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Dinning

[11] **3,827,491**

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[54] **APPARATUS FOR SELECTIVELY RECEIVING AND RELEASING WELL TOOLS**

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[52] **U.S. Cl.**..... **166/154,** 166/224 R, 166/242

[51] **Int. Cl.**..... **E21b 33/16,** E21b 33/00

[58] **Field of Search** 166/154, 153, 224, 242

[56] **References Cited**

UNITED STATES PATENTS

3,334,690	8/1967	Garrett	166/153
3,419,074	12/1968	Brown	166/153
3,527,297	9/1970	Todd	166/154
3,606,926	9/1971	Schwegman	166/154

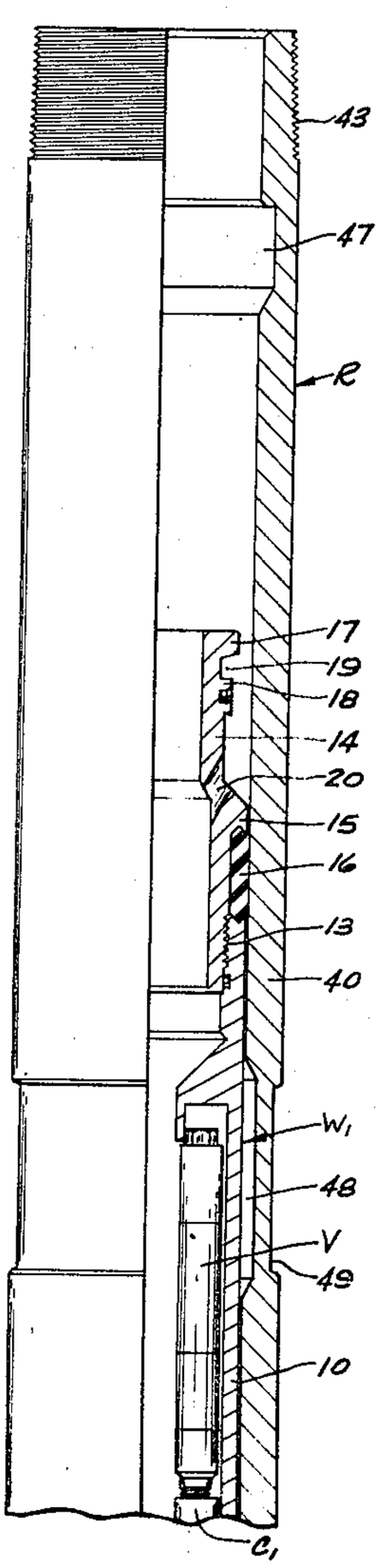
Primary Examiner—James A. Leppink

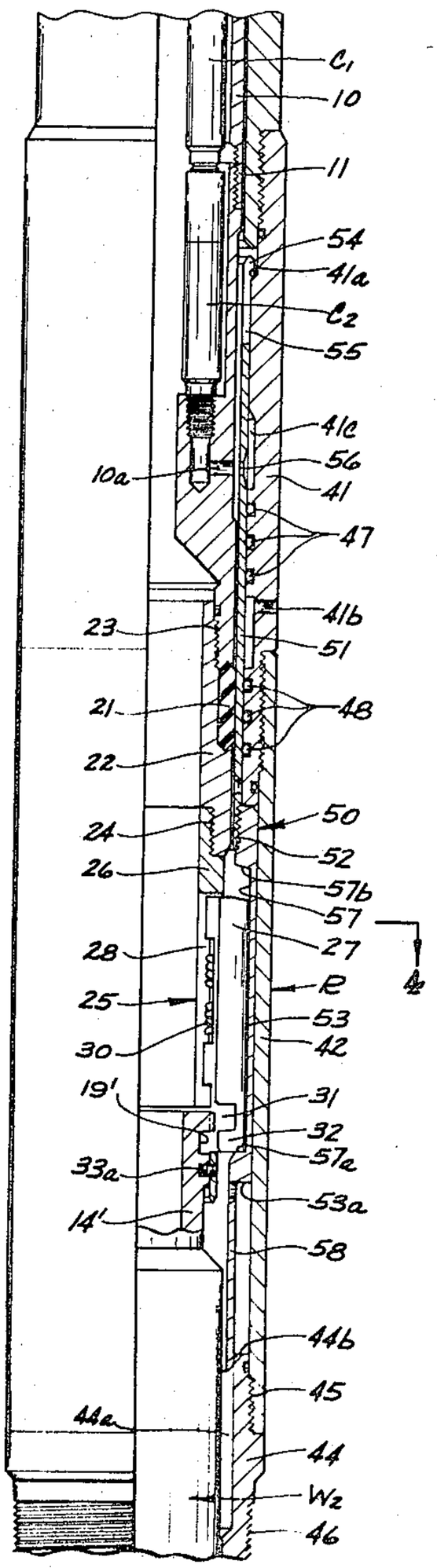
Attorney, Agent, or Firm—Torres & Berryhill

[57] **ABSTRACT**

Apparatus for selectively receiving a well tool within a well conduit comprising: a tubular housing adapted for connection in a well conduit; a tubular sleeve disposed within the housing for limited movement between an upper closed position and lower open position; cooperable ports in the sleeve and housing, registerable when the sleeve is in the lower position, to provide fluid communication between the interior and exterior of the conduit; and a latch recess engageable by latches on the well tool for receiving the well tool and moving the sleeve from its closed position to its open position as the well tool is moved downwardly through the conduit. Seals may be provided between the well tool and the sleeve and housing respectively, isolating the upper end of the sleeve from the pressure within the conduit, the lower end of the sleeve being subjected to the pressure within the conduit. The upper end of the sleeve may be in fluid communication with the exterior of the conduit through the ports when the sleeve is in its open position.

