United States Patent [19]

Outhouse

[11] **3,796,259**

[45] **Mar. 12, 1974**

[54] **APPARATUS FOR INSTALLING AND REMOVING FLOW VALVES**

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[73] Assignee: **Production Specialties, Inc.,** Lafayette, La.

[22] Filed: **Feb. 7, 1973**

[21] Appl. No.: **330,291**

[52] **U.S. Cl.** **166/117.5**

[51] **Int. Cl.** **E21b 23/02**

[58] **Field of Search** 166/117.5, 117.6

[56] **References Cited**

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Primary Examiner—David H. Brown

[57] **ABSTRACT**

An apparatus for installing and removing flow valves in a well tubing having a plurality of flow control receiving stations off-set from the tubing each of which is provided with a seat for a flow control unit including an elongated housing means with a shifting tool pivotally supported at its upper end to the housing means. Sleeve means slidably surrounds the housing means and shifting tool and is initially positioned to lock the pivotal support to thereby retain the shifting tool aligned with the housing means as the apparatus is lowered in well tubing with a wire line. The housing means carries spring urged guide means that are normally retracted within the housing by engagement with the sleeve means as the apparatus is lowered in the well tubing and the shifting tool is provided with spring urged cam means that is also retained within the shifting tool by the sleeve means as the apparatus is lowered in the well tubing.

The well tubing is provided with a plurality of orienting means one of which is positioned immediately above each off-set flow control receiving station in the well tubing and when the predetermined off-set flow control receiving station is reached in which valve means is to be set or valve means removed therefrom the brake on the lowering cable is set so that downward movement of the housing means is arrested which enables the sleeve means to continue moving downward and thereby disengage from the spring urged guide means carried by the housing means; to unlock the pivotal support so that the shifting tool may move laterally; and alignes a slot in the sleeve means with the spring urged cam means of the shifting tool so that the cam means may move outwardly of the shifting tool to engage the well tubing wall and shift the shifting tool laterally. The spring urged guide means carried by the housing means engages the orienting guide in the well tubing to orient the shifting tool in a desired manner relative to the off-set section or station so that a flow control unit may be either installed therein or removed therefrom.

