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METHODS AND APPARATUSES FOR TREATING WELLS

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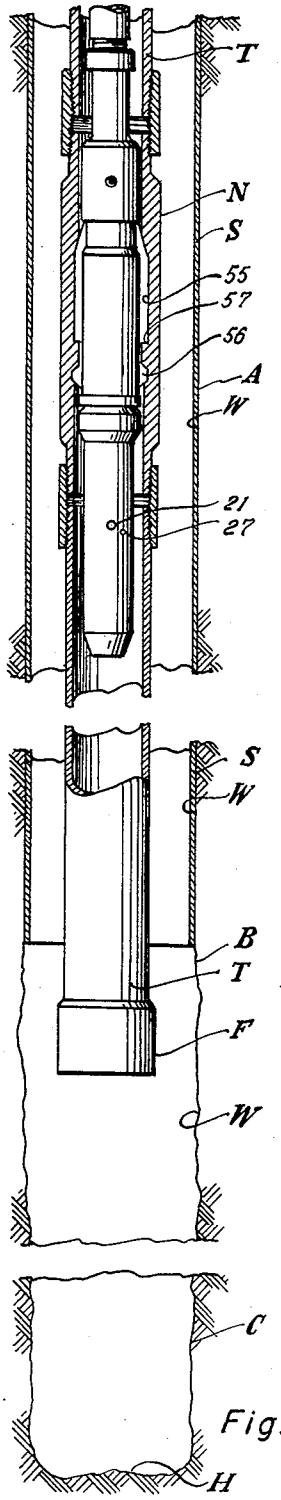


Fig. 1

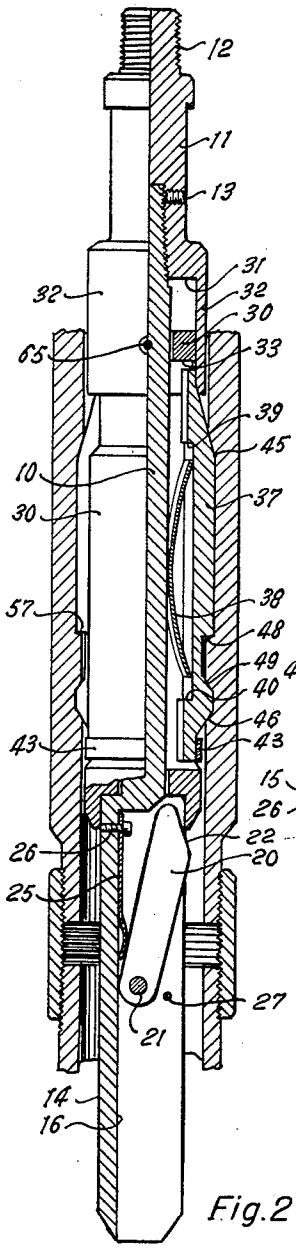


Fig. 2

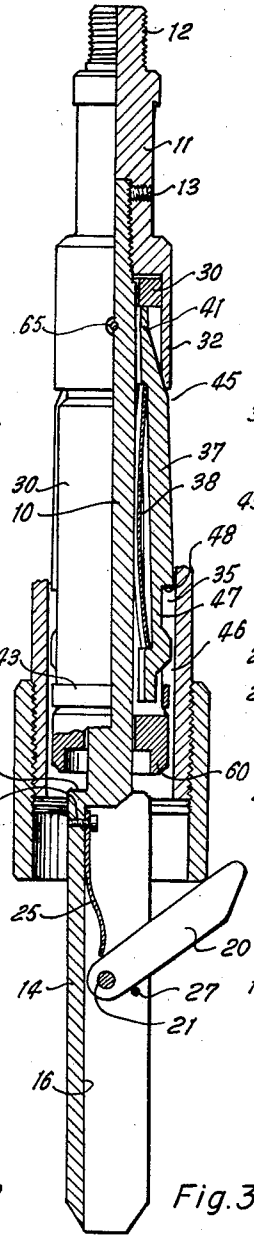


Fig. 3

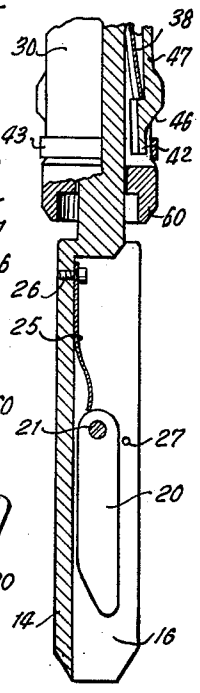


Fig. 4

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METHODS AND APPARATUSES FOR TREATING WELLS

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10 Claims. (Cl. 166—4)