22 Claims, 5 Drawing Figures





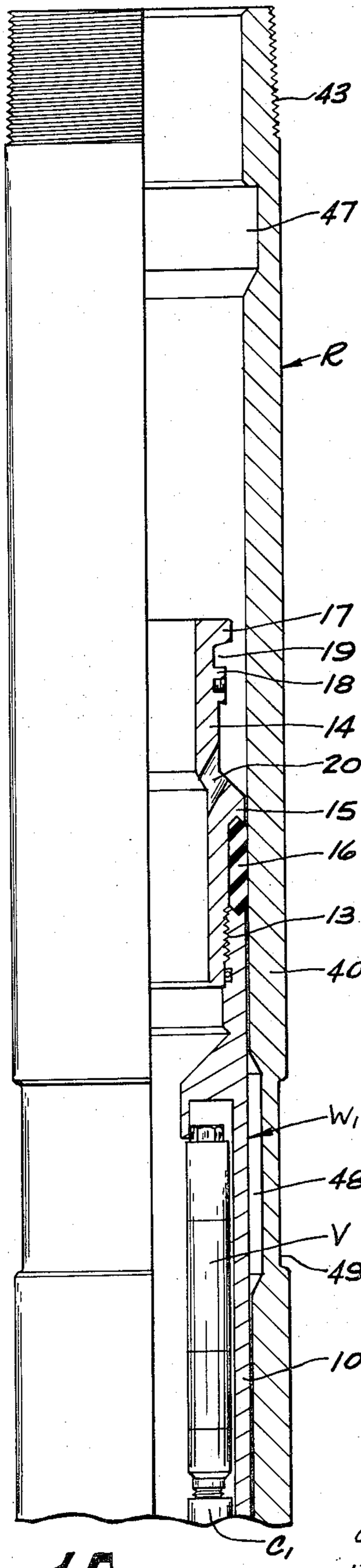
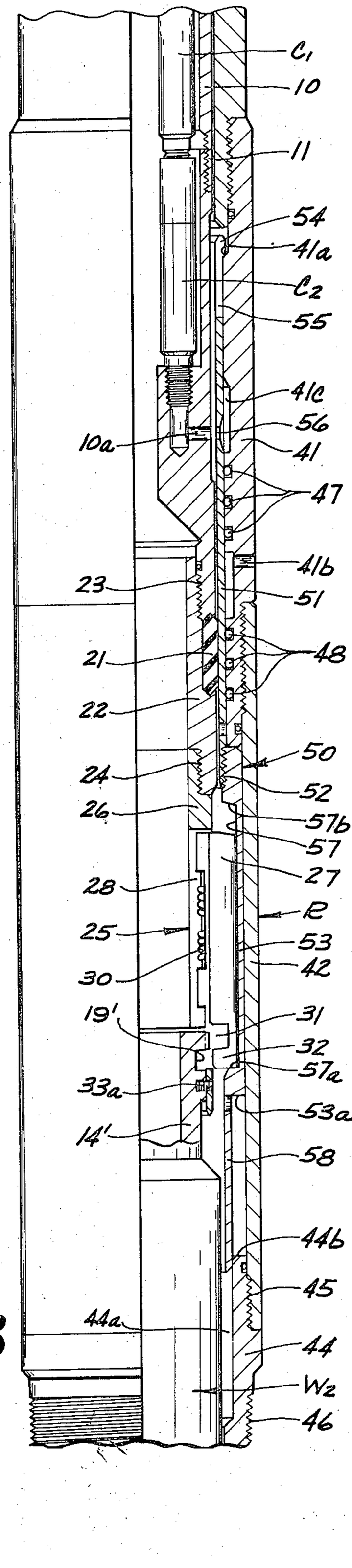

43
47
R
17
19
18
14
20
15
16
13
40
W1
48
V
49
10
C1

Fig. 1A


C1
10
11
54
41a
C2
55
41c
56
10a
41
47
41b
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50
24
52
26
57b
57
27
28
R
25
53
30
42
19'
31
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33a
53a
14'
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44b
45
44a
44
W2
46
4
4

