

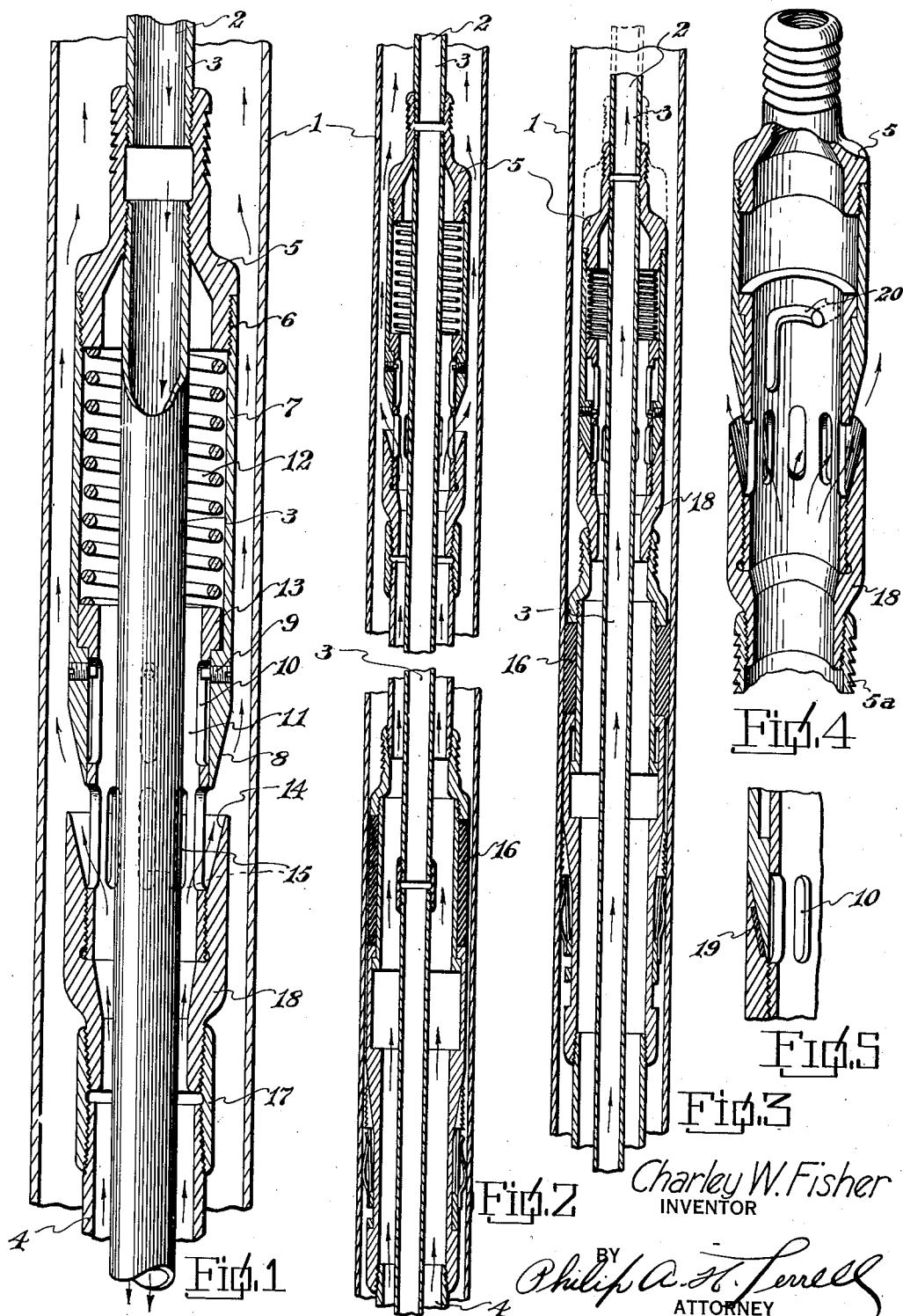
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OIL WELL VALVE

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OIL WELL VALVE

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The invention relates to oil well valves and particularly to a valve to be used in the tubing string in an oil or gas well and forming means whereby fluid passing from the well may be by-passed through the tubing string and around the packers, or around any number of packers.

It has been found that when a packer is run on the tubing string in the well casing and the hole is filled with fluid, the packer makes a very close fit in the casing, there is very little chance for the fluid to pass between the packer and the casing, as pressure builds up in the well under the packer, consequently the packer will move downwardly very slowly in the casing, therefore it is an object of the invention to provide valve means carried by the tubing string and controlling by-pass means around the packet, whereby the fluid may be discharged into the casing above the packer and around the tubing string.