This invention relates to new and useful improvements in methods and apparatuses for treating wells.

The invention is particularly adapted for use in the treating of wells wherein the tubing string in the well bore contains one or more locking and seating or landing nipples for receiving a removable well flow control or similar tool, and wherein the lower end of the tubing is disposed substantially above the lower end of the bore of the well. In such wells, it is frequently desirable to perform operations such as cementing, perforating, and re-cementing or the like; so treating the well while the tubing remains in place in the bore of the well. In such cases, it becomes extremely desirable to be able to locate with accuracy the depth in the well, or the position in the well, in which the locking and seating or landing nipple is disposed, the depth to the lower end of the string of well tubing, and the depth to the bottom of the well bore.

It is, therefore, one object of this invention to provide an improved method and means for locating the position of locking and seating or landing nipples in a well tubing string, the position of the lower end of the well tubing string, and the depth to the bottom of the well bore.

It is an important object of the invention to provide a method and an apparatus for locating the positions of the locking and seating or landing nipples in place in a well tubing, the depth to the lower end of the well tubing string, and the distance to the bottom of the well bore, such operations being performed in a series of steps without removing the locating apparatus from the well bore and without making more than one trip with the apparatus into the well bore.

Another object of the invention is to provide a means and a method of the character described which are simple in operation, providing accurate measurements, and requiring minimum amounts of time and manipulation to obtain the desired results.

Still another object of the invention is to provide an apparatus for locating, successively, the position of a selected locking and seating or landing nipple in a string of well tubing, the position of the lower end of the string of well tubing, and the depth to the bottom of the well, wherein the means for locating the several positions is rendered inoperative successively so as not to interfere with later locating operations.

A still further object of the invention is to provide an apparatus of the character described which may be run into a well bore on a flexible measuring line for obtaining the desired results, and which may be as readily removed from the well bore by means of said flexible line lowering mechanism.

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

Figure 1 is a view, partly in elevation and partly in section, of the lower portion of a well bore having a well tubing string disposed therein having a locking and seating or landing nipple connected in said tubing string, and illustrating a locating tool positioned in the locking and sealing nipple, performing the first step of the method;

Figure 2 is an enlarged fragmentary view, partly in elevation and partly in section, showing the locating tool in place in the locking and seating or landing nipple of Figure 1;

Figure 3 is a view similar to Figure 2 showing the locating tool after it has passed below the locking and seating or landing nipple and indicating the position of the lower end of the well tubing string; and

Figure 4 is fragmentary view, partly in elevation and partly in section, of the lower portion of the locating tool, showing the tool in the position the parts assume after the lower end of the tubing has been located and in which position the tool may be used for locating the bottom of the bore of the well and in which the tool may be removed from the well bore through the tubing string.

In the drawings, Figure 1, a well bore W is illustrated in three sections; the upper section A illustrating the well bore having a string of casing S positioned therein and also having a flow conductor or string of well tubing T, supported in the well at the surface by a suitable casing and tubing head (not shown) in the usual manner, and having connected in said tubing string a locking and seating or landing nipple N; a middle section B, wherein the lower end of the tubing string T is shown terminating in a footpiece or shoe F; and the extreme lower portion C wherein the bottom of the hole or well bore H is shown.

