks with the shoulder 134, but the control sleeve may move downwardly to permit the dogs 125 to move below the expander surface 130 into the lower retracting recess 145 above the shoulder 133, and so move to retracted position to permit the locator device to pass upwardly through the restriction in the flow conductor above the downwardly facing shoulder S–2 in the conductor. The operation of the locator device 110 is otherwise identical to that of the form first described.

A further modified form of the invention is shown in FIGS. 10 and 11, wherein the locating device 210 has an elongate mandrel 211 provided at its upper end with coupler member 214 threaded onto a reduced pin at the upper end of the mandrel, by means of which the device may be connected to the coupling element 16 of the pumpdown equipment in the same manner as the form of FIG. 1. Of course, rather than the coupler member 214 a suitable wire line connector sub such as the connector sub 14*b* of FIG. 2 may be threaded onto the upper end of the mandrel for operation of the device by flexible line mechanisms. The control sleeve 218 carries locator and stop dogs 225 which are in all respects identical to the dogs 25 of the form first described and which are slidable in lateral apertures 221 formed in the enlarged portion 219 of the control sleeve. A reduced depending tubular boss 219*a* projects from the lower end of the control member and a lower helical coil spring 239 surrounds the boss and is confined between the shoulder at the lower end of the enlarged portion 219 of the control member and an upwardly facing shoulder 240 above the point or head 247 on the lower end of the mandrel. This mandrel is not shown as provided with a longitudinal flow bore, but such a bore may be provided if desired.

The reduced tubular upper portion 220 of the control member 218 projects upwardly above the enlarged portion 219 and an upper helical coil spring 237 surrounds the reduced portion and abuts against an upwardly facing shoulder 236 between the enlarged portion 219 and the reduced upper portion 220 and is confined between such upwardly facing shoulder and the downwardly facing shoulder 214*a* of the coupler member or upper mandrel section 214, so biases the control sleeve 218 downwardly relative to the mandrel. An elongate longitudinal slot 222 is formed in the large portion of the control sleeve between the dogs 225 and a shear pin 223 is inserted in above 224 in the cylindrical expander section 230 of the mandrel and limits downward movement of the control sleeve on the mandrel, while permitting upward movement of the sleeve relative to the mandrel to the length of the slot. A plunger or latch member 250 is slidable in a diametrically extending bore or aperture 251 formed in the upper reduced portion 213 of the mandrel above the expander portion 230 and is biased outwardly by means of a helical coil spring 252 confined between the bottom of the bore and the inner end of the latch plunger. A retaining pin 253 is positioned transversely of the lower portion of the aperture or bore 251 and engages a relieved key way 254 formed in the lower surface of the plunger to limit outward movement of the plunger in the bore and to retain the plunger in place in the bore. The upper outer end edge of the plunger is beveled to provide a camming surface 225 for engaging the downwardly facing inwardly and upwardly inclined cam surface 235 of the internal annular flange 233 formed in the bore of the reduced upper portion of the control sleeve. The shoulder 234 at the upper end of the flange extends inwardly at substantially right angles to the bore and provides an abrupt locking surface against which the lower projecting outer end surface of the plunger 250 may engage, as will be explained.

An annular retracting recess 245 is formed in the medial portion of the cylindrical expander section 230 of the mandrel 211 and the lower portion 230*a* of the expander surface provides a guide for the control sleeve 218 as it moves downwardly on the mandrel until its lower end engages the upwardly facing shoulder 246*a* at the upper end of the lower cylindrical portion 246 of the mandrel.

In use, the device operates in the same manner as the forms previously described. Upon encountering upwardly facing shoulders S–1 in the flow conductor the beveled lower outer surfaces 225*a* of the dogs 225 will move the control sleeve upwardly against the spring 237 until the dogs are positioned above the shoulder 232 at the upper end of the cylindrical expander surface 230, where the dogs may move inwardly to retracted position in the retraction recess area 31*a*, to pass restrictions in the well conductor, such as flanges or the like. When the device has reached the position at which it is desired to reverse the direction of motion of the tool in the flow conductor, it is moved in the opposite direction in the conductor, toward the surface, and the upper beveled shoulders 225*b* of the dogs 225 will engage the next above downwardly facing shoulder S–2 in the conductor and move the control sleeve 218 downwardly, shearing the pin 233 as shown in FIG. 11, and moving the sleeve sufficiently downwardly to move the internal annular flange 233 below the latch plunger 250. The plunger is thus disposed above the upwardly facing abrupt shoulder 234 on the flange and the control sleeve 218 cannot move upwardly thereafter, so that when the device is moved downwardly in the well in the first direction of movement, the locking dogs will engage the upwardly facing shoulders S–1 in the flow conductor to accurately locate the shoulders and to stop or prevent further downward movement of the device, and so located the tool with respect to the shoulder in the same manner as the tool of the form first described. However, it will readily be seen that upon further upward movement of the tool in the opposite direction, the upper beveled surfaces 225*b* of the dogs will engage the downwardly facing shoulders S–2 in the conductor to move the control sleeve 218 downwardly against the force of the lower spring 239 until the dogs are in registry with the retraction recess 245 formed in the expander surface of the mandrel, where the dogs may move inwardly to retracted position to permit the tool to pass the shoulder and any restriction thereabove. It will therefore be seen that the device functions in the same manner as the devices previously described.

Of course, if desired, the latch plunger 250 may be replaced by an expansible annular snap or lockring of a diameter sufficiently smaller than the bore 220*a* of the upper portion 220 of the control sleeve 218 to permit the sleeve to move freely with

respect thereto, but which will interfere with and engage the upwardly facing shoulder 234 of the internal annular flange 233 in the control sleeve to positively hold the sleeve against upward movement after the sleeve and the locating and stop dogs have been moved to the lower position shown in FIG. 11. It is also believed to be clearly apparent that other latching means may be provided than those just described. In the case of the spring snap ring being used as a latch member, the mandrel may be provided with an axial bore for flow therethrough.