A further object is to provide a valve cage having discharge ports around the tubing string in spaced relation with the tubing string and a valve carried by the tubing string and telescopically cooperating with the cage for closing the cage ports when the tubing string reaches the bottom of the well and the anchor, which carries the valve cage, is forced upwardly.

A further object is to provide the anchor with a frusto conically shaped valve around the valve cage and with which the spring actuated valve, carried by the tubing string, cooperates.

A further object is to provide a slidable connection between the valve sleeve and valve whereby the parts will move longitudinally in relation to each other, but will rotate together.

A further object is to provide valve means in connection with an anchor member through which the tubing string extends and forming means whereby fluid may by-pass packers carried by the string and anchor member, thereby relieving pressure beneath the packers for allowing rapid downward movement of the tubing string and free flowing of the well, particularly when there is a low pressure in the well. Also to allow rapid lowering of the string into the well casing when the well is flowing, or when the well has been mudded off to hold back the pressure coming from the producing formation.

With the above and other objects in view the invention resides in the combination and arrangement of parts as hereinafter set forth, shown in the drawing, described and claimed, it being understood that changes in the precise embodiment of the invention may be made within

the scope of what is claimed without departing from the spirit of the invention.

In the drawing:

Figure 1 is a vertical transverse sectional view through a well casing and tubing string, showing the valve means applied thereto.

Figure 2 is a vertical transverse sectional view similar to Figure 1, but showing conventional forms of packers on the tubing string, and the valve in open position for allowing by-pass of fluid around the packers and into the casing above the packers.

Figure 3 is a view similar to Figure 2, showing the valve closed and the fluid passing through the tubing string.

Figure 4 is a detail perspective view in section of the valve in open position and a bayonet slot connecting means for holding the valve in open position until adjacent tubing sections are partially rotated.

Figure 5 is a detail sectional view through one side of the valve showing a packing element in the frustoconically shaped valve seat.

Referring to the drawing, the numeral 1 designates the well casing, which is of conventional form, and disposed within the well casing is the tubing string 2, which is formed from a plurality of axially disposed sections 3. The tubing string 2 is provided with anchor section 4, which is adapted to engage the bottom of the well and to be forced upwardly when the tubing string is lowered into the casing. The anchor member 4 surrounds the tubing sections 3 and is supported by the reducer couplings 5, which also form a connection between adjacent tubing sections 3. Threaded on the coupling 5, at 6, is a valve sleeve 7, which surrounds the tubing string in spaced relation thereto and terminates at its lower end in a frustoconically shaped valve 8, which has a lug and slot connection 9 and 10 to a valve cage 11. The valve cage 11 is in sleeve form and is normally forced downwardly by an expansion spring 12, interposed between its upper enlarged end 13 and the lower end of the coupler 5, therefore it will be seen that the valve 8 will be maintained unseated in relation to the valve seat 14 during a lowering operation.

The cage valve 11 is provided with a plurality of ports 15 within the valve seat 14, therefore it will be seen when the valve 8 is unseated as shown in Figures 1 and 2, the fluid passing upwardly through the anchor 4 will by-pass the packer members 16 and be discharged into the casing 1 above the packer, thereby relieving pressure below the relatively tight packer, and allowing

the rapid lowering of the string 2 into the well, which is not the case with strings, as at present constructed, and wherein pressure builds up under the packers and retards the downward movement of the string. The packers are of conventional construction and it is to be understood that any kind of packer may be used. The anchor 4 is connected by means of a coupling 17, to the reducer coupling 18, which is connected to the cage valve 11.

When the string 2 reaches the bottom of the well, the anchor 4 is forced upwardly with the valve cage and valve seat 11 and 14 carried thereby against the action of the weight of the string and the expansive action of the coiled spring 12 until the valve 8 is seated in the valve seat 14, thereby cutting off the discharge of the fluid into the casing and at which time the fluid may be discharged from the well through the tubing string 2 as shown in Figure 3. It will be noted however, if it is desired to apply pressure for lifting the fluid, the tubing string may be raised as shown in Figures 1 and 2 and pressure may be forced downwardly through the tubing string 2, thereby causing the liquid to be forced upwardly through the anchor and valve cage 11 and into the casing. An intermittent operation of raising and lowering the tube string and applying pressure would build up a column of fluid in the casing 1 for discharging the same from the casing as distinguished from the tubing string. Such a system is particularly applicable to non-flowing wells.

If so desired any number of packers and valves may be used and the string raised or lowered for operating at different levels, however for purposes of illustration only one packer is shown.