Fig. 1B

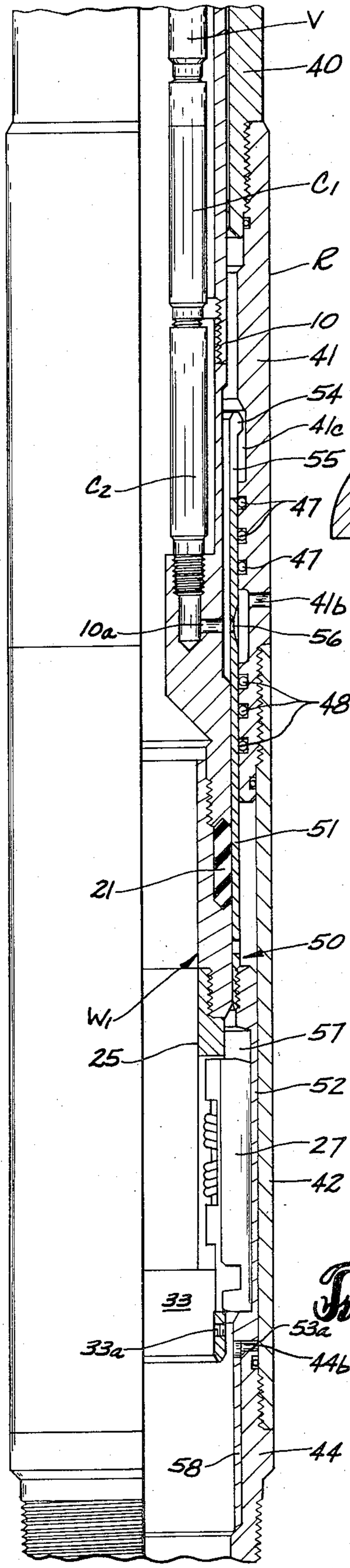

Fig. 2

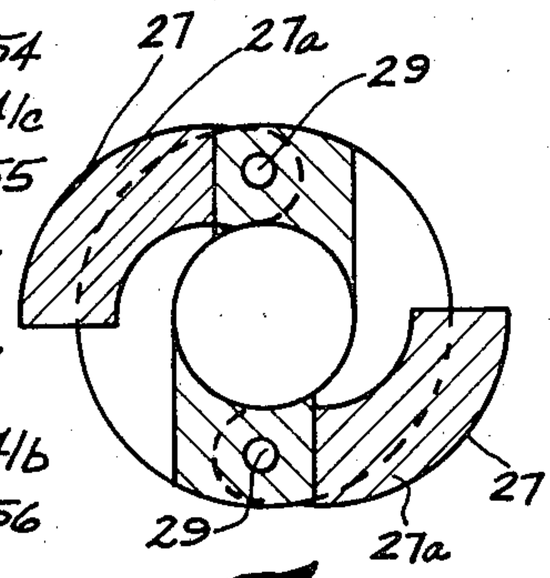

Fig. 4

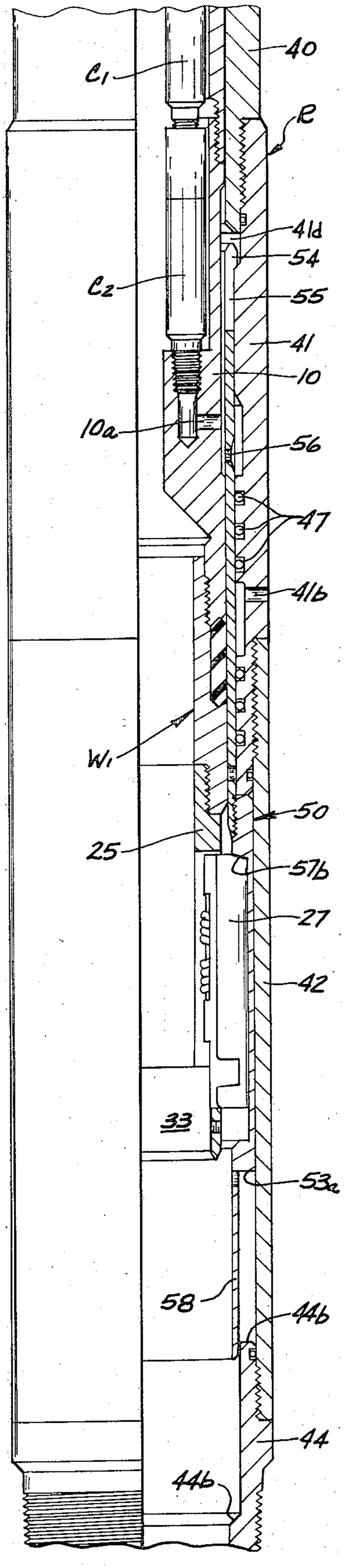

Fig. 3

APPARATUS FOR SELECTIVELY RECEIVING AND RELEASING WELL TOOLS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to well tools. In particular, the present invention pertains to well tools and apparatus for receiving such well tools within a well conduit. Still more specifically, the invention pertains to well tools and apparatus suitable for implementing a gas lift system for the production of petroleum liquids.

2. Brief Description of the Prior Art

Petroleum wells normally employ a tubing string extending from the surface of the well into a producing formation. The tubing string is usually concentrically surrounded by a larger diameter casing string. The tubing string often contains valves, at various locations, for injecting gas, chemicals, etc., or for controlling various conditions encountered in the completion of wells and production of petroleum liquids from such a well. For example, the producing formation of such a well may lack the natural pressure necessary for natural flow of liquids to the surface. In such cases, an artificial form of lift must be employed. One popular method of artificial lift is by injecting gas, at various levels of the tubing string. The gas mixes with the petroleum liquids producing a mixture of lower specific gravity and allowing a continuous flow of the mixture.