A combination locating device and well tool running or setting tool is illustrated in FIG. 12. The locating device 310 has a setting tool 360 formed integral with the lower portion of the mandrel 311 of the locating device. The setting tool comprises an elongate tubular sleeve 361 having an inwardly and upwardly inclined downwardly facing stop shoulder 362 at the upper end of its bore 363 the lower portion of which is enlarged to a point spaced slightly below the shoulder 362. An upper shear pin bore 364 receives a shear pin 365 which is disposed to engage and support an upper movable member of a well tool T which is to be set by means of the device. A lower shear pin bore 366 is provided in the lower portion of the sleeve for receiving a lower shear pin 367 for connecting the sleeve to the body of the well tool which is to be anchored by means of the setting tool. An elongate plunger 368 having an enlarged head 369 on its lower end is slidable in the bore 348 of the mandrel 311 of the locator tool, and the upper end of the plunger 368 is connected by threads to the coupler member 314 in the same manner as was the coupler of the locator device first described. An upper helical coil spring 338 abuts the downwardly facing shoulder 314*a* of the coupler member and rides against a follower ring 337 which engages the upper hook ends 322 of the spring or collet fingers 320 of the control sleeve 318 which carries locating and stop dogs 325 slidable in radial slots 321 formed in the enlarged portion 319 of the sleeve. The spring 338 biases the control sleeve downwardly to the position shown in FIG. 12 wherein dogs are in engagement with the upper cylindrical expander surface 330 of the lower section 312 of the mandrel 311, and are so held in expanded locating position. The hook members 322 at the upper ends of the spring fingers 320 engage over an external annular flange 333 formed on the upper section 313 of the mandrel, so that downward movement of the control sleeve member 318 is yieldably limited by the engagement of the hooks with the flange. A lower helical coil spring 339 is confined between an upwardly facing shoulder 340 on the lower end of the lower mandrel section 312 and the lower end of the enlarged portion 319 of the control member, and so acts to bias the control sleeve member upwardly on the mandrel.

The locator device is lowered into the well flow conductor in the usual manner, the dogs 325 moving the control sleeve member 318 upwardly as the device passes inwardly projecting upwardly facing shoulders in the bore of the well flow conductor C. When the device has reached the desired position, the locator tool and running tool are moved upwardly in the opposite direction in the well flow conductor until the cam surfaces 325*b* at the upper outer ends of the dogs engage the downwardly facing shoulder S–2 at that location and move the control sleeve 18 downwardly, the hooks 322 at the upper end of the spring fingers 320 camming outwardly over the flange 333 to permit the control sleeve to move downwardly until the hooks are disposed below the downwardly facing shoulder 334 of the flange. Upward movement of the control sleeve and the dogs is then prevented when the hooks at the upper ends of the fingers engage the downwardly facing shoulder 334. The dogs, of course, may move downwardly and inwardly as they pass the downwardly facing shoulders S–2 until they enter and pass through the restriction thereabove, whereupon the lower spring 339 will bias the control sleeve upwardly to move the dogs into engagement wit the expander surface 330, which holds the dogs in locating and stopping position on the mandrel. Subsequent movement of the mandrel in the first downward direction in the well flow conductor will then bring the lower beveled outer surfaces 325*a* of the dogs into engagement with the upwardly facing shoulder S–1 at the desired position, and downward movement of the locator device is positively stopped by such engagement since the control sleeve 318 cannot move upwardly because of the engagement of the upper ends of the hook portions 322 of the spring fingers with the downwardly facing shoulder 334 of the external annular flange 333 on the mandrel. This engagement of the dogs with the desired upwardly facing shoulder S–1 locates the running tool 360 with respect to that shoulder, and so locates the well tool T at a predetermined position with respect to the shoulder engaged by the dogs.

Downward force applied to the plunger 368 will then move the enlarged head 369 downwardly and force the upper movable portion or slip carrier 371 of the well tool T downwardly relative to the lower body portion 372 of the well tool and shear the upper shear pin 365 to permit such movement. The lower shear pin 367 holds the body portion 372 against movement while the upper portion is moved downwardly. Locking members (not shown) on the well tool are then moved to expanded locking position in the usual manner, and the well tool is thus locked in the flow conductor at a point therein predetermined by the position of the desired upwardly facing shoulder S–1 engaged by the dogs 325. After the well tool has been locked in place in conductor, the combined locator tool and setting tool are moved upwardly in the opposite direction, and such upward movement will shear the lower shear pin 367 to free the setting tool sleeve 361 from connection with the well tool T and permit the setting tool and locator device to be moved upwardly out of the well flow conductor away from the anchored well tool T.

The combined locator device and setting tool therefore provides means for positively positioning a well device at a predetermined location in a well flow conductor with respect to the upwardly facing shoulder S–1 selected for use, and also provides means for effecting operation for the setting tool 360 for locking the well tool in place at such location.

In FIG. 13, a modified form of setting tool 460 is shown connected with the locator device 410 which is generally identical to the locator device 310 just described. All elements of the locator device are the same as those of the form just described, but the lower mandrel section 412 has a tubular reduced depending setting tool body portion 461 extending downwardly from the lower end thereof and this body portion 461 is further reduced to provide supporting stem or shank 465 at its extreme lower end having a boss or head member 466 screw threaded into a bore 467 in the lower end of the shank. The head member has an enlarged annular flange locking surface 468 which is engaged by the depending collet or detent fingers 470 of a collet support or detent connector sleeve member 471 which is slidable on the lower reduced shank 465 of the setting tool. The connector sleeve 471 is held against movement on the shank by a shear pin 472 which extends through a transverse diametrical opening 473 in the shank and matching openings 475 in the upper end of the collet sleeve. Thus, the collet sleeve 471 is held in the upper position on the shank, shown in FIG. 13, with the external bosses 480 at the lower ends of the spring fingers 470 of the collet sleeve positively held in expanded supporting position, for a purpose which will be hereinafter more fully explained.

The setting tool body portion 461 is provided with a pair of diametrically opposed elongate longitudinally extending slots 463, and an elongate transverse connecting pin 484 extends through a diametrical aperture 485 in the lower end of the elongate stem 487 which is slidably mounted in the bore of the mandrel 411 and extends downwardly into the bore 462 of the setting tool body. A drive ring 488 is slidable on the outer cylindrical surface of the setting tool body 461 and is secured to the lower end of the stem by the engagement of the opposite ends of the pin in diametrically opposed openings 486 in the drive ring, so the drive ring is movable with the stem 487 for setting a well tool as will be hereinafter more fully explained. The upper end of the stem 487 is threaded into the reduced lower shank or stem portion 417 of the coupler or

upper mandrel section 414 which has a socket 416 for receiving the connector coupler member 16 of the pumpdown operating tool mechanism. The upper helical coil spring 438 engages the downwardly facing shoulder 414*a* at the lower end of the coupling member and presses downwardly on the spring follower ring 437 which biases the control sleeve 418 downwardly in the same manner as the control sleeve of the locator device just described. The dogs 425 also function in the same manner, being held in expanded position by the expander surface 430 until they engage an upwardly facing shoulder S–1 to move the control sleeve upwardly against the force of the spring to permit the dogs to retract against the outer cylindrical portion 413 of the central mandrel section 413 to pass the shoulder in the manner already described. The lower helical coil spring 439 is confined between the lower end 419*a* of the control sleeve and the upwardly facing shoulder 440 of the lower mandrel section 412.