3 Claims, 7 Drawing Figures

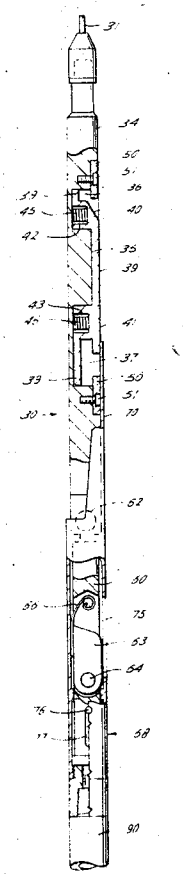


Fig. 1

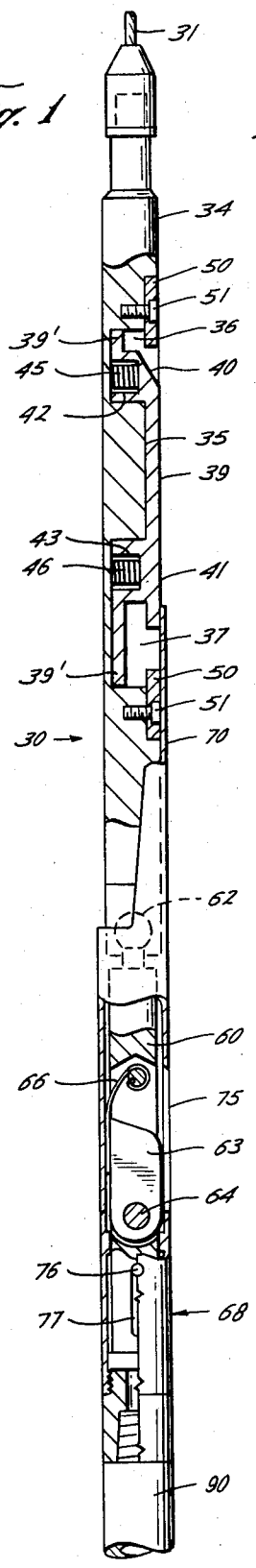


Fig. 2

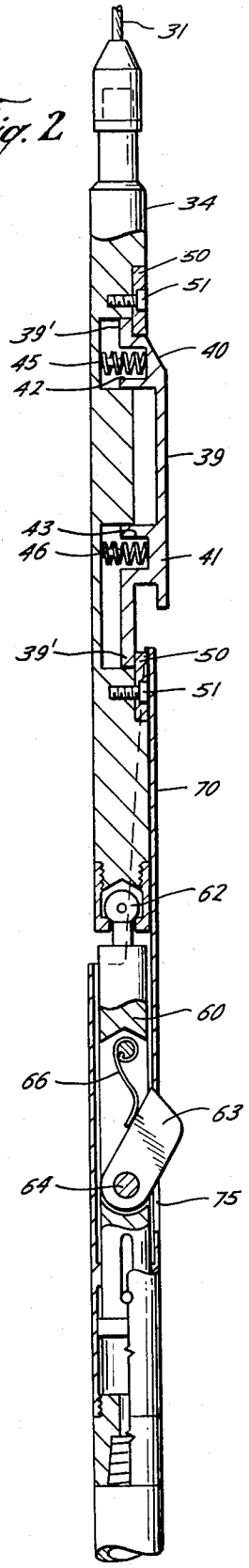
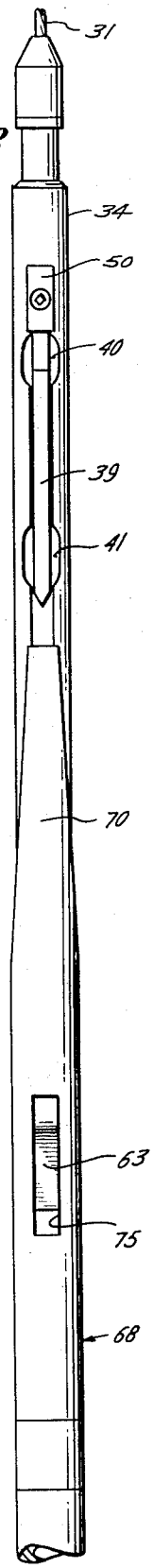