In the production, or reworking, of the well, it is frequently extremely necessary to know with accuracy the locations of the landing nipple N, the lower end of the tubing string T as exemplified by the shoe F, and the bottom of the hole H. For obtaining the measurement from the well surface to the respective locations, the method and apparatus of the invention is used. The method includes lowering a locating tool into the well bore to locate the position of the nipple N, freeing the locating means for movement below the nipple N; locating the shoe or footpiece F indicating the lower end of the string of well tubing T; lowering the locating tool to the bottom of the hole H to measure the depths to that position; then removing the locating tool from the well bore through the tubing string.

For carrying out the invention, a preferred form of locating tool L is illustrated which includes an elongate mandrel or body or rod member **10** having on its upper end a top sub or connector member **11** provided with a screw-threaded end **12** by means of which the locating tool may be connected to a flexible line lowering and manipulating mechanism of the usual type including a string of link jars, a weight member, a wire line socket and a flexible measuring line, which may be either solid or stranded material. The measuring line is run through a suitable measuring head or instrument, of any desired well-known type, as such measuring line is used to lower the locating tool into the well bore. The measuring instrument carries an indicator for showing and/or recording the length of the measuring line passing through such measuring instrument in either direction, and thus will indicate the distance the locating tool moves into the well bore from the surface.

The top sub or connector member is held securely in place on the upper end of the body member **10** by means of a set or lock screw **13** threaded into a suitable lateral aperture in the top sub and engaging the upper end of the body member. The lower portion **14** of the body member or mandrel **10** is enlarged in diameter to provide an upwardly facing shoulder **15** spaced substantially below the top sub **11**. The elongate longitudinal slot **16** is formed in the enlarged lower portion **14** of the mandrel and extends substantially throughout the length of such

enlarged lower portion. An elongate trip latch arm or member **20** is pivotally mounted at one end on a pivot pin **21** extending transversely of the slot **16** in the lower portion of the mandrel, said latch arm being swingable on said pivot from an upper position in said slot as shown in Figure 2 to a lower position in the slot such as is shown in Figure 4, wherein the latch arm does not project beyond the periphery of the enlarged lower portion **14** of the mandrel. An elongate leaf spring **25** is secured in the bottom of the upper end of the groove **16** by means of a screw **26**, and this leaf spring engages the latch arm and biases the free end of the latch arm outwardly from the slot. Pivotal movement of the latch arm is normally limited by a stop pin **27** disposed in suitable apertures formed in the enlarged lower portion **14** of the mandrel and extending transversely across the slot **16** therein. As is clearly shown in Figure 3, the latch arm is biased outwardly by the spring **25** until the arm engages the pin **27**, where the latch arm is supported by the pin in a substantially horizontal position, whereby the outer end of the arm is disposed to engage the lower end of the tubing string through which the tool is lowered, for a purpose and in a manner hereinafter more fully explained.

An elongate key cage or restraining sleeve **30** is slidably mounted upon the upper portion of the mandrel **10** between the shoulder **15** and a downwardly facing internal annular shoulder **31** formed in the bore of the top sub or connecting member **11** at the upper end of an elongate annular skirt member **32** depending from said top sub and surrounding the upper portion of the mandrel **10**. The upper portion of the key cage **30** is slidable in the annular space between the mandrel **10** and the skirt **32** from a lower position shown in Figure 2 to an upper position shown in Figure 3.

The key cage is provided with a pair of opposed longitudinally disposed lateral slots **35**, in which elongate key and stop members or stop means **37** are movably mounted. The elongate key and stop members are biased outwardly of the slots **35** by elongate leaf springs **38**, each of which has an inwardly curved central portion engaging the mandrel and bears at its ends against the inner face of the respective key and stop member. Inwardly projecting opposed shoulders **39** and **40** are formed on the inner surface of the key and stop member for engaging the ends of the leaf spring and retaining the springs in position as the key moves in the slot **35**.

The upper end of each of the key and stop members is provided with an upstanding lug portion **41** which is engageable with the inner wall of the skirt **32** to limit outward movement of the upper end of the key from the slot. A similar downwardly extending lug **42** is formed on the lower end of each key and is disposed to engage a retaining band **43** secured in an annular groove in the lower portion of the key cage **30** to limit outward movement of the lower end of said key and stop member from the slot. The upper and lower ends of the key and stop members are provided with outwardly convergent beveled surfaces **45** and **46** which provides means for camming the keys inwardly when they come into contact with obstructions as the locating tool is lowered through the well flow conductor or tubing T.