The locator device and setting tool combination of this form is adapted to be used with a landing nipple or receptacle N–1 and a well tool T–2 comprising a locking assembly L–1 and a sealing mandrel assembly P–1, which may be used to support a well flow control N or other device, as shown in FIGS. 14–A and 14–B.

The landing nipple N–1 comprises an elongate tubular body or housing 500 having external threads at its opposite ends by means of which it may be connected by couplings 501 in the flow conductor C. As shown in FIG. 14–A, the body has an upwardly facing stop shoulder 502 at the upper end of its bore 504 for engagement by the locating and stop dogs 425 of the locator device 410 to position the locking device L–1 in proper position in the landing nipple N–1 to be anchored and locked therein. Spaced a predetermined distance from the upper shoulder in the bore of the landing nipple is an internal annular locking recess 505 which has opposed divergent shoulders 506*a* and 506*b* at its ends between which the locking dogs of the locking device L–1 are adapted to be expanded to hold the well tool securely positioned in the landing nipple. Below the internal annular locking recess 505 the bore of the nipple provides an elongate internal cylindrical sealing surface which is adapted to be engaged by the sealing assembly P–1 to direct fluids flowing through the flow conductor into and through the bore of the mandrel and into the conductor thereabove in the usual manner. The position of the annular locking recess 505 in the bore of the landing nipple below the upwardly facing stop shoulder 502 at the upper end thereof is such that when the dogs 425 of the locator device 410 are engaged with said stop shoulder, the locking dogs of the locking device L–1 are disposed in registry with the locking recess 505 in position to be expanded into locking engagement in the recess, as shown in FIGS. 15 and 17.

The locking assembly or device L–1 includes an elongate tubular mandrel 530 having its upper cylindrical portion reduced in external diameter to provide a neck 534 on which a plurality of locking dogs 535 are supported by means of a cylindrical supporting or dog carrying sleeve 536 threaded at its lower end 536*a* onto the enlarged lower portion 530*a* of the mandrel 530 below the neck 534. The upper portion of the bore of the dog-supporting sleeve is enlarged to provide an elongate internal annular recess 537 having an inwardly projecting annular stop flange 537*a* formed in the medial portion of said recess. The locking dogs 535 have handles 535*a* which extend upwardly in the bore of the dog-carrying sleeve 536 and have a pair of longitudinally spaced outwardly projecting lugs or bosses 539*a* and 539*b* formed on their upper ends and engaging in the elongate recess 537 on opposite sides of the flanges 537*a* for retaining and supporting the dogs pivotally at their upper ends by means of such engagement of the internal projecting flange and the external bosses on the handles of the dogs. The inner surfaces 535*b* of the dogs are inclined inwardly and upwardly from adjacent the lower boss upwardly to a point near the lugs in the upper ends of the dogs to permit the dog handles to pivot in the annular space between the neck 534 of the mandrel and the bore of the slip-carrying sleeve 536 at the recess 537.

An expander sleeve 545 is slidable on the neck 534 of the mandrel and has its lower portion longitudinally slotted as at 545*a* to straddle and slide longitudinally along the dog handles 535*a* and provide a plurality of expander legs 546 having expander bosses or locking surfaces 547 at their lower ends adapted to engage the inwardly facing lock surfaces or portions 535*c* at the back of the bosses 535*e* of the lock dogs 535 to hold the lock dogs in the expanded position shown in FIGS. 15 and 17, when the expander sleeve is moved downwardly relative to the dog carrier 536 to move the expander bosses into engagement with the inner lock surfaces 535*c* of the dogs on either side of the handles of the dogs. The structure of the expander sleeve and the locking dogs is clearly illustrated in FIGS. 16, 18 and 19, and in the patent to Tamplen, U.S. Pat. No. 3,207,222. The locking dogs are thus held positively, by the locking surfaces 547 of the legs 546 of the expander sleeve, in the expanded locking position shown in FIGS. 15 and 17 to prevent displacement of the mandrel in either longitudinal direction from the bore of the landing nipple N–1.

The expander sleeve 545 is held in the upper position shown in FIG. 14–A by means of at least one shear pin 549 extending through a suitable aperture 549*a* in the upper end of the dog carrying sleeve above the recess 537 and engaging in a registering aperture 549*b* formed in one of the legs of the expander sleeve 545, whereby the expander sleeve is positively held against downward movement with respect to the locking dogs 535 until the shear pin 549 has been sheared, as will be hereinafter explained. A knuckle joint assembly 533 joins the locking mandrel device L–1 to the sealing mandrel device P–1. The knuckle joint assembly comprises a tubular ball knuckle member 555 having a spherical ball segment 566 at its upper end. The ball segment is seated upon a plurality of circumferentially spaced pads or bushings 557 which are confined within a thimble sleeve member 558 threaded on the reduced lower end of the mandrel 530 of the lock assembly L–1 below the slip carrier sleeve 536. The thimble sleeve 558 is locked in place in any suitable manner on the threaded lower end of the mandrel to prevent displacement of the thimble from the mandrel and to provide a positive connection between the locking assembly L–1 and the sealing assembly P–1. The lower end portion or skirt 554 of the tubular ball knuckle member 555 is threaded onto the upper end of a tubular packing mandrel 560 of the sealing assembly P–1.

A pair of opposed sets of a plurality of sealing rings 562 are mounted on the reduced upper portion 561 of the mandrel 560, the sealing rings being shown to be of V-type rings with the opposed sets disposed on opposite sides of a central spacer 563 and supported between backup rings 564 at the upper and lower ends of the sets of sealing rings. The backup rings are confined between the lower end of skirt 554 of the knuckle member 555 at the upper end of the packing mandrel and an upwardly facing shoulder 565 at the upper end of an external annular flange 566 formed at the lower end of the packing mandrel. The tubular packing mandrel receives in the threaded lower end 567 of its bore the threaded reduced upper end of a well flow control device or other well device W. The well device may be a safety valve, a flow regulator, or any other desired suitable flow controlling device or well tool adapted for use in the well flow conductor and to be anchored at the location of the landing nipple N–1.