Gas lift valves are normally lowered through the tubing string for installation in special mandrels at predetermined positions within the tubing string. Sometimes the valves are installed in special mandrels in the tubing string at the surface and lowered into position in the producing well with the tubing. In another way of installing such valves, the valve is suspended on a wire line and lowered through the tubing, which is already in place, to the desired depth.

More recently, gas lift valves have been installed by the use of through-flow-line tools (TFL) developed specifically for such uses. With such tools a plurality of valves may be releasably attached in a train to a motor or locomotive unit which is pumped downwardly through the tubing string. The valves are successively disengaged from the train and selectively received within a receiver assembly at the desired location. In some systems the valves are released and installed in their respective receiver assemblies one-by-one, tail valve first, as the train moves downwardly through the string. After all valves are installed the motor or locomotive unit is returned to the surface and removed from the tubing string. Such a system is shown and described in detail in U.S. Pat. No. 3,334,690 — Garrett. In other systems, the train is first pumped to the bottom of the tubing string. Then the train is reversed, releasing the valves one-by-one as the train moves back toward the surface. After all valves have been installed the motor or locomotive unit is removed from the tubing string. Such a system is fully described in U.S. Pat. No. 3,419,074 — Brown.

With through-flow-line tools (TFL), as well as in others, some means must be provided for allowing fluid communication between the casing and the gas lift valve. The gas lift valve then controls fluid communication with the tubing string. In the past, it has been necessary to perforate the tubing string or its receiver assembly to allow such communication. This procedure is difficult and somewhat hazardous, since there is usually a period of time, before installation of the gas lift valve, when there is no control over the fluid communication between the casing and tubing string. Various valve devices have been developed to solve this problem. However, most of them are rather complex and inherently disadvantageous for various other reasons. One such valve is the spool type shown in and described in the aforementioned U.S. Pat. No. 3,334,690. Another is the sleeve type valve shown in the aforementioned U.S. Pat. No. 3,419,074. One of the problems encountered in the sleeve type valve is adapting such a valve for opening and closing, yet allowing easy installation and removal of gas lift valves from the receiver assemblies. In the past it has been necessary to utilize a special tool for selectively engaging and disengaging the sleeve valve on both installation and removal. The tools and apparatus of such sleeve valves have been relatively complicated.

SUMMARY OF THE PRESENT INVENTION

The present invention pertains to apparatus, including a receiver assembly for selectively receiving well tools, such as gas lift valves, attached to a through-flow-line pumpdown train. The receiver assembly may comprise a tubular housing adapted for connection in the well conduit and a tubular sleeve disposed within the housing for limited movement between an upper closed position and a lower open position. The sleeve and housing are provided with cooperable ports which are registerable, when the sleeve is in the lower position, to provide fluid communication between the interior and exterior of the conduit. Seals may also be provided between the well tool and the sleeve and housing, respectively, isolating the upper end of the sleeve from the pressure within the tubing string, the lower end of the sleeve being subjected to pressure within the tubing string. The upper end of the sleeve may be in fluid communication with the casing string through the cooperable ports, when the sleeve is in its open position.

With the apparatus of the present invention a tool train including a leading motor or locomotive unit and a purality of well tools, i.e., gas lift valves, releasably connected thereto, may be pumped downwardly through the tubing string. Each of the well tools may be provided with selective latches for selectively engaging a corresponding receiver assembly to successively release the last of the well tools as the tool train moves downwardly through the conductor. As a particular well tool engages its corresponding receiver assembly, the sleeve is shifted from a closed position to its open position, permitting fluid communication with the casing string. Fluid communication is also established between the casing string and tubing string through the well tool, i.e., the gas lift valve. After all well tools are installed, the motor or locomotive unit is returned to the surface and the well is ready for production.

To block fluid communication between the casing and tubing string and to remove the gas lift valves, it is first necessary to raise the pressure within the tubing string above a certain predetermined level. The pressure differential between the upper end of the sleeve (casing pressure) and the lower end of the sleeve (tubing pressure) causes the sleeve to shift from its downwardly open position to its upper closed position, preventing further flow communication between the cas-

ing and tubing string. Then the well tools (gas lift valves in this case) can be removed from the tubing string by any appropriate means, e.g., motor or locomotive unit, wire line tools, etc.