Each of the keys is also provided with an external groove **47** which forms a downwardly facing stop shoulder **48** extending substantially perpendicularly to the longitudinal axis of the key and stop member and a downwardly and outwardly inclined surface **49** spaced below said stop shoulder **48** and above the lower beveled end **46** of the key and stop member. The external groove divides the outer portion of the key and stop member into an upper key portion **50** and a lower boss or guide portion **51**. The vertical or longitudinal dimensions of the key portion and the boss portion of each of the key and stop members are so chosen that the key and stop members may move outwardly into expanded positions in the well flow conductor only when these portions of the key and stop members are aligned with corresponding annular key and stop grooves **55** and **56** of like dimensions and configuration in a particular landing nipple N connected in the well flow conductor or tubing string T.

The groove **55** of the landing nipple defines an annular upwardly facing stop shoulder **57** which is adapted to be engaged by the downwardly facing stop shoulders **48** of the key and stop members when they are in expanded position to stop further downward movement of the locating device through the landing nipple. The beveled surfaces **45** and **49** of the key and stop members will cam the key and stop member inwardly upon upward movement of the locating tool with respect to the landing nipple. Thus, the key and stop members serve to stop or limit downward movement of the locating device through the well tubing but will permit upward movement of the device therethrough.

The key cage or restraining sleeve **30** is provided at its lower end with a depending annular flange **60** which telescopes over the upper end of the enlarged lower portion **14** of the mandrel, in the manner shown in Figure **2**, and is adapted to engage the beveled outer end **22** of the latch arm **20** to hold the latch arm retracted into the groove **16** in the enlarged lower portion of mandrel against the force exerted by the spring **25**, whereby the latch arm will not engage or contact the wall of the well tubing string as the locating tool is lowered therethrough.

The key cage or sleeve is releasably held in the lower position on the mandrel **10**, shown in Figure 2, by means of a shear pin **65** which extends through transverse apertures formed in the upper end of the key cage **30** and in the mandrel **10**. However, when the locating tool has been lowered into the well tubing string until the stop members **37** engage in the recesses **55** of the landing nipple N, the stop shoulders **48** on the key and stop members engage the stop shoulder **57** in the landing nipple and limit further downward movement of the locating tool through the tubing. Downward jars may be applied by means of the wire line lowering and operating mechanism to the top sub **11**, and thus thereby to the mandrel **10**. Such blows will move the mandrel **10** and the cage **30** connected thereto by the shear pin **65** downwardly with respect to the key and stop members **37**. When the upper ends of the key and stop members engage the downwardly facing shoulder **33** at the upper ends of the slots **35** in the key cage, further downward movement of the key cage is prevented. Application of further downward force to the mandrel **10** will then shear the pin **65** and permit the mandrel to move downwardly with respect to the key cage and the key and stop members **37** and the upper ends of the key and stop members **37** will move upwardly into the skirt **32**, the beveled surface **45** camming the upper ends of the key and stop members into the bore of the skirt. Continued downward movement of the mandrel and the top sub and skirt **32** with respect tot he key and stop members will ultimately retract the key and stop members in the slot **35** to the position shown in Figure 3, retracting the stop shoulders **48** of the key and stop member from the upwardly facing stop shoulder **57** of the landing nipple and permitting the locating device to move downwardly with respect to such landing nipple.

The upward movement of the key cage or sleeve **30**, during the operation of retracting the key and stop members just described, moves the depending flange **60** at the lower end of the cage upwardly with respect to the enlarged lower portion **14** of the mandrel and permits the free end of the latch arm **20** to swing outwardly, such latch arm being biased outwardly by the spring **25**. As the locating tool is moved downwardly through the lower portion of the tubing and out through the footpiece or shoe F at the lower end of the tubing, the latch arm is permitted to swing outwardly on the pin **21** to the substantially horizontal position shown in Figure 3, where the

latch arm is supported by the cross pin **27**. The locating tool may then be drawn upwardly until the latch engages the lower end of the shoe F, and the position of the lower end of the tubing thus determined by the measurement indicated on the measuring device of the wire line lowering and operating mechanism.