Fig. 3



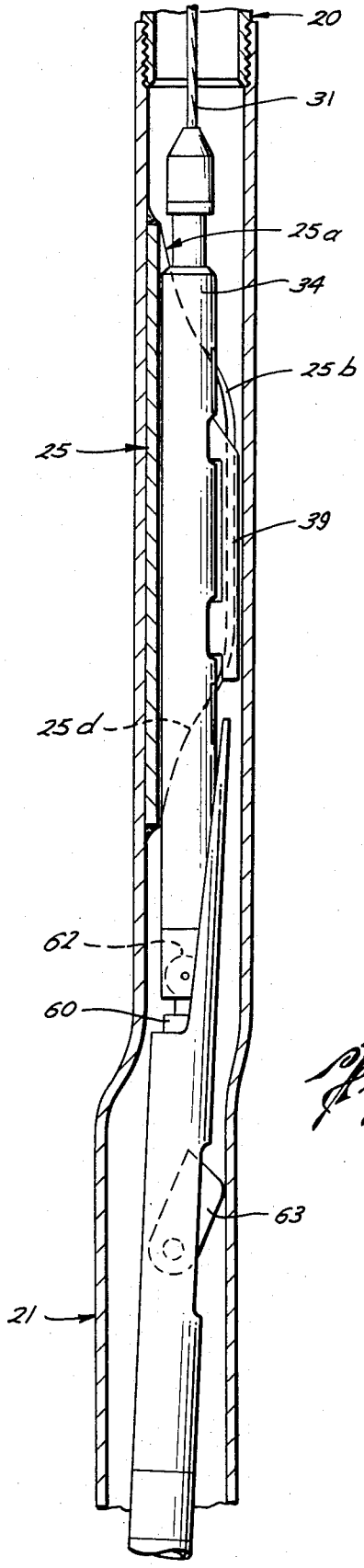


Fig. 4

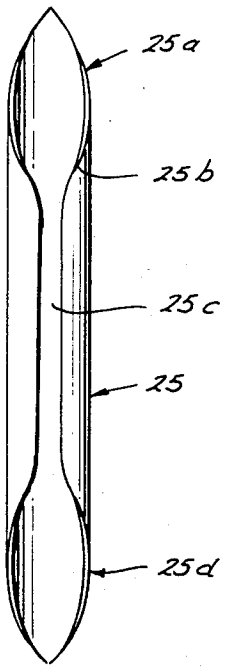


Fig. 5

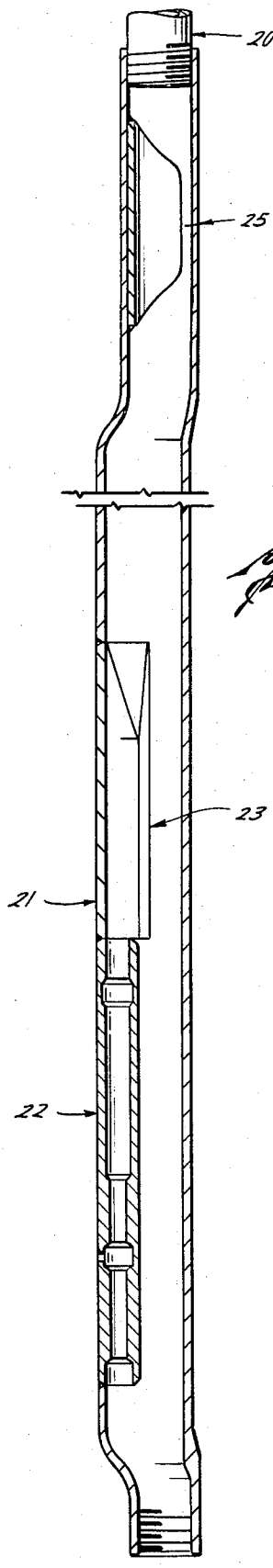


Fig. 6

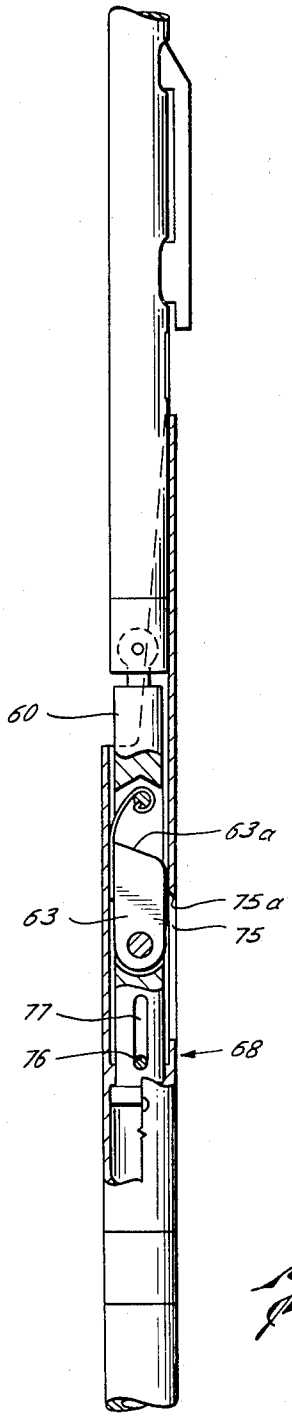


Fig. 7

APPARATUS FOR INSTALLING AND REMOVING FLOW VALVES

SUMMARY OF THE INVENTION

The closest prior art with which the applicant is familiar is the U.S. Pat. to Beebe, et al, No. 3,353,608. The present invention provides features not found in the prior art in that the operating components of the tool are kept covered, and are uncovered for operation of the invention merely by stopping downward movement of the apparatus in the well tubing.

Another object of the invention is to provide a flow control valve handling apparatus for a bypassing valve seat receiving station which includes housing means that pivotally supports a shifting tool at one end. A sleeve is slidably carried on the shifting tool and the housing means and engages spring loaded guide means in the housing means to normally retain it in retracted position. The sleeve means also locks the pivotal support between the housing means and the shifting tool so that the shifting tool is aligned with the housing means as the apparatus is lowered in the well bore and the sleeve means also engages a spring loaded cam means carried by the shifting tool to retain it retracted within the shifting tool as the apparatus is lowered in the well bore.

Another object of the invention is to provide a flow control valve handling apparatus for a bypassing valve seat receiving station which includes housing means that pivotally supports a shifting tool at one end. A sleeve is slidably carried on the shifting tool and the housing means and engages spring loaded guide means in the housing means to normally retain it in retracted position. The housing means also locks the pivotal support between the housing means and the shifting tool so that the shifting tool is aligned with the housing means as the apparatus is lowered in the well bore and the sleeve means also engages a spring loaded cam means carried by the shifting tool to retain it retracted within the shifting tool as the apparatus is lowered in the well bore. The sleeve means includes a pin engaging a slot on the shifting tool so that when movement of the housing means in the well tubing is stopped, the weight of the sleeve means causes the sleeve means to slide longitudinally of the housing means and shifting tool in a predetermined aligned relationship to disengage from the spring loaded guide means; to unlock the pivotal support between the housing means and the shifting tool; and to align the slot in the sleeve with the spring loaded cam means so that the spring loaded cam means may move outwardly into engagement with the well tubing and urge the shifting tool laterally relative to the housing means.