The locking mandrel assembly L–and the sealing mandrel assembly P–1 are run into the well flow conductor C by means of the combination setting tool 460 and locator device 410 of FIG. 13, which is reproduced in FIG. 4–A showing the setting tool connected to the mandrel of the locking device L–1. The neck 534 of mandrel 530 of the locking device has an internal annular groove 570 formed therein near its upper end, and the bosses 480 of the collet supporting sleeve 471 of the running tool are disposed in said recess and engage the downwardly facing shoulder 571 at the upper end of the recess to support the mandrel for lowering into the well flow conductor. The length of the body portion 461 and the shank 465 of the setting tool is such that the shoulder 488*a* formed by the lower end of the annular setting ring 488 of the setting tool is

disposed closely adjacent the upper end of the expander sleeve **545** when the collet bosses **480** are engaged in the mandrel recess **570**, as shown in FIG. **14**–A. The bore of the expander sleeve has an internal annular recess **580** formed therein having a downwardly facing shoulder **581** at its upper end which is used for retrieving the tool in the manner to be hereinafter described. The expander member **545** is held in the upper position shown in FIG. **14**–A by means of the shear pin **549**.

When the combined setting tool and locator device has been lowered into the well flow conductor C to a position below the landing nipple N–**1**, so that the locating and stop dogs **425** of the locator device are disposed below the downwardly facing shoulder **507** at the lower end of the tubular housing **500** of the landing nipple N–**1**, the motion of the tools is reversed and the locator device is moved upwardly in the opposite direction to bring the upwardly facing surfaces **425***b* of the dogs **425** into engagement with the downwardly facing shoulder and move the control sleeve **418** of the locator device downwardly to the position shown in FIG. **14**–A. The control sleeve is now prevented from moving upwardly by the engagement of the hooks **422** with the downwardly facing shoulder **434** of the flange **433** on the locator mandrel. After the string of tools has moved upwardly until the dogs **425** have passed above the upwardly facing shoulder **502** at the upper end of the bore of the landing nipple N–**1**, the string of tools is again lowered in the first direction in the well until the downwardly facing lower beveled outer edge surfaces **425***a* of the dogs engage the upwardly facing shoulder **502** and stop further downward movement of the string of tools with respect to the nipple. Engagement of the dogs with the shoulder **502** therefore positions and locates the well locking device L–**1** of the assembly in a position in which the bosses **535***e* of the locking dogs **535** of the locking device are in registry with the locking recess **505** in the landing nipple and in a position to be expanded into locking engagement in said recess. Also, the sealing mandrel assembly P–**1** is disposed in the sealing section of the bore **504** of the landing nipple below the locking recess **505** in position to seal therewith, in the usual manner.

Downward force applied to the stem **487** of the setting tool moves the transverse connecting pin **484** downwardly with respect to the body **461** of the setting tool and moves the setting ring **488** downwardly on the exterior of such body portion **461** of the setting tool. Such downward movement of the setting ring **488** moves the expander sleeve **545** downwardly and shears the pin **549** to permit the sleeve to be moved completely downwardly to expand the dogs **535** to the locking position shown in FIGS. **15** and **17** by moving the expander surfaces **547** of the locking sleeve into engagement with the inner locking surfaces **535***c* of the dogs to hold the dogs in such expanded position.

Since there is no connection between the setting tool and the expander sleeve **545**, the locking device L–**1** is now securely locked in place in the landing nipple N–**1** against movement in either longitudinal direction, the upper ends of the bosses of the locking dogs **535** being engageable with the downwardly facing shoulder **506***a* of the locking recess **505** and the lower ends of the bosses being engageable with the upwardly facing shoulder **506***b* at the lower end of the recess, to positively prevent displacement of the locking device in either direction from the landing nipple.

With the locking device so positively locked in place in the landing nipple, upward force is applied to the locator device and setting tool by the pumpdown fluid operator mechanism to move the lower reduced shank or stem portion **465** of the setting tool upwardly with respect to the collet sleeve **471** and shear the shear pin **472**. When the shear pin is sheared, the collet sleeve **471** is moved downwardly on the mandrel until the internal annular shoulder **476** in the upper end of the bore of the sleeve engages the upwardly facing shoulder **468***a* at the upper end of the expander surface **468** on the head member **466** at the lower end of the reduced shank of the setting tool. Such engagement prevents further downward movement of the collet sleeve **471**, but moves the spring fingers **470** downwardly to project below the expander surface **468** where the fingers may flex inwardly at their lower ends to permit the bosses **480** to pass the shoulder **571** at the upper end of the recess **570** in the mandrel neck **534**, as shown in FIG. **17**, to disconnect the setting tool from the locking mandrel assembly. The setting tool and locator device may then be moved upwardly in the well flow conductor out of the well bore.

A suitable retrieving tool of the usual type (not shown) may be lowered into the well by means of the pumpdown operator mechanism to engage in the annular recess **580** in the expander sleeve beneath the downwardly facing shoulder **581** at the upper end of said recess. An upward force applied to the expander sleeve by means of the operator mechanism and the retrieving tool in the usual manner will then move the expander sleeve **545** upwardly to withdraw the expander surfaces or lock surfaces **547** at the lower end of the expander sleeve from engagement with the lock surfaces **535***c* of the locking dogs **535**. A continued upper pull will cause the bosses **535***e* of the locking dogs **535** to cam inwardly along the downwardly facing beveled shoulder **506***a* at the upper end of the locking recess in the landing nipple to retracted position and thus permit the entire assembly of locking device, sealing mandrel assembly and well tool to be moved upwardly out of the well flow conductor in the usual manner.

It will therefore be seen that the combination locator device and setting tool provides means for positively and accurately positioning a well tool at a desired position within the well bore as, in this case, in the landing nipple N–**1** with the locking dogs thereof disposed in registry with the locking recess in the landing nipple in position to be expanded into locking engagement in said recess to positively lock the locking mandrel device against movement in either direction in the landing nipple.

The locator device of the invention may also be used to operate a lateral port sliding sleeve valve **700** having a tubular housing or body **701** threadedly connected at its upper end to the flow conductor C and provided with a bore **702** which is enlarged below a shoulder **703** formed in the upper end of the bore to limit upward movement of a sliding sleeve member **705** in the housing. A stop bushing or sub **708** is threaded into the lower end of the housing to limit downward movement of the sleeve **705** in the housing, and the other end of the sub may be connected to the flow conductor. A lateral flow port **710** is formed in the wall of the housing intermediate its ends and a complementary port **715** is formed in the wall of the sleeve **705** at a point at which it will be in longitudinal registry with an internal annular recess **711** in the bore of the housing **701** which communicates with the lateral port **710** in the housing, to assure passage of fluids from the port **715** in the sleeve to the port **710** in the housing when the lower end **706** of the sleeve is in engagement with the upper end of the bushing **708**. O-ring seals **716** and **717** are disposed in suitable internal annular recesses in the bore of the housing **701** above and below, respectively, the recess **711**, and these O-rings seal against the external cylindrical surface of the sliding sleeve **705**. When the sleeve is in the upper position shown in FIG. **20**, the lateral ports are closed. When the sleeve is moved downwardly to position the port **715** in the sleeve in registry with the annular recess **711** in the housing, the ports are open to flow therethrough.