Thus, the apparatus of the present invention provides a simple means by which fluid communication can be established or prevented between the casing string and the tubing string. This fluid communication is made possible through the unique sleeve valve design which also allows easy installation and removal of well tools in and from the receiver assemblies. The apparatus is easily installed, maintained and operated. It is relatively simple and inexpensive to manufacture. Other objects and advantages of the invention will become apparent from the description and claims which follow when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A and 1B are vertical elevation views, in quarter section, of a well tool and apparatus for selectively receiving such a well tool in a well conduit, according to a preferred embodiment of the invention, FIG. 1A being the upper portion and FIG. 1B being the continued lower portion, and showing the well tool and receiving apparatus upon initial engagement of the well tool with the receiver apparatus;

FIG. 2 is a quarter sectional elevation view, similar to FIG. 1B, showing the well tool and receiving apparatus after full engagement and shifting of the receiving apparatus sleeve to its open position;

FIG. 3 is a quarter sectional elevation view, similar to FIGS. 1B and 2, showing the well tool and sleeve of the receiving apparatus shifted to an upper closed position to permit removal of the well tool; and

FIG. 4, taken along line 4—4 of FIG. 1B is a horizontal cross-section of the well tool and receiving assembly for the primary purpose of understanding the well tool latches.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring first to FIGS. 1A and 1B, there is shown a receiver assembly R, a well tool W_1 and the upper portion of another well tool W_2. The receiver assembly R represents any number of such assemblies which may be installed at various levels within a well conduit, usually the tubing string. The purpose of the receiver assembly R is to selectively receive a well tool W_1 for installation in the well conduit.

One type of well tool with which the present invention is intended to be used is the gas lift valve. In gas lift systems, there are a plurality of such valves installed at axially spaced intervals either within the tubing string or externally thereof, such as in a surrounding casing. The purpose of the gas lift valve is to provide controlled fluid communication between the tubing string and the surrounding annulus within the casing string. Gas is usually pumped into the casing string and admitted into the tubing string by means of the gas lift valve. The gas lift valve may operate in response to casing pressure, tubing pressure or the differential therebetween. In any of these cases, the gas is injected into the fluid within the tubing string causing the specific gravity to be reduced and permitting flow to the surface which might not be possible under normal circumstances without a pump.

Gas lift valves may be installed by several methods. Sometimes the valves are attached to the tubing string as it is lowered into the well hole. In other methods, the gas lift valves are lowered into place on wire line equipment. More recently, a line of tools referred to as through-flow-line tools (TFL) or pumpdown equipment has been developed for pumping such valves into place. It is with this type of method that the present invention is contemplated for use. However, it can easily be adapted for wire line and other type installations.

The well tool W_1, illustrated in the drawings, includes such a gas lift valve V and cooperative check valves C_1 and C_2. For descriptive purposes, the gas lift valve V will be described as one responsive to tubing pressure (fluid operated). Such valves are commonly known and used in the industry and forms no part of the present invention except for being in combination with the other apparatus of well tool W_1. Of course, gas lift valves other than the tubing pressure responsive type could also be used with the present invention.

The well tool W_1 also includes a tubular housing or mandrel 10 within which the gas lift valve V and associated check valves C_1 and C_2 may be mounted. A threaded connection 11 may be provided for separating the mandrel 10 into two parts so as to allow assembly and disassembly of the valve V. Threadedly connected at 13 to the upper end of mandrel 10 is a coupling adaptor or pulling neck 14. Carried on the coupling adaptor 14 between an annular retaining shoulder 15 and the upper end of mandrel 10 is a seal 16 which provides a sliding seal between the well tool W_1 and the surrounding receiver assembly R. The upper end of the coupling adaptor 14 is provided with a pair of axially spaced annular lips or flanges 17 and 18 separated by groove 19, the purpose of which will be more fully understood hereafter. A fluid port 20 may be provided through the wall of coupling adaptor 14.

Another seal assembly, including seal 21 and adaptor 22, is threadedly connected at 23 to the lower end of mandrel 10. The seal 21 provides a sliding seal between the well tool W_1 and the surrounding receiver assembly R.

Threadedly connected at 24 to the lower seal assembly is a latch assembly 25. The latch assembly comprises a tubular latch housing 26 and a plurality of latches 27. Referring also to FIG. 4, the latches 27 are mounted within windows 28, cut in latch housing 26, on pins 29 for pivoting radially, inwardly and outwardly, between retracted positions and expanded positions. Torsion springs 30 may be provided, biasing the latches 27 in a radially outward or expanded position. The lower end of latches 27 are notched at 31 providing a lip 32, the purpose of which will be described hereafter. The lower end of latch housing 26 is counterbored at 33. See FIGS. 2 and 3 also.

The receiver assembly R may comprise a tubular housing which is made up, in the present case, of upper, intermediate and lower sections 40, 41, 42, respectively. The upper section 40 may be threaded at 43 for connection to an upper section of a tubing string. An adaptor 44, threadedly connected at 45 to lower housing section 42, may be provided with threads 46 for connection with lower sections of the tubing string. The upper housing section 40 may be provided with an internal annular groove 47, the purpose of which is to allow installation of other tools. Internal and external grooves 48 and 49 may also be provided on upper hous-

ing section **40.** These grooves reduce the wall thickness, so that housing section **40** may be perforated, should the sleeve and/or the well tool W_1 malfunction to the extent that intended flow communication between the casing and tubing strings is prevented.