Still another object of the invention is the provision of an apparatus for installing and removing a flow valve in a well tubing having collars and a plurality of flow control receiving stations which are off-set from the tubing by providing a housing means which pivotally supports a shifting tool, the housing means including sleeve means surrounding the shifting tool and the housing means to retain the shifting tool in retracted position and which will bypass the receiving sections as the housing means is lowered in the well tubing and providing a means for moving the shifting tool away from the housing means for installing or removing a valve from a desired valve seat in a predetermined or desired flow control receiving station.

Still another object of the invention is to provide an apparatus for installing and removing flow valves from a particular or desired off-set section of a well tubing so that other off-set sections may be bypassed as desired, wherein such apparatus is constructed and arranged so that operation is initiated merely by stopping downward movement of the apparatus in the well string.

Other and further objects, features and advantages of the present invention will become more readily apparent from consideration of the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view, partly in elevation illustrating the housing means, the shifting tool pivotally supported at one end thereon and the sleeve means positioned to engage the spring loaded guide means; to lock the pivotal support means between the housing means and the shifting tool; and to retain a spring loaded cam mounted in the shifting tool in retracted position;

FIG. 2 is a view similar to FIG. 1, but illustrates the position of the sleeve means after movement of the housing means has been arrested by stopping the downward movement thereof as it is being lowered on a cable into the well tubing and shows the spring loaded guide means moved radially outwardly from the housing means; the pivotal support exposed to enable the shifting tool to move laterally relative to the housing means and the cam in the shifting tool urged outwardly through a slot in the sleeve means for engaging the well tubing to effect lateral movement of the shifting tool;

FIG. 3 is an elevational view of FIG. 2 but rotated 90° for an elevational view of the cam means and the spring loaded guide means;

FIG. 4 is a partial sectional view illustrating the present invention positioned in a well tubing relative to an off-set flow control receiving section thereof for installing or removing a flow valve from such off-set section;

FIG. 5 is an enlarged view illustrating an orienting and guide device positioned in the well tubing above each off-set section to enable the tool of the present invention to be properly oriented for installation or removal of a flow valve in such off-set section;

FIG. 6 illustrates one of the off-set sections of a well tubing with a valve pocket therein and the orienting guide illustrated in FIG. 5 positioned thereabove; and

FIG. 7 is a sectional view, partly in elevation illustrating the position of the sleeve means after the tool has been actuated to either install or remove a flow valve in a desired off-set section of the well tubing to engage the spring loaded cam carried by the shifting tool and move it back into the shifting tool for removal of the apparatus from the well tubing.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Attention is first directed to FIG. 6 of the drawings wherein the well tubing is referred to generally by the numeral 20. The well tubing 20 includes a plurality of flow control receiving stations or sections referred to generally at 21 off-set from the tubing. Each station 21 is provided with a seat arrangement 22 for receiving a flow control valve. If desired, suitable means as referred to generally at 23 immediately above the seat ar-

rangement 22 are provided for preventing entry into the valve seat arrangement 22 of any of device except that which is desired or predetermined for the particular off-set section with which the means 23 is associated.

It can be appreciated that each off-set of section 21 is provided with a valve seat arrangement 22 and if desired with means 23 for insuring that only a predetermined tool may be inserted into the seat 22.

Additionally, an orienting guide 25 is provided immediately above each of the off-set sections 21 for orienting the tool of the present invention relative to the off-set station 21 to enable a flow control unit to be installed into the seat arrangement 22 or to be removed therefrom.

In FIG. 1 the present invention is referred to generally by the numeral 30 and is shown as being suspended on a wire line 31. The apparatus of the present invention includes the housing means 34 with which the cable 31 is connected at its upper end. A longitudinally extending recess 35 is provided in the housing means 34, which recess is enlarged at each end as shown at 36 and 37. An elongated guide 39 is carried in the recess 35 as shown in FIG. 1 of the drawings and has its ends 40 and 41 fitting in the enlarged recesses 36 and 37 at each end of the recess 35 shown in FIG. 1

The ends 40 and 41 are in turn provided with recesses 42 and 43 which receive spring means 45 and 46 respectively which tend to urge the elongated guide 39 outwardly of the housing means 34 as will be described hereinafter. Suitable means are provided for retaining the guide means 39 on the body 34 even when urged outwardly by the springs 45 and 46 as shown in FIG. 2 of the drawings, such means including suitable lock plates 50 carried on the housing means 34 by any suitable means such as screws 51, such lock plates 50 having a portion which projects into or over the recesses 36 and 37 respectively to engage the outer most ends 39′ of the spring loaded guide, as illustrated in FIG. 2 of the drawings.