The locator device **10** of FIGS. **1** through **7** is adapted to be used to shift the sleeve **705** from the upper closed position to the lower open position. The locator device is moved downwardly below the sleeve until the locator and stop dogs **25** thereof are disposed below the lower end **706** of the sliding sleeve. Upward movement of the locator device then moves the dogs upwardly to engage the lower end of the sleeve and move the control sleeve **18** downwardly on the mandrel **11** to move the hook members **22** at the upper ends of the spring collet fingers **20** below the external annular flange **33** on the mandrel in the manner already described. The tool is moved

further upwardly and the dogs cam inwardly into the retracting recess 45 and will then pass through the bore 718 of the sleeve 705 and upwardly therepast to a point above the upper end of the sleeve. Reverse motion of the locator device downwardly in the well in the first direction of movement will then move the beveled surfaces 25*a* at the lower outer ends of the dogs into engagement with the upper end of the sleeve to move the sleeve downwardly from the upper closed position shown in FIG. 20 to the open position in which the lower end 706 of the sleeve engages the upper end of the bushing 708 and the port 715 in the sleeve is in registry with the annular recess 711 and the lateral port 710 in the housing. Flow may then take place through the ports. The locator device may be moved upwardly in the opposite direction out of the flow conductor or to a position above another lateral port slidable sleeve valve for opening such valve in the same manner.

From the foregoing, it will be seen that a locator device has been provided which is capable of locating the position of downwardly facing shoulders in a well flow conductor during movement of the locator device into the conductor and of locating upwardly facing shoulders in the conductor during movement of the device in the opposite direction upwardly out of the well bore. It will also be seen that the locator device is constructed to provide a positive stop limiting or preventing downward movement of the locator device past any selected one of a plurality of upwardly facing shoulders in a well bore to position well tools in the flow conductor in which the shoulders are present at a particular point predetermined by the position of the desired shoulder.

Also, it will be seen that a combined locator device and setting tool has been provided for locating and setting well tools in a well flow conductor at predetermined positions with respect to an upwardly facing shoulder in said flow conductor. It will further be seen that the locator device and setting tool is adapted for use with a landing nipple having a locating stop shoulder formed thereon and an annular locking recess therein, for positioning the locking device of a well tool in proper registry with said annular locking recess for locking the well device in the landing nipple; and, that the locator device may be used for so locating and locking the well device in any one of a plurality of longitudinally spaced identical landing nipples in the flow conductor.

It will also be seen that the locator device is usable for engaging movable shoulders in a well flow conductor to perform operations thereupon, such as shifting a sliding sleeve side port valve between closed and open positions or between open and closed positions in the well flow conductor.

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 locator device including: an elongate mandrel; a control sleeve slidable on said mandrel; expansible and retractable locator and stop dogs carried by said control sleeve; an expander surface on said mandrel engageable with said dogs for moving said dogs to expanded locating and stopping positions; coengageable means on said mandrel and said control sleeve for restraining movement of said control sleeve in one direction longitudinally of said mandrel to position said dogs in expanded engagement with said expander surface and yieldable to permit movement of said control sleeve further in such direction on said mandrel to disengage said dogs from said expander surface; and means on said mandrel and said control sleeve coengageable to prevent movement of said control sleeve in the opposite direction on said mandrel to hold said locator and stop dogs in engagement with the expander surface on the mandrel in expanded position to provide a positive stop.

2. A locator device including: an elongate mandrel; a control sleeve slidable on said mandrel; expansible and retractable locator and stop dogs carried by said control sleeve; an expander surface on said mandrel engageable with said dogs for moving said dogs to expanded locating and stopping positions; coengageable restraining means on said mandrel and control sleeve for restraining movement of said control sleeve on said mandrel in one direction longitudinally thereof at a point at which the locator and stop dogs are in engagement with said expander surface, said control sleeve being yieldably movable in the direction opposite said one direction from said first position to disengage said dogs from said expander surface and biased to return to said first position; said restraining means being yieldable to permit movement of said control sleeve and dogs in such one direction on the mandrel past said first position to a second position in which said locator and stop dogs engage said expander surface; and stop means on said mandrel and said control sleeve coengageable to prevent movement of said control sleeve in said opposite direction on said mandrel past said second position to hold said locator and stop dogs in engagement with the expander surface on the mandrel in expanded position to provide a positive stop by means of said dogs; said control sleeve being yieldably movable in said one direction on said mandrel from said second position after having been moved to said second position.

3. A locator device including: an elongate mandrel; a control sleeve slidable on said mandrel; expansible and retractable locator and stop dogs carried by said control sleeve; expander means on said mandrel engageable by said dogs for moving said dogs to expanded locating and stopping positions; coengageable restraining means on said mandrel and said control sleeve for restraining movement of said control sleeve in one direction longitudinally of said mandrel past a first position in which said dogs are in engagement with said expander surface; biasing means on said mandrel engaging said control sleeve resiliently biasing said control sleeve to said first position and yieldable to permit said control sleeve to move away from said first position to move the dogs in the opposite direction out of engagement with the expander surface; said restraining means being yieldable to permit movement of said control sleeve further in said one direction past said first position to a second position wherein the said dogs engage said expander surface and are held in expanded position thereby; second biasing means on the mandrel engaging the control means resiliently biasing said control means in said opposite direction on said mandrel toward such second position and yieldable to permit said control sleeve to move the dogs in said one direction out of engagement with the expander surface; and stop means on said control sleeve and on said mandrel coengageable to prevent movement of said control sleeve in said opposite direction on said mandrel past said second position to hold said locator and stop dogs in engagement with the expander surface on the mandrel.

4. A locator device of the character set forth in claim 2 wherein said restraining means comprises: an external annular flange on the mandrel intermediate the ends thereof; and elongate spring fingers on said control sleeve having inwardly extending hook members on their ends having cam surfaces on one side engageable with the flange on the mandrel for restraining movement of said control sleeve in said one direction on the mandrel, said hook members having abrupt shoulders on their other sides engageable with an abrupt shoulder on the external annular flange to prevent movement of said control sleeve in said opposite direction on said mandrel.

5. A device of the character set forth in claim 2 wherein said biasing means comprises: springs confined on the mandrel between a shoulder thereon at one end and the control sleeve at the other end; said springs engaging opposite ends of said control means and each biasing the control means toward the other spring.