Mounted for limited axial movement within the receiver housing is a sleeve member **50.** In the illustrated example, the sleeve comprises an upper reduced diameter portion **51** threadedly connected at **52** to a lower large diameter portion **53.** In FIG. **1B** the sleeve **50** is shown in its upper position. It is initially retained in this position by engagement of lugs **54** with upwardly facing annular surface **41***a* on housing section **41.** The lugs **54** are carried on the ends of upwardly extending collet fingers **55** formed by longitudinal cuts in the upper end of sleeve portion **51.** Radial ports **56** may be drilled in the upper sleeve section **51.** The radial ports **56** are in fluid communication with gas lift valve V and its associated check valves C_1 and C_2 through a port **10***a* provided in mandrel **10.**

Seals **16** and **21** isolate ports **10***a* and **56** from the interior of receiver assembly R and the tubing string to which it is attached. The receiver housing carries two sets of seals **47** and **48** which slidingly and sealingly engage the exterior of upper sleeve portion **51.** Thus, in the upper position shown in FIG. **1B**, seals **47** prevent fluid communication between ports **10***a* and **56** and the port **41***b* which communicates with the exterior of receiver assembly R (usually surrounded by a casing string). Thus, in the upper position shown in FIG. **1B** communication between the surrounding casing and tubing string through ports **41***b*, **56, 10***a* and gas lift valve V is prevented. The sleeve **50** can then be said to be in its upper or closed position.

The lower or larger diameter portion **53** of sleeve **50** is provided with an annular latch recess **57.** The longitudinal dimension of the latch recess **57** may be selected to correspond with the length of latches **27** for a particular well tool W_1. Therefore, a well tool, such as W_2, having longer latches will not engage recess **57,** allowing the well tool W_2 to pass through the receiver assembly R. However, when latches such as **27,** having corresponding lengths, pass through the receiver assembly R the latches **27** will be biased outwardly into the groove **57.** The bottom of the latches **27** are so designed that they will then engage the upwardly facing annular surface **57***a* preventing further downward movement of well tool W_1. The lower end of sleeve portion **53** may be reduced in external diameter to provide a tubular guide portion **58** telescopically receivable within a counterbored portion **44***a* of adaptor **44.**

In operation, a plurality of well tools W_1, W_2 etc., may be coupled together and attached to a motor or locomotive unit (not shown) and introduced into the tubing string at the surface of a well. Suitable motor or locomotive units are well known in the art. For present purposes it is sufficient to understand that such units are provided with seals engageable with the interior of the tubing string so that pressure may be applied at the upper end of the tubing string forcing the motor or locomotive unit and its attached train downwardly through the tubing string. The sleeve member **50** of each receiver assembly from the top down may be provided with increased length latch grooves **57.** Likewise, the well tools W_1, W_2 etc. may be provided with increasing length latches **27,** the shortest length latch being on the tail-end well tool, W_1 in the exemplary embodiment. Adjacent well tools, e.g., W_1 and W_2, are connected by telescopic engagement of the lower well tool's pulling neck **14'** within the counterbored portion **33** of latch assembly **25.** This connection is initially maintained by shear pin **33***a* and engagement of latch lip **32** with the pulling neck groove **19'**.

When the well tool W_1 which corresponds with a particular receiver assembly R reaches such receiver assembly, its latches spring outwardly into engagement with latch grooves **57.** Further pressure on the motor or locomotive unit of the train causes a downwardly directed force to be applied to the sleeve **50,** through latches **27,** until enough force is exerted to cause the ends of sleeve collet fingers **55** and their respective lugs **54** to be contracted inwardly, allowing the sleeve **50** to move downwardly to the position shown in FIG. **2.** Downward movement is arrested by the engagement of sleeve shoulder **53***a* with upwardly facing annular surface **44***b* of adaptor **44.** At this point the lugs **54** of collet fingers **55** are in registration with housing groove **41***c* and expand radially into engagement therewith, preventing premature return to the upper or closed position.

As the latches **27** move into engagement with the corresponding groove **57,** latch lips **32** disengage pulling neck groove **19'**. Further pressure is then applied to the motor or locomotive unit of the train until sufficient force is exerted to shear the shear pin connection **33***a* allowing tool W_2 and the remainder of the train to continue downwardly through the tuning string. The train continues its downward movement until all the remaining well tools are installed in their respective receiver assemblies.

In the lower or open position of FIG. **2,** the ports **10***a* and **56** are in registration with ports **41***b*, permitting fluid communication between the exterior of the receiver assembly R (casing string therearound) and the interior of the tubing string. This fluid communication is controlled, as is well understood in the industry, by gas lift valve V and its respective check valves C_1 and C_2. The seals **48,** along with seals **16** and **21,** prevent uncontrolled communication with the tubing string. It will be noted that the upper end of upper sleeve portion **51** is thus subjected to the pressure externally of receiver assembly R (casing pressure). The lower end of sleeve portion **51** and sleeve portion **52** is subjected to the pressure within the tubing string (tubing pressure). As long as the differential between casing pressure and tubing pressure is below a predetermined level, the sleeve **50** and well tool W_1 will remain in the downward or open position. This position is maintained during the operation of the gas lift system. Therefore, gas may be injected into the casing string and selectively controlled for injection into the tubing string by gas lift valve V.