It can be appreciated that when retracted the guide 39 is of a suitable configuration on its outer surface to conform with the circular housing 34 as is the lock plates 50 carried thereby.

A shifting tool 60 is pivotally supported at 62 at its upper end to the housing means 34 to enable the shifting tool 60 to move laterally relative to the housing means 34 in a manner as will be described in greater detail hereinafter. The shifting tool 60 includes a cam 63 pivotally mounted at 64 therein which cam 63 is engaged by spring means 66 carried in the shifting tool to tend to urge such cam 63 outwardly relative to the body of the shifting tool 60 on which it is mounted.

As shown in FIG. 1 the elongated guide means 39 is engaged by the projection 70 on the sleeve means 68 which sleeve means surrounds the shifting tool 60 so that the projection 70 engages the guide means 39 and retains it in retracted position as the apparatus is lowered in the well tubing on cable 31 as shown in FIG. 1.

The sleeve means 68 is hollow and circular in configuration and the projection 70 at the upper end thereof extends upwardly from adjacent the pivotal support 62 when the sleeve means 68 is in the position shown in FIG. 1 of the drawings. When the sleeve means 68 is in the position shown in FIG. 1 of the drawings the circular portion of the sleeve means 68 surrounds a portion of the housing means 34 and the pivotal support 62 so that the pivotal support 62 is locked to align the shifting tool 60 and housing means 34 relative to each other. Similarly, the sleeve means 68 in such position engages the cam 63 and forces it against the action of the spring 66 to a retracted position within the shifting tool as shown in FIG. 1. Frictional contact between sleeve means 68, cam 63 and guide 39 aid in retaining the sleeve means 68 in the position shown in FIG. 1 as the apparatus is lowered in the well tubing.

The sleeve means 68 includes a slot 75 and pin means 76 are provided on the sleeve means 68 for fiting in the slot 77 in the shifting tool 60 so that when the sleeve means 68 moves from the position shown in FIG. 1 to that shown in FIG. 2 the sleeve means 68 slides longitudinally along housing means 34 and shifting tool 60 in a predetermined relationship so that the slot means 75 aligns with the cam 63 to enable the cam 63 to be urged outwardly through the slot 75 by the spring 66 and against the well tubing. Also, the circular portion of the sleeve means 68 is moved beneath the pivot connection 62 between the housing means 34 and shifting tool 60 so that such pivotal connection is now operable. Additionally, it will be noted that the extension 70 of the cylindrical sleeve means 68 is disengaged from the lower end of the guide means 39 and the guide means 39 is urged outwardly of the housing means for purposes which will be described in greater detail hereinafter.

In the use of the apparatus, it is lowered into the well tubing on the cable 31 until the particular or desired off-set flow control receiving station 21 such as illustrated in FIG. 6 is approached. It can be appreciated that the housing means 34, shifting tool 60 and sleeve means is of suitable longitudinal extent so as to span the off-set stations 21 particularly where such off-set stations may be on the low side of a hole in a deviated well.

It can be appreciated that from previous information relating to any particular well, the location of the off-set station or section 21 in which a flow control apparatus is to be installed or removed is known. Therefore, by way of example only, approximately 100 feet above such location the brake is set on the wire line unit to retard the downward movement of the apparatus in the well tubing. When this occurs the weight of the sleeve means 68 causes it to continue to move downward longitudinally relative to housing means 34 and shifting tool 60 so that sleeve means 68 moves from the position of FIG. 1 of the drawings to that shown in FIG. 2 of the drawings.

As can be seen in FIG. 3, the guide means 39 has an elongated configuration and continued lowering of the apparatus on the wire line or cable 31 after sleeve means 68 has moved downwardly to expose guide 39 moves the guide means 39 into the orienting guide and sleeve referred to generally at 25 arranged above the next off-set flow control receiving station as better seen in FIG. 4. It will be noted that the configuration of the elongated guide 39 is such that it will move against the tapered upper end 25*a* of the guide and orienting sleeve 25. As the apparatus is lowered, the guide 39 rides along the edges 25*b* of the tapered upper end 25*a* to rotate the housing means 34 and connected shifting tool 60 until the guide means 39 moves into the slot 25*c* connecting the tapered upper end 25*a* with the tapered lower end 25*d* of sleeve 25 which has edges similar to edges 25*b*. The relationship of the guide means 39 on the housing 34 to the housing 34 and to the slot 25*c* is

illustrated more clearly in FIG. 4 as such movement occurs.