6. A locator device of the character set forth in claim 2 wherein said control sleeve is provided with a plurality of circumferentially spaced radially extending apertures; said locator and stop dogs have retainer flanges on their inner ends en-

gageable with the inner ends of the apertures in the sleeve, and have converging beveled surfaces on their upper and lower outer ends; and said mandrel is provided with retracting recesses on opposite longitudinal sides of the expander surface.

7. A locator device including: an elongate mandrel; an annular expander surface intermediate the ends of said mandrel; annular recess means at each end of said locking surface having a diameter smaller than that of the locking surface; a control sleeve slidable on said mandrel; a plurality of locator and stop dogs carried by said sleeve and engageable with said expander surface to be held in projected locating position by said expander surface; said control sleeve being movable longitudinally on said mandrel to dispose said dogs in registry with a first one of said recesses to permit said dogs to be moved to retracted position; resilient means biasing said sleeve in one direction on said mandrel toward a first position on said mandrel in which said dogs are disposed in engagement with said expander surface; yieldable retaining means on said sleeve and on said mandrel coengageable to yieldably prevent further movement of said sleeve in said one direction from said first position with said dogs in engagement with said expander surface; said resilient means permitting movement of said sleeve and dogs longitudinally in said opposite direction on said mandrel to align said dogs with said first recess; said restraining means being yieldable upon application of a predetermined longitudinal force to said dogs and said sleeve to move said sleeve further longitudinally in said one direction on said mandrel to disengage said restraining means and to dispose said dogs in alignment with said second recess for movement to retracted position; and stop means on said sleeve and said mandrel coengageable upon subsequent movement of said sleeve and dogs in said opposite direction on said mandrel to stop said sleeve and dogs in a second position thereon in which the dogs are in engagement with said expander surface and held in expanded locating position and second resilient means biasing said sleeve and said dogs in said opposite direction toward said second position on said mandrel, said resilient means being yieldable to permit said sleeve and said dogs to move longitudinally in said one direction on said mandrel to align said dogs with said second recess, whereby said dogs are retractable from said expanded location position; said sleeve and said dogs when in said second position provide a positive stop means against movement of said mandrel with said sleeve and said dogs in said expanded position in said one direction axially of said mandrel.

8. For use in combination with a tubular landing nipple adapted to form part of a well flow conductor and having a stop shoulder thereon and an annular locking groove in the bore wall thereof intermediate its ends, and a well tool anchoring device insertable through the well flow conductor into said landing nipple and having a mandrel, radially expansible and contractable locking members, and means for expanding said locking members into expanded position into the locking groove in the landing nipple, a locator and setting tool device for inserting said anchoring device into the well flow conductor, locating the same at the landing nipple and anchoring the same in place in the landing nipple and comprising: setting tool and locator means having support means for attachment to the mandrel of the anchoring device; expansible and retractable locator means adapted to engage said stop shoulder on the landing nipple to position the locking members of the anchoring device in registry with the landing nipple locking recess; means on the setting tool movable with respect to the mandrel of the anchoring device to move the expander means on said mandrel into expanding engagement with the locking members to move the same into expanded position engaged in the locking recess of the landing nipple while said support means is connected to said locking device and said locator means is engaged with said stop shoulder to positively lock the mandrel of the locking device against movement in either longitudinal direction in the nipple; and means for releasing the connection of the support means with the mandrel of the locking device only after said locking device has been locked in said nipple to permit the setting tool and locator device to be moved from the flow conductor after the anchoring device has been anchored in the landing nipple.

9. For use in combination with a tubular landing nipple adapted to form part of a well flow conductor and having a stop shoulder thereon and an annular locking groove in the bore wall thereof intermediate its ends, and a well tool anchoring device insertable through the well flow conductor into said landing nipple and having a mandrel, radially expansible and contractable locking members, and means for expanding said locking members into expanded position into the locking groove in the landing nipple, a locator and setting tool device for inserting said anchoring device into the well flow conductor, locating the same at the landing nipple and anchoring the same in place in the landing nipple and comprising: an elongate mandrel; a control sleeve slidable on said mandrel; expansible and retractable locator and stop dogs carried by said control sleeve; an expander surface on said mandrel engageable with said dogs for moving said dogs to expanded locating and stopping positions; coengageable restraining means on said mandrel and control sleeve for restraining movement of said control sleeve on said mandrel in one direction longitudinally thereof at a point at which the locator and stop dogs are in engagement with said expander surface, said control sleeve being yieldably movable in the direction opposite said one direction from said first position and biased to return to said first position; said restraining means being yieldable to permit movement of said control sleeve and dogs in such one direction on the mandrel past said first position to a second position in which said locator and stop dogs engage said expander surface; and stop means on said mandrel and said control sleeve coengageable to prevent movement of said control sleeve in said opposite direction on said mandrel past said second position to hold said locator and stop dogs in engagement with the expander surface on the mandrel to provide a positive stop by means of said dogs; said control sleeve being yieldably movable in said one direction on said mandrel from said second position after having been moved to said second position, said locator and stop dogs when in said second position being engageable with a stop shoulder of said landing nipple to position the locking members of the anchoring device in registry with the landing nipple locking recess; support means on said locator and setting tool device for attachment thereof to the mandrel of the anchoring device for supporting the same in position for the locking members to be moved into the locking recess of the landing nipple when said locator and stop dogs are engaged with the stop shoulder of the landing nipple; means on said locator and setting tool device movable with respect to the mandrel of the anchoring device while the locator and stop dogs are in engagement with the stop shoulder of the landing nipple to move the expander means on said mandrel into expanding engagement with the locking members to move the same into expanded position engaged in the locking recess of the landing nipple to positively lock the mandrel of the locking device against movement in either longitudinal direction in the nipple, and means for releasing the connection of the support means with the mandrel of the locking device to permit the setting tool and locator device to be moved from the flow conductor after the anchoring device has been anchored in the landing nipple.

10. In combination: a tubular landing nipple having an annular internal locking recess in its bore wall and having an upwardly facing locator shoulder spaced from the locking recess; a locking device for supporting well tools in place in said landing nipple and including a mandrel, locking members expansible and retractable on the mandrel, an expander sleeve movable on the mandrel into engagement with the locking members to move said locking members into expanded locking position and positively hold them in such expanded position, and means for connecting a seal member to said mandrel; and a locking and setting tool device for positioning the locking device in the nipple for anchoring therein and including: an

elongate mandrel; means for detachably connecting said locator and setting tool mandrel to the mandrel of the locking device; expansible and retractable locator and stop means on said locator and setting tool mandrel engageable with the upwardly facing locator shoulder of the landing nipple to position the locking device in the nipple with the locking members thereof in registry with the locking recess for expansion into locking engagement in such recess; means on said locator and setting tool device for moving the expander means on the mandrel of the locking device into engagement with the locking members to expand the locking members into the locking recess of the landing nipple and positively hold the locking members in said expanded position in engagement in the locking recess, while said locator and stop means is engaged with said locator shoulder of said nipple and said detachable connecting means is connected to said mandrel, to prevent longitudinal movement of the locking device in either direction out of the landing nipple; said detachable means connecting said locator and setting tool device with the mandrel of the locking device being releasable only by the application of an upward longitudinal force to the locator and setting tool device after the locking members of the locking device have been expanded to locking engagement in the locking recess of the landing nipple to free the locator and setting tool device from the mandrel of the locking device for removal of the locator and setting tool device from the flow conductor.