Should it be desired to block communication with the casing string, such as is necessary to remove well tool W_1 for repair or replacement, the pressure within the tubing string would be raised. This could be accomplished by providing a check valve at the lowermost end of the tubing string, as is common practice. Increased pressure within the tubing string would cause the check valve to close, allowing continued tubing pressure increase. When the tubing pressure reaches a sufficient level the force exerted thereby on the lower end of sleeve **50** would overcome the force exerted on the upper end of the sleeve **50** by casing pressure and

the frictional forces, causing lugs **54** and collet fingers **55** to be contracted and forcing the sleeve **50** along with the tool W_1 to return to the upper or closed position of FIG. **3**. In the upper position, collet fingers **55** would again expand causing lugs **54** to reengage groove **41***d*. In this position seals **47** again block communication between ports **41***b* and **56**, preventing further communication between the casing string and the tubing string.

It is important to note that the upper end of sleeve **50** is isolated from the pressure within the tubing string by seals **16** and **21**. This unique feature is what permits the sleeve **50** to be shifted from the open or lower position to the closed or upper position by increasing the tubing pressure. No other such apparatus is known in the art.

To remove the well tools W_1, W_2, etc., pressure could then be applied, through the casing string, to a motor or locomotive unit at the bottom of the tubing string, causing the motor or locomotive unit to move upwardly through the tubing string. As it moves upwardly, it would reengage the lowermost well tool, causing its latches to be retracted and releasing it from its respective receiver assembly R. As the motor or locomotive unit and it's train move up the tubing string, it picks up successive well tools until well tool W_1 is reached where the same thing occurs. The upwardly directed force on well tool W_1 causes its latches **27** to be cammed inwardly, by virtue of cam surfaces **27***a* and frustoconical sleeve latch groove shoulder **57***b*. With the latches **27** fully retracted well tool W_1 is free to return to the surface of the well. Alternatively, wire line tools can be lowered into the tubing string for engagement with the annular lip **18** on adaptor **14** of well tool W_1 and successively lower well tools W_2, etc., for one-by-one removal thereof.

The latches **27** and the latch groove **57** described for use with the present invention depend on varying longitudinal lengths for selectiveness. There are, of course, other ways for providing such selectively. For example, the length of latches and latch grooves could be the same, depending on different latch and groove profiles for selectivity. This method of providing selectivity for a plurality of well tools installed at different levels is well known in the art.

Although the apparatus of the present invention has been described for installation with a pumpdown train in which the trailing well tools are released one-by-one as the train moves downwardly through the tubing string, it can easily be adapted for TFL tools which release the tools one-by-one from the bottom up. Furthermore, as previously indicated, the present invention can be adapted for use with wire line tools.

The present invention has been described for use with pumpdown trains in which a plurality of tools are installed one-by-one as the train moves through the tubing. It is possible, and even probable, that the present invention would be used for installing well tools one at a time. In such a situation, the motor or locomotive unit would be disposed above the well tool as it is pumped into place. Once the tool were installed, the motor or locomotive unit would be returned to the surface.

Although the present invention has been described for installing gas lift valves in a gas lift system, it can be used for installing any type of well tools which is to be installed at a predetermined location within a flow conductor. Many variations and adaptations of the present invention can be made by those skilled in the art without departing from the spirit of the invention. It is therefore intended that the scope of the invention be limited only by the claims which follow.

I claim:

1. Apparatus for selectively receiving well tools within a flow conductor comprising:

a. tubular housing means adapted for connection in said flow conductor;

b. sleeve means disposed within said housing means for limited axial movement between first and second positions;

c. first and second port means in said sleeve and housing means, respectively, cooperable with each other when said sleeve means is in said second position to provide fluid communication between the exterior of said conductor and said tool means;

d. latch recess means included with said sleeve means engageable by latch means on a well tool for receiving said well tool and moving said sleeve means from said first to said second position;

e. a first annular surface on said sleeve means in pressure communication with and responsive to an increase of pressure within said conductor above a predetermined level, when said well tool is received therein, to shift said sleeve means to said first position, preventing said fluid communication and allowing removal of said well tool from said conductor.

2. Apparatus as set forth in claim **1** in which said sleeve and housing means are provided with cooperable retainer means for retaining said sleeve means against premature movement between said first and second positions.

3. Apparatus as set forth in claim **2** in which said retainer means comprises a plurality of collet fingers carried by said sleeve means having lugs thereon engageable with annular grooves carried by said housing means in both said upper and lower positions.

4. Apparatus as set forth in claim **1** and a second annular surface on one end of said sleeve means, when in said second position, subjected to pressure on the exterior of said conductor, said first annular surface being on the opposite end of said sleeve means and being subjected to the pressure within said conductor.

5. Apparatus as set forth in claim **4** comprising first seal means between said well tool and said sleeve means and second seal means between said well tool and said housing means, said first and second seal means being axially spaced from each other on opposite sides of said first port means.

6. Apparatus as set forth in claim **5** comprising third and fourth seal means between said sleeve means and said housing means axially spaced from each other on opposite sides of said second port means.