The tool may then be further lowered in the well bore W until the lower end of the mandrel engages the bottom H of the hole forming the well bore. The measurement to this point may be repeatedly taken for accuracy. After all measurements have been made, the tool may be lifted upwardly till the latch arm **20** engages the lower end of the shoe F. An upward force or pull applied to the mandrel **10** will then shear the pin **27** and permit the latch arm **20** to swing downwardly to the position shown in Figure 4, wherein the arm is disposed entirely within the slot **16** in the enlarged lower portion of the mandrel. The locating tool may then be drawn upwardly through the bore of the tubing string T to the well surface and removed therefrom.

Should the key and stop members **37** for any reason be moved downwardly to a position at which they are again biased outwardly by the springs **38** to engagement with the wall of the well tubing, the beveled shoulders **45** at the upper end of the keys and beveled surface **49** at the guide boss will cam the keys inwardly as the device is moved upwardly through the tubing and permit the tool to be withdrawn without hindrance.

If desired, a plurality of key and stop members each having key portions **49** of different dimensions may be utilized to locate a series of landing nipples N having selective locking grooves **55** and **56** of correspondingly different longitudinal dimensions provided therein.

It will thus be seen that a method has been disclosed for locating the position in the well of the landing nipple N, the position of the lower end of the tubing string T, and the depth of the bottom H of the hole or the bore of the well. It will also be seen that an improved locating tool has been devised which is provided with means for selectively indicating the location of a desired landing nipple N in a well tubing string T in a well bore, for locating the position of the lower end of the well tubing T in the well bore, and for locating the bottom H of the well bore. It will likewise be seen that such locating tool provides for successively locating the various positions without removing the tool from the well between measurements, whereby the several locations may be successively determined with a single trip of the locating tool into the well bore. It will also be seen that the locating tool is simple in structure, easy to operate and provides for making the measurements without difficulty. Furthermore, the tool provides for positive removability of the locating tool from the well bore, since the key and stop members are retractable and the latch arm is readily movable to a lower inoperative position. It will likewise be seen that accurate measurements locating the positions of the landing nipple, the lower end of the tubing and the bottom of the hole may be made by means of the device.

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 I claim and desire to secure by Letters Patent is:

1. A locating device for use in treating wells having a string of well pipe positioned therein with its lower end disposed above the bottom of the bore of the well and having one or more locking and seating nipples connected therein, which locating device includes: a body having means for connecting it to a lowering mechanism; stop means slidably mounted on said body and adapted to project laterally from said body to engage a locking and seating nipple for limiting downward movement of the locating tool therepast in the pipe; means biasing said stop means toward projecting engaging position, whereby said stop means is retractably positioned in such projecting engaging position; latch means carried by the body and movable to a laterally projecting position wherein said latch means is adapted to engage the lower end of the well pipe; and restraining means movably mounted on the body and initially engaging said latch means to hold said latch means retracted, said restraining means being engageable by said stop means for movement thereby to a position freeing said latch means for movement to laterally projecting position, said restraining means being moved from restraining position upon retraction of the stop means from projecting position.

2. A locating device of the character set forth in claim 1, wherein means is provided on the body for releasably supporting the latch means in position to engage the lower end of the well tubing, said supporting means being releasable to permit said latch means to move to fully inoperative non-engaging position.

3. A locating device for use in treating wells having a string of well pipe positioned therein with its lower end disposed above the bottom of the bore of the well and having one or more landing nipples each having an upwardly facing stop shoulder therein connected in said pipe, which locating device includes: a body having means for connecting it to a lowering mechanism; stop means slidably mounted on said body and adapted to project laterally from said body to engage the upwardly facing stop shoulder of a landing nipple for limiting downward movement of the locating tool therepast in the pipe; means biasing said stop means outwardly toward projecting engaging position, said stop means being retractable from such projecting engaging position; latch means carried by the body and movable to a laterally projecting position for engaging the lower end of the well pipe; restraining means movably mounted on the body and movable between a position initially engaging said latch means to hold said latch means retracted and a position freeing said latch means for movement to projecting position, said restraining means being engageable by said stop means and movable thereby out of restraining position to permit said latch means to move to projecting position; and means on the body engageable with the latch means for supporting the latch means in such laterally projecting engaging position and releasable from such supporting position whereby said latch means is movable to a non-projecting position to permit withdrawal of the locating device from the well pipe.