Referring to Figure 5, a modified form of valve seat 14 is provided including a packing 19, otherwise the structure is the same. In Figure 4 is shown a structure particularly adapted for discharging from various levels, and in this structure, the tubing string does not extend through the valve cage and a bayonet slot connection 20 is provided. In many cases a series of openings are desired at various levels on the tubing, wherein the gas may be introduced at various points. This can be accomplished by putting valves in the string at several levels and not running the string clear through the valve. By threading the tubing into the top reducing coupling 5 and then threading another section 5a on the valve seat coupling 18 below the valve it will not be necessary to run the string through the valve, but at the same time a break in the tubing string will occur within the valve structure permitting gas induction into the tubing at this point. When a series of valves are used on the tubing string, it is obvious that when the tubing is raised to open the ports in the valve the one at the highest elevation will open first and by a continued lifting of the tubing string the next in line will open and so on to the lowest one. When closing, the lowest valve will close first and so on to the top. The bayonet slot connection 20 provides a positive means, other than spring for holding the valves open, however the valves can be closed by a partial rotation of the string sections.

The device has been found to be particularly desirable where relatively close packers are used on the string. In such structures there is very little chance for the fluid to pass between the packer and the casing, consequently pressure builds up under the packer, and the packer moves

downwardly into the hole very slowly. This difficulty is overcome by the by-passing valve. Packers are also retarded by particles of the rock formation being carried upwardly with the flowing fluid, and it will be seen that if relief passage is small or narrow, it becomes clogged and sealed, and the packer then acts as a wall-sealed piston, and the only relief would be up through the tubing string, which is not desirable because the fluid would spill over the top of the tubing string and create a fire hazard. Another advantage of the by-passing valve is in cases where the well has been mudded in to hold back the flow of oil and after the packer has been set. It is always customary to wash the mud out of the casing, and by the use of the by-passing valve, it is possible to either wash the mud out through the tubing by allowing pressure in the casing or to wash the mud out through the casing by induction of pressure in the tubing. These operations are not possible with the ordinary set up as at present used. If, after the mud has been washed out of the casing and tubing, the well has sufficient pressure to flow a large volume of oil through the casing, the valve is held open, permitting the fluid to flow up through the packer and out through the valve apertures. After the natural pressure of the well has diminished to a point where it is desirable to flow through the tubing, this operation is accomplished by letting down on the tubing, thereby closing the valve case ports, and as there is no outlet to the casing, the oil will be compelled to flow upwardly through the tubing.

The invention having been set forth what is claimed as new and useful is:

1. A valve of the character described, comprising an upper body portion, a lower body portion carrying an apertured sleeve anchored to the lower body portion and telescopically mounted within the upper body portion, both upper and lower portions having cooperating valve seating surfaces which will seal against each other when telescoped in one direction.

2. A valve as set forth in claim 1 including a means for preventing the upper body portion from revolving in relation to the lower body portion.

3. A valve as set forth in claim 1 including means to hold the upper body portion and the lower body portion extended during a running in operation.

4. A valve comprising an upper body portion mounted on a tubing string, a lower body portion having an apertured sleeve anchored to the lower body portion and extending upwardly and telescopically mounted in the upper body portion, means within the upper body portion cooperating with the telescopic sleeve and forming means for holding both body portions in extended relation to each other, a casing carrying a packer at its bottom end and suspended to the bottom end of the lower body section, said packer when set in the casing proper forming means for holding the lower body portion against vertical movement, seating surfaces carried by both body portions, said vertical movement of the tubing forming means for opening or closing the two seating surfaces.

5. A valve comprising an upper body portion having an enlarged chamber therein, a tubing string extending axially through said upper body portion and chamber therein, a valve cage sleeve slidably mounted in the lower end of the upper body portion, said cage having ports therein posi-

tioned below the lower end of the upper body portion when the cage is downwardly extended; a lower body portion surrounding the tubing string in spaced relation thereto, said cage being anchored within the lower body portion at a point spaced from its upper end, a valve seat carried by the lower body portion and surrounding the ports of the cage in spaced relation thereto and a valve element carried by the lower end of the upper body portion surrounding the cage and when in lowered position closing the ports in the cage and seating in the valve seat.

6. A device as set forth in claim 5 including an expansion spring within the chamber of the upper body portion, a shoulder carried by the

upper end of the valve cage and engaged by the spring, a shoulder in the upper end of the chamber of the upper body member and engaged by the spring, said shoulder carried by the upper end of the valve cage being limited by a shoulder within the chamber of the upper body member adjacent its lower end.

7. A device as set forth in claim 5 including an upwardly and horizontally extending bayonet slot carried by the upper end of the cage and a lug carried by the upper body member and extending into said slot and forming means whereby the upper body member may be maintained in raised position.

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