The swivel connection 62 is such that relative rotation between housing means 34 and shifting tool 60 is prevented, but such connection accomodates pivoting of the shifting tool 60.

When the apparatus is thus oriented by the guide means 39 in slot 25c the cam 63 engages the wall of the off-set section 21 opposite the valve seat arrangement 22 and shifts or moves the shifting tool 60 toward the valve or flow control seating arrangement 22 shown in FIG. 6 of the drawings. The pivot connection 62 enables such movement to occur in order that a flow control arrangement may be either inserted into the valve seat arrangement 22 or removed therefrom as desired. It can be appreciated edges when a flow control arrangement is to be positioned in the valve seat arrangement 22 of the off-set 21, a running tool illustrated at 90 is securred to the lower end of the sleeve means 68. Such running tool is of a well known configuration and supports a flow control apparatus, or valve thereon, and enables such valve to be seated in the seat arrangement 22.

If a valve or flow control apparatus is to be removed from the seat arrangement 22, then a pulling tool of well known configuration is substituted for the running tool and is connected to the lower end of sleeve 68 so that when the shifting tool 60 moves laterally towards the valve seat arrangement 22 it will engage a valve, or flow control unit in the valve seat arrangement 22 and retract it from such seat arrangement.

The orienting guide means 25 or sub is positioned as mentioned previously, immediately above each off-set station 21 and it will be noted that the slot 25c is on the side of the well bore opposite valve seat arrangement 22 in each off-set portion 21 so that the apparatus will be properly oriented when the guide means 39 is moved into the slot 25c. The guide and orienting sub 25 is of the same internal diameter as the tubing so as to not interfere with passage of the present invention or other tools downwardly through the well tubing.

After the flow control apparatus has either been seated in the seat arrangement 22, or engaged for removal therefrom, a downward jar may be exerted on the apparatus and this shears pin 76 so that sleeve 68 moves down relative to cam 63. This position is illustrated in FIG. 7 of the drawings and it will be noted that the upper end of the slot 75 is tapered as shown at 75a for engaging the surface 63a of the cam 63 to aid in moving it back into retracted position in the shifting tool 60.

This enables the apparatus to then be removed from the well tubing.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape, and materials as well as in the details of the illustrated construction may be made without departing from the spirit of the invention.

What is claimed is:

1. A flow control unit handling apparatus adapted for use in placing a flow control unit in a well tubing having collars and having a plurality of flow control receiving sections off-set from the tubing each of which is provided with a seat for a flow control unit and for removing said unit from said seat comprising:

a. an elongated housing means;

b. a shifting tool pivotally supported at its upper end to said housing means;

c. sleeve means slidably mounted on said housing means and shifting tool normally locking said pivotal support to thereby retain said shifting tool aligned with said housing means as the apparatus is lowered in the well tubing;

d. spring urged guide means carried by said housing means, said guide means normally retracted in said housing by engagement with said sleeve means as the apparatus is lowered in the well tubing;

e. spring urged cam means carried by said shifting tool and normally retained retracted in said shifting tool against the force of said spring, said cam means in retracted position in said shifting tool engaging said sleeve means;

f. said sleeve means having a slot therein for aligning with said cam means;

g. said sleeve means upon arresting downward movement of said housing means in the well tubing shifting longitudinally along said housing means to disengage from said spring urged guide means to enable said guide means to move outwardly from said housing means; to align the slot in said sleeve means with said cam means to enable said cam means to move outwardly into engagement with the well tubing; and to release said pivotal support whereby said cam means may shift said shifting tool laterally of the well bore.

2. The invention of claim 1 including orienting guide means carried by the well tubing and engageable with said guide means carried by said housing to orient the apparatus in the well tubing.

3. The invention of claim 1 including cooperating pin and slot means in said sleeve means and shifting tool to guide said sleeve means as it slides longitudinally of said housing means and shifting tool, said pin adapted to shear whereupon said sleeve means engages said cam means and urges it into retracted position in said shifting tool so that the apparatus may be retrieved from the well tubing.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,796,259 Dated March 12, 1974

Inventor(s) JAMES V. OUTHOUSE

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 5, line 16, change "edges" to -that-

Signed and sealed this 17th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PC-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.