7. Apparatus for selectively receiving well tools within a flow conductor comprising:

a. tubular housing means adapted for connection in said flow conductor;

b. sleeve means disposed within said housing means for limited axial movement between first and second positions;

c. first and second port means in said sleeve and housing means, respectively, cooperable with each other when said sleeve means is in said second posi-

tion to provide fluid communication between the exterior of said conductor and said tool means;

d. latch recess means included with said sleeve means engageable by latch means on a well tool for receiving said well tool and moving said sleeve means from said first to said second position;

e. seal means between said well tool and said sleeve and housing means, respectively, isolating one end of said sleeve means from the pressure within said conductor, the opposite end of said sleeve means being subjected to pressure within said conductor so that said sleeve means is movable from said second to said first position in response to an increase of pressure within said conductor above a predetermined level to prevent said fluid communication and to allow removal of said well tool from said conductor.

8. Apparatus as set forth in claim **7** in which said one end of said sleeve means is in fluid communication with the exterior of said conductor through said first and second port means when said sleeve means is in said second position.

9. Apparatus as set forth in claim **7** in which said sleeve means comprises a first portion of smaller diameter adjacent said one end and a second portion of larger diameter adjacent said opposite end, said first portion engaging said housing in sliding and sealing engagement therewith on opposite sides of said second port means.

10. Apparatus for selectively receiving a well tool within a well conduit comprising:

a. tubular housing means adapted for connection in said well conduit;

b. sleeve means disposed within said housing means for limited movement between an upper closed position and a lower open position;

c. cooperable port means in said sleeve and housing means registerable when said sleeve means is in said lower position to provide fluid communication between the interior and exterior of said conduit; and

d. latch recess means on said sleeve means engageable by latch means on said well tool for receiving said well tool and moving said sleeve means from said closed position to said open position as said well tool is moved downwardly through said conduit;

e. said sleeve means including upwardly and downwardly facing annular surfaces subjected to the pressure within said conduit, the area of said downwardly facing surfaces being greater than said upwardly facing surfaces so as to force said sleeve means into said upper position, blocking said flow communication and allowing removal of said well tool, upon an increase of pressure within said well conduit above a predetermined level.

11. Apparatus as set forth in claim **10** comprising seal means between said well tool and said sleeve and housing means, respectively, isolating the upper end of said sleeve means from the pressure within said conduit, the lower end of said sleeve means being subjected to the pressure within said conduit.

12. Apparatus as set forth in claim **11** in which said upper end of said sleeve means is in fluid communication with the exterior of said conduit through said port means when said sleeve means is in said open position.

13. Apparatus as set forth in claim **12** comprising other seal means between said sleeve means and said housing means, above and below said port means, when said sleeve means is in said open position.

14. Apparatus as set forth in claim **13** in which said sleeve means comprises an upper smaller diameter portion and a lower larger diameter portion, said other seal means sealingly engaging said upper smaller diameter portion.

15. Apparatus as set forth in claim **13** in which said port means comprises first and second ports in said sleeve and housing means, respectively, said other seal means isolating said first and second ports from each other when said sleeve means is in said closed position.

16. Apparatus as set forth in claim **11** comprising cooperable retainer means carried by said sleeve means and housing means, preventing premature movement of said sleeve means between said open and closed positions.

17. Apparatus as set forth in claim **11** in which said sleeve means is movable from said open position to said closed position, to prevent said fluid communication through said port means and to allow removal of said well tools from said sleeve means, upon an increase of pressure differential between the interior and exterior of said conduit above a predetermined level.

18. Apparatus as set forth in claim **11** in which said sleeve means comprises upper and lower portions joined by an intermediate portion of a larger outside diameter, the junction of said lower and intermediate portions providing a downwardly facing surface engageable with an annular shoulder on said housing means to limit the downward movement of said sleeve means.

19. Apparatus for selectively installing a plurality of well tools within a flow conductor comprising:

a. a plurality of receiver assemblies connected at axially spaced intervals in said flow conductor including housing means and sleeve means axially movable therein from a first position in which there is no fluid communication between the exterior and interior of said conductor to a second position in which fluid communication is provided between the exterior and interior of said conductor, cooperable port means in said sleeve and housing means, registerable when said sleeve means is in said second position, to provide said fluid communication;

b. a tool train including a leading locomotive unit and a plurality of well tools releasably connected thereto and pumpable through said conductor, each of said well tools being provided with selective latch means for selectively engaging one of said receiver assemblies to release the last of said well tools as said tool train moves through said conductor, seal means carried by each of said well tools engageable with its respective receiver assembly so as to isolate the upper end of said sleeve means from the internal pressure of said flow conductor; and

c. the sleeve means of a particular receiver assembly being movable from said first to said second position as its corresponding well tool is released from said train.

20. Apparatus as set forth in claim **19** comprising cooperable port means in said sleeve and housing means,

registerable when said sleeve means is in said second position, to provide said fluid communication.

21. Apparatus as set forth in claim 19 comprising other seal means between said sleeve means and said housing means blocking said fluid communication through said port means when said sleeve means is in said first position.

22. Apparatus as set forth in claim 19 in which the

lower end of said sleeve means is subjected to said interior pressure of said flow conductor, said sleeve means being movable from said second position to said first position in response to an increase of pressure differential, between the interior and exterior of said flow conductor, above a predetermined amount.

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