4. A locating device for use in treating wells having a string of pipe positioned therein with its lower end disposed above the bottom of the bore of the well and having one or more landing nipples each having an upwardly facing stop shoulder in its bore connected therein, which locating device includes: an elongate body having means for connecting it to a lowering mechanism; a sleeve slidably mounted on said body; means on said sleeve and body initially releasably holding said sleeve in a lower position on said body; a stop member movably mounted on said body; means resiliently biasing said stop member to project outwardly from said body to engage the bore wall of the well pipe, said stop member having a downwardly facing stop shoulder formed thereon adapted to engage the upwardly facing stop shoulder of the landing nipple for limiting downward movement of the locating tool therepast in the pipe; means on said body and said sleeve retaining said stop member on said body; means on said body and said stop member co-engageable to retract said stop member upon downward force applied to the body, whereby the stop member is moved upwardly with respect to said body, upward movement of said stop member with respect to said body moving said sleeve upwardly of said body to an upper position on said body; a contacting member having one end pivotally mounted on the body below the sleeve; means resiliently biasing the free end of said contacting member outwardly; means

on said slidable sleeve engaging said free end of said contacting member when said sleeve is in its lower position to initially restrain said contacting member in inoperative position, upward movement of said slidable sleeve to said upper position freeing the free end of said contacting member for pivotal movement outwardly and into engagement with the bore wall of the pipe, said contacting member being further movable beyond the maximum diameter of said well pipe whereby it will engage the lower end of said well pipe after the locating device has moved out of the open end thereof; and supporting means on said body engaging said contacting member for supporting said contacting member in position to engage the lower end of the well pipe, said supporting means being releasable to permit said contacting member to swing downwardly to fully retracted inoperative position.

5. A locating device for use in treating wells having a string of well pipe positioned therein with its lower end disposed above the bottom of the bore of the well and having one or more landing nipples each having an upwardly facing stop shoulder in its bore connected therein, which locating device includes: an elongate body having means for connecting it to a lowering mechanism; a stop member slidably mounted on said body; means resiliently biasing said stop member to project laterally of said body to engagement with the bore wall of the well pipe; a restraining sleeve slidably mounted on said body; means on said body and said sleeve engaging said stop member to retain said stop member on said body; said stop member having a downwardly facing stop shoulder provided thereon adapted to engage the upwardly facing shoulder of the landing nipple for limiting downward movement of the locating device in the well pipe; said body and said stop member having co-acting surfaces engageable upon downward force applied to the body to positively retract said stop member inwardly of said body to permit the stop shoulder on said stop member to pass the landing nipple whereby the locating device may move below said landing nipple; a contacting member pivotally mounted on the body below the stop member and having a free end swingable to project laterally beyond said body; means resiliently biasing the free end of said contacting member outwardly of said body member; said restraining sleeve having means engageable with the contacting member for retaining said contacting member in inoperative position when said sleeve is in a lower position on said body; means on said body and sleeve releasably holding said sleeve in said lower position; said restraining sleeve being engaged by the stop member as said stop member is moved to retracted position to move said restraining sleeve from its lower position and free said contacting member for movement to operative position; and a releasable supporting means carried by the body and engaging said contacting member for limiting pivotal swinging movement of said contacting member, whereby said contacting member is positioned to engage the lower end of the string of well pipe after the locating device has passed out of the lower open end of said well pipe, said supporting means being releasable to permit said contacting member to swing downwardly to fully inoperative retracted position upon application of downward force to said contacting member.