11. In combination: a subsurface well locking device having a mandrel, expansible and retractable locking members thereon and means for moving the locking members from retracted to expanded position and positively holding said locking members in such expanded position; a landing nipple having means for connecting it in a well flow conductor and having an internal annular recess in its bore wall intermediate its ends for receiving the locking members of the locking device and an annular upwardly facing locator shoulder spaced above said locking recess a predetermined distance; and a locator and setting tool device comprising: means releasably connecting the setting tool means with the mandrel of the locking device; expansible and retractable locator and stop members carried by the locator and setting tool device and movable to a position to engage the upwardly facing shoulder of the landing nipple and spaced from the means for connecting the setting tool to the mandrel of the locking device a distance such that when the locator and stop members of the locator and setting tool device are in engagement with the upwardly facing locator shoulder of the landing nipple the locking dogs are in registry with the locking recess in the nipple and are in position to be expanded into said recess to lock the locking device in place in the nipple; and means on the setting tool engageable with the expanding means on the mandrel for moving said expanding means into engagement with the locking members of the locking device to expand the same into locking engagement in the locking recess in the nipple and to positively hold the same in such position; said means releasably connecting the setting tool and the mandrel of the locking device being releasable only after the locking members of the locking device have been expanded to locking engagement in the locking recess of the landing nipple; said locator and setting tool device being removable from the well flow conductor after said releasable connection between the setting tool means and the mandrel of the locking device has been released after the device has been locked in place in the nipple.

12. A device for releasably anchoring a well tool at a selected level in a well pipe comprising: a setting tool subassembly having means for connecting the same to said well tool; a locator subassembly connected with the setting tool subassembly engageable with a stop shoulder in said well pipe for positioning the setting tool subassembly at a selected level in the well pipe; and connector means on the setting tool subassembly having means for connecting the same to a well tool to support the same in position to be anchored at said selected level while said locator subassembly is engaged with said stop shoulder, releasable from such connection with the well tool by upward movement only after the well tool has been anchored at said selected level in the well pipe.

13. A device of the character set forth in claim 12 wherein the means for connecting the setting tool subassembly to the well tool comprises: resiliently expansible and contractable detent means; expander means for holding said detent means in expanded position; and releasable means holding said detent means in engagement with said expander means and releasable to permit movement of said detent means from expanded position for releasing the setting tool subassembly from the well tool.

14. A device of the character set forth in claim 12 wherein said setting tool subassembly includes operator means for actuating said well tool for anchoring said well tool in said flow conductor while said well tool is held at said selected level in said well pipe by the engagement of said locator subassembly with said stop shoulder and before said setting tool subassembly is released from connection with said well tool after the same has been anchored in said well pipe.

15. A locating device including: an elongate mandrel; a plurality of expansible and retractable locator and stop members mounted on the mandrel for movement laterally between expanded and retracted positions on the mandrel; means for supporting said locator and stop members on the mandrel and movable longitudinally of the mandrel; expander means on the mandrel engageable by the locator and stop members to move the locator and stop means to expanded position; means resiliently holding said carrier means in position longitudinally of the mandrel to dispose the locator and stop members in engagement with the expander surface thereon, said resilient means permitting movement of said support means longitudinally of said mandrel to move said locator and stop members out of engagement with the expander means to permit the members to retract from expanded position; and restraining means on said support member and mandrel engageable to restrain movement of said support means in one longitudinal direction of said mandrel to position the locator and stop members in engagement with expander means on the mandrel, and yieldable to permit further movement of said connectors in said one direction past said expander means; and stop means on the mandrel and support means engageable upon movement of said support means in the opposite longitudinal direction on said mandrel to dispose the locator and stop members in engagement with the expander surface to prevent movement of said support means and to hold said stop members in such engagement with said expander means against movement in said opposite direction past said expander means.

16. A locating device of the character set forth in claim 15 wherein the restraining means on the support member and mandrel comprises: resilient detent means on one of said support member and said mandrel and stop means on the other of said support member and said mandrel.

17. A locating device of the character set forth in claim 15 wherein said restraining means comprises: expansible and retractable member on the mandrel and a shoulder means on the support member engageable by said expansible and contractable member; and cam means on at least one of said expansible and contractable member and said shoulder providing for camming movement of said expansible and contractable member past said shoulder in one direction, said member and said shoulder being engageable to prevent movement of said member past said shoulder in the opposite direction.

18. A locating device of the character set forth in claim 17 and frangible means limiting movement of said support means in a direction which permits camming movement of said expansible and retractable member past said shoulder, said frangible means being yieldable to permit said camming movement.

19. In combination in a well flow conductor: a plurality of landing nipples connected at longitudinally spaced positions in said well flow conductor and each having an annular locking

recess therein and a stop and locating shoulder thereon spaced a predetermined longitudinal distance from said locking recess, and a locator and setting tool device adapted for use in locating and anchoring a well tool locking device having locking members thereon in a selected one of said plurality of landing nipples and comprising: a setting tool subassembly including a body having means thereon for connecting said body with the well tool locking device, and means for moving the locking members of said well tool device to anchoring engagement in the locking recess of the landing nipple; a locator and stop subassembly connected with the setting tool and including an elongate mandrel, a carrier sleeve movable on the mandrel, a plurality of locator and stop members carried by the carrier sleeve and movable therewith longitudinally of the mandrel, expander means on said mandrel engageable with said locator and stop members for moving the same to expanded positions; first resilient means on the mandrel engageable with the carrier sleeve for moving said carrier sleeve longitudinally of the mandrel in one direction to a position in which the locator and stop members are in engagement with the expander means restraining means on the mandrel and carrier sleeve yieldably coengageable to restrain movement of said sleeve in said one direction longitudinally of the mandrel past said expander means, said carrier sleeve being movable in the opposite direction on the mandrel against the force of said first resilient means to move the locator and stop members out of engagement with said expander means to permit said members to retract, whereby the locator and setting tool device may be moved through each of the landing nipples in the flow conductor, said locator and stop members engaging a downwardly facing shoulder on said landing nipple to move said carrier sleeve further in said one direction on the mandrel to pass said yieldable restraining means, whereby the locator and stop members may be moved downwardly on the mandrel below the expander means out of engagement with the expander means to move to retracted position to pass the downwardly facing shoulder, whereby the locator and setting tool device may be moved upwardly through the plurality of landing nipples to a predetermined selected one of said landing nipples to a position in which the locator and stop members of the locator and setting tool device are disposed above the upwardly facing locating and stop shoulder of said selected nipple, means on said mandrel and said supporting sleeve coengageable to stop upward movement of said supporting sleeve in said opposite direction on the mandrel at a position in which the locator and stop members are engaged with the expander means and positively held in expanded position, whereby said locator and expander members will engage said upwardly facing locator and stop shoulder of said selected nipple to position the setting tool sub-assembly with respect to the landing nipple in a position for expanding the locking members of the well tool locking device in place in the locking recess of the landing nipple, and means for releasing said means for connecting the setting tool subassembly with the well tool locking device from connection therewith only after said locking device has been anchored in place in the landing nipple.

