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PACKER AND VALVE

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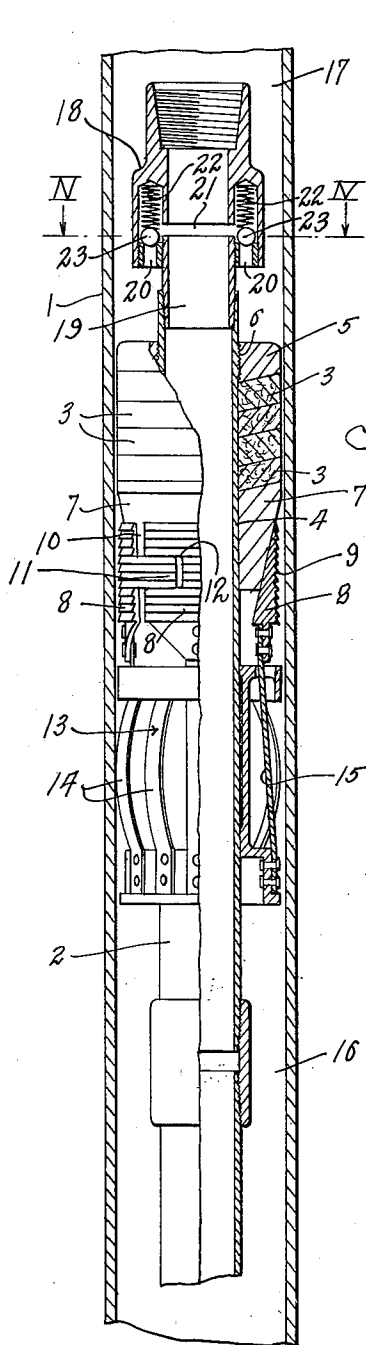


Fig. 1.

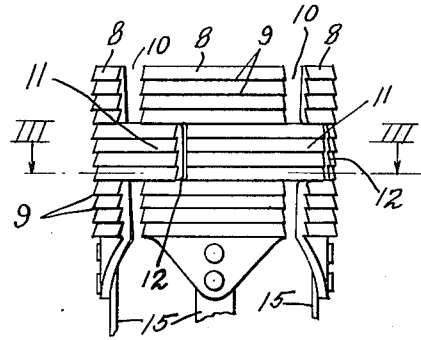


Fig. 2.

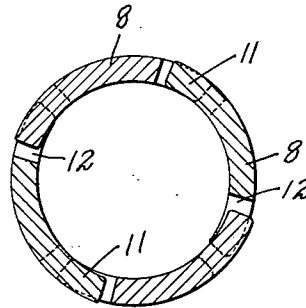
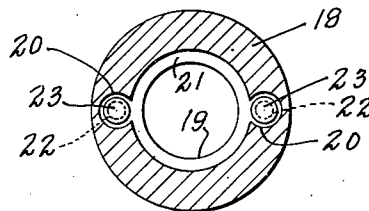


Fig. 3.

Fig. 4.



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PACKER AND VALVE

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6 Claims. (Cl. 166—12)

My invention relates to oil-well packers, and has particular reference to the combination of an oil-well packer and a valve for maintaining pressure upon fluid in an oil-well.

In the pumping of oil-wells it is the common practice to insert within the well casing a device which closes off the oil-well casing at a predetermined level, thereby dividing the casing into two separate chambers, namely an upper chamber and a lower chamber through both of which chambers extends a tube or pipe through which oil may be pumped from the lower compartment to the top of the well by means of fluid pressure which is placed in the upper compartment between the oil-well casing and the pump tubing.

In combination with packers dividing the casing into upper and lower compartments, I find that it is especially desirable to place a valve in the pump tubing immediately above such packer so that the oil or gas or other fluid which is employed for pumping the well may pass from the exterior of the tubing in the upper compartment to the interior of the pump tubing and it is, therefore, an object of my invention to apply a valve at such position which will effectively prevent back-flow of pressure from the interior of the pump tubing to the interior of the casing in such upper compartment.

Another object of the invention is to provide a valve of the character set forth in the preceding paragraph in which the valve is constructed to automatically close by gravity.

Another object of the invention is to provide an oil-well packer set in place by means of slips which are adapted to engage the interior surface of the oil-well casing throughout the entire inner circumference of the oil-well casing.

Another object of the invention is to provide a slip construction for oil tools which will engage the interior of an oil-well casing throughout the entire circumference of said casing.

Other objects and advantages will be apparent from a study of the following specifications, read in connection with the accompanying drawing, wherein

Figure 1 is a vertical elevational view partly in section of an oil-well packer and valve constructed in accordance with my invention;

Figure 2 is a detail, elevational view of a set of slips which may be employed for the setting of a packer or other oil-well tool constructed in accordance with my invention;

Figure 3 is a detail horizontal sectional view taken along the line III—III of Figure 2; and

Figure 4 is a detail horizontal sectional view taken along line IV—IV of Figure 1.

Referring particularly to Figures 1, 2 and 3, I have illustrated a section of oil-well casing 1, within the interior of which is located a flow tubing 2 which may be formed of any desired construction providing an interior passage through which oil from the well may flow without communicating with the casing 1.

Immediately above the casing 1, I provide what is known as a packer which consists of a plurality of annular rings of packing material 3 mounted upon an interior nipple 4 having a flange 5 rigidly secured as by threads 6 to the nipple 4 resting upon the upper surface of the packing rings 3. The lower surface of the packing rings 3 preferably abut upon a cone-shaped slide 7, the exterior surface of which forms a wedge-like construction along which slips 8 may slide. The slips 8 are illustrated as being formed of substantially wedge-shaped cross section, the exterior surface of which is provided with a plurality of teeth 9 constituted by a series of serrations in the exterior base of the slips 8, while the exterior surface of the slips presents a smooth, tapered surface engaging the tapered exterior surface of the cone-shaped slide 7.

It will be observed that each of the slips constitutes a segment of a cylinder of such width that when all of the slips are assembled together around the slide 7 such assembled slips do not completely enclose the slide 7, there being spaces 10 between adjacent slips whereby these slips may move inwardly toward each other and outwardly relative to each other as their tapered interiors ride up upon the tapered exterior of the cone-slide 7. However, it will be observed that each of the slips 8 is provided along its mid-section with an extending tongue 11 engaging a corresponding recess or groove 12 formed in the opposite side of the adjacent slip. Thus each of the slips, though capable of inward and outward movement relative to the cone 7 independent of the others, is fixed against longitudinal movement relative to the remainder of the slips.

It will also be observed that by the overlapping construction of the tongues 11 and recesses or grooves 12, the area of the casing 1 engaged by any one slip is of greater width than the width of the main body of the slip. Thus while the exterior surface of the main body of each of the slips engages a section of the interior of the casing 1 equal to its width, the midportion upon which the extending tongue 11 is formed engages

the casing 1 throughout that portion of the interior surface of the casing 1 which would be aligned with the space 10 between adjacent slips. In this way the grip of the assembled slips extends not to a plurality of points or sections of the casing 1, as is the usual practice, but such contact actually extends throughout the entire internal circumference of the casing 1.

With the construction thus far set forth, it will be apparent that even though considerable pressure is exerted upon the wedge-shaped slips 8 tending to force them into the walls of the casing 1, such pressure will be exerted evenly throughout the interior circumference of the casing, and there will be no tendency for the casing to be distorted out of its true circular shape, as is the case where a number of separate slips are used which do not have the overlapping sections 