6. A locating device for use in treating wells having a string of well pipe positioned therein with its lower end disposed above the bottom of the bore of the well and having one or more landing nipples each having an upwardly facing stop shoulder connected therein, which locating device includes: an elongate body having means for connecting it to a lowering mechanism; a stop member slidably mounted on said body; means resiliently biasing said stop member to project laterally outwardly of said body to engagement with the bore wall of the well pipe; a restraining sleeve slidable on said body between a lower and an upper position on said body; means on said sleeve and said body engaging said stop member to retain said stop member on said body; said stop member having a downwardly facing stop shoulder provided thereon adapted to engage the upwardly facing stop shoulder of a landing nipple for limiting downward movement of the locating device in the well pipe; said body and said stop member having co-acting surfaces engageable upon downward force applied to the body to positively retract said stop member inwardly of said body to permit the stop shoulder on said stop member to pass the landing nipple whereby the locating device may move below said landing nipple; a contacting member movably carried by the body and movable from a retracted position on said body to a laterally projecting position to engage the lower end of the well pipe, said contacting member being further movable to a fully retracted position; restraining means on said restraining sleeve engaging the contacting member to initially hold said contacting member out of engaging position when said sleeve is in its lower position on said body; means on said sleeve and body releasably holding said sleeve in said lower position; said restraining sleeve being engageable by the stop member as said stop member moves to retracted position to move said restraining means out of restraining engagement with the contacting member whereby said contacting member may move to projecting position; means biasing said contacting member toward projecting position; and means engaging and releasably supporting said contacting member in projecting position and releasable to permit said contacting member to move to said fully retracted position.

7. A locating device including: an elongate body having connecting means at its upper end; a sleeve slidable on said body between an upper and a lower position; means releasably restraining said sleeve in its lower position on said body; a plurality of stop members movably mounted on said body between a retracted position and a laterally projecting position; means on said body and said sleeve engageable with said stop members to retain said stop members on said body; first biasing means biasing said stop members toward projecting position and yieldable to permit said stop members to move to retracted position; a latch member pivotally mounted at one end on said body below said sleeve and having its free end swingable from an upper non-projecting position downwardly and outwardly to a laterally projecting position and then further downwardly to a lower non-projecting position; second biasing means engageable with said latch member to bias said latch member from upper non-projecting position downwardly toward projecting position; means on said body positioned to engage said latch member to support said latch member in laterally projecting position, and supporting means releasing said latch member for movement to its lower non-projecting position upon application of a sufficient downward force to the free end of said latch members; said slidable sleeve having means engageable with the free end of said latch member when said latch member is in its upper non-projecting position and said sleeve is in its lower position to releasably hold said latch member in said upper non-projecting position, said sleeve being movable upwardly out of engagement with said latch member to permit said second biasing means to bias the free end of said latch member to laterally projecting position; said stop members each having a downwardly facing stop shoulder adapted when said member is in projecting position to engage an upwardly facing shoulder whereby said stop member may be moved longitudinally upwardly relative to said body; camming means on said body and said stop members engaging to move said stop members from projecting to retracted position and restrain said stop members in such retracted position when said stop members are moved upwardly relative to said body; and means on said stop members and said sleeve engageable upon upward movement of said stop members relative to said body whereby upward movement of said stop members moves said sleeve upwardly relative to said

body from its lower to its upper position thereon, said means releasably restraining said sleeve in lower position being released to permit such movement; said body having a portion extending below the free end of the latch member when said latch member is in its lower non-projecting position.