20. A locator device for locating the position in the well flow conductor of a plurality of longitudinally spaced upwardly facing shoulders and a plurality of longitudinally spaced downwardly facing shoulders and including: a mandrel; means on one end of said mandrel for attachment thereof to an operating means; a supporting control sleeve slidable longitudinally on said mandrel; means on said mandrel limiting the longitudinal movement of said sleeve on said mandrel; locator and stop dog means carried by said supporting control sleeve and movable radially thereof between expanded and retracted positions; and expander member on said mandrel engageable with said locator and stop dog means for moving said locator and stop dog means to expanded position and holding the same in expanded position; yieldable restraining means on said mandrel and said supporting control sleeve coengageable for positioning said sleeve at a first position on said mandrel wherein said locator and stop dog means are disposed in engagement with said expander means; first biasing means yieldably biasing said supporting control sleeve to said first position and yieldable to permit said sleeve to move upwardly longitudinally of said mandrel to move said locator and stop dog means to a second position on said mandrel out of engagement with said expander means; said locator and stop dog means being engageable with the upwardly facing shoulders in said flow conductor for moving said supporting control sleeve from said first position to the second position in which the dogs are permitted to retract, whereby the dogs may pass the upwardly facing shoulders in the flow conductor, after which said resilient means biasing said supporting control sleeve back to said first position on said mandrel in which the dogs are expanded, whereby the device may be moved upwardly in the flow conductor to engage a downwardly facing shoulder in the conductor to locate the position thereof; said yieldable restraining means restraining said sleeve at said first position on said mandrel while the dogs are in locating engagement with the downwardly facing shoulder; said mandrel being movable upwardly with respect to said supporting control sleeve and said dogs while said dogs are in engagement with said downwardly facing shoulder to move said supporting control sleeve to a third position on said mandrel wherein the dogs are positioned below the expander member on the mandrel in retracted position and may pass the downwardly facing shoulder and through the restriction thereabove; second biasing means on said mandrel engageable with said supporting control sleeve biasing said sleeve to a fourth position on said mandrel wherein said dogs are again disposed in engagement with said expander surface means on said mandrel and held in expanded position; and coengageable means on said mandrel and said supporting control sleeve engageable when said sleeve is in said fourth position to prevent further upward movement of said sleeve on said mandrel and positively retain said dogs in engagement with said expander surface when the tool device is moved downwardly in the flow conductor to engage the dogs with an upwardly facing shoulder in said conductor to provide a positive stop preventing further downward movement of the mandrel, sleeve and dogs in the flow conductor and locating the position of the upwardly facing shoulder in the flow conductor; said device being movable upwardly to engage the expanded dogs with other downwardly facing shoulders in the flow conductor thereabove to move the supporting control sleeve downwardly to said third position in which the dogs are disposed for retraction to pass said downwardly facing shoulder and the restriction in the conductor thereabove, said second biasing means biasing said dogs upwardly to said fourth position upon passing the restriction in the flow conductor.

21. A well tool for use in a well flow conductor having internal annular flanges providing upper and lower stop shoulders therein, comprising: mandrel means; means on said mandrel means for attaching the same to a well string; expansible and contractable locator means on said mandrel engageable with said upper and with said lower stop shoulders in said well flow conductor; means biasing said locator means toward shoulder engaging position; and means associated with said locator means shiftable by a predetermined force applied thereto between a first position wherein said locator means will pass said stop shoulders in a downwardly direction but will lodge against said downwardly facing stop shoulders when encountering the same from below and a second position wherein said locator means will pass said stop shoulders in an upwardly direction but will lodge against said upper stop shoulders when encountering the same from above.

22. A well tool for use in a well flow conductor having an internal flange providing upper and lower stop shoulders comprising: an elongate mandrel; means at the upper end of said mandrel for connecting it to a well tool string; a sleeve disposed about said mandrel and adapted for movement between upper, intermediate, and lower positions and having window means through the wall thereof; dog means disposed

in said window means adapted for movement between an inner retracted position wherein they will not interfere with said internal flange of said flow conductor and an expanded position wherein they will lodge against said internal flange; expander means on said mandrel for moving said dog means to expanded position upon movement of said sleeve to said intermediate position; means carried by said mandrel biasing said sleeve towards said intermediate position; means on said sleeve and said mandrel releasably coengageable to limit movement of said sleeve between upper and intermediate positions; said releasable means being releasable upon application of a predetermined longitudinal force thereto to move said sleeve to said lower position, said releasable means then limiting the movement of said sleeve between intermediate and lower positions.

23. A locator and setting device for releasably anchoring a well tool in a selected one of a plurality of longitudinally spaced substantially identical landing nipples in a well flow conductor each having a locking recess therein and an upwardly facing stop shoulder thereon spaced from said locking recess, said device comprising: a setting tool subassembly having means for connecting the same to said well tool; a locator subassembly connected with the setting tool subassembly for engaging said upwardly facing stop shoulder of any selected one of said landing nipples in said well flow conductor for positioning the setting tool subassembly in position for anchoring said well tool in said locking recess of said selected landing nipple; and connector means on the setting tool subassembly having means for releasably connecting the same to said well tool to support said well tool and releasable from such connection with said well tool after the well tool has been anchored in the selected landing nipple.

24. A device of the character set forth in claim 23 wherein said setting tool subassembly includes: means for anchoring said well tool in said selected landing nipple while said well tool is held in registry with the locking recess in said selected landing nipple by said locator subassembly and before the said setting tool subassembly is disconnected from said well tool after said well tool has been anchored in said selected landing nipple.

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