8. A locating device for use in treating wells having a string of pipe positioned therein with its lower end disposed above the bottom of the bore of the well and having one or more locking and seating nipples connected therein, said locating device including: an elongate body having an enlarged lower portion providing an upwardly facing stop shoulder; a connecting member on the upper end of said body and providing a downwardly facing external annular stop shoulder, said connecting member having a depending annular skirt extending downwardly exteriorly of and spaced laterally beyond the upper portion of said body; a restraining sleeve slidable on said body between said upwardly and downwardly facing stop shoulders and having a depending annular retaining flange telescoping the upper end portion of the enlarged lower portion of the body when said sleeve is in its lower position on said body and positioned above said shoulder when said sleeve is in its upper position on said body, the upper end of said sleeve being slidably positioned in said depending skirt of said connecting member; said sleeve having a plurality of longitudinally extending slots formed therein; a plurality of stop members, one positioned in each of the slots of said sleeve and movable laterally and longitudinally therein relative to said body, said stop members being retained in place on said body and in said slots by engagement of their upper ends with the inner surface of the depending skirt and engagement of their lower ends with stop means on the sleeve at the lower end of each slot, whereby said stop members may move between a retracted position and a laterally projecting position relative to said body; means between said stop members and said body biasing said stop members toward projecting position and permitting said members to move to retracted position; said enlarged lower portion of said body having a longitudinally extending groove formed therein; a latch member pivoted at one end in said groove intermediate the ends thereof and having its free end swingable from an upper position in said groove downwardly and outwardly to a laterally projecting position and then further downwardly and inwardly to a lower position in said groove; stop and supporting means positioned on said body in said groove to engage said latch member to releasably support said latch member in laterally projecting position, said stop and supporting means being releasable upon application of a sufficient downward force to the free end of said latch member to permit said latch member to move to lower position in the groove; resilient means engageable with said latch member when said latch member is in its upper position in said groove to resiliently urge the free end of said latch member downwardly and outwardly toward projecting position, said free end of said latch member when in upper position in said groove being disposed to be engaged by the depending annular flange of said sleeve when said sleeve is in lower position on said body, whereby said flange retains said latch member in said upper position in said groove; means releasably connecting said slidable sleeve and said body when said sleeve is in its lower position on said body and releasable to permit said sleeve to move upwardly on said body; downwardly facing stop shoulders on said stop members adapted when said stop members are in projecting position to engage an upwardly facing shoulder in said well pipe, whereby downward force applied to said body causes relative upward longitudinal movement of said stop members on said body; said stop members engaging the upper ends of the slots in said sleeve upon such upward movement of the stop members relative to said body to move said sleeve upwardly relative to said body to its upper position thereon, such movement of the sleeve moving its depending flange upwardly from engagement with the free end of the latch to permit the free end of said latch member to swing outwardly; said stop members having cam surfaces at their upper ends engageable with the depending skirt upon upward movement of said stop members relative to said body and skirt to cam said stop members to retracted position and free said downwardly facing stop shoulders on said stop members from engagement with the upwardly facing shoulder of the well pipe, whereby said locating tool may move further downwardly through said pipe below said upwardly facing stop shoulder.

9. The method of locating desired levels with respect to a point of reference in a well having a string of tubing fixed therein with its lower end disposed at some point above the lower end of the bore of the well and having a landing nipple connected therein near the lower end of the tubing string, said method including: lowering a well tool on a line in said tubing string to said landing nipple to establish said point of reference at said landing nipple; then lowering the well tool by means of the line to position it at a second position at the lower end of the tubing string; noting at the surface the distance traveled by said well tool from said point of reference to the lower end of the tubing string; then lowering said well tool by means of the line from said second position at the lower end of the tubing string to a third position at the bottom of the well bore; noting at the surface the distance traveled by the well tool from said second position to said third position; said movements of said well tool from said point of reference to said second and third positions in said well bore being effected without removing the line or the well tool from within the well bore.

10. The method of locating desired levels with respect to a point of reference in a well having a string of tubing fixed therein with its lower end disposed at some point above the lower end of the bore of the well and having a landing nipple connected therein near the lower end of the tubing string, said method including: lowering a well tool on a line in said tubing string to said landing nipple to establish said point of reference at said landing nipple; then lowering the well tool by means of the line to position it at a second position at the lower end of the tubing string; noting at the surface the additional length of the line lowered into the well in moving said well tool from said point of reference to said second position; then lowering said well tool by means of the line from said second position to a third position at the bottom of the well bore; noting at the surface the additional length of line lowered into the well in lowering said tool from said second position to said third psition; said movement of said well tool and of said line from said point of reference to said second and third positions in said well bore being effected without removing the line or the well tool from within the well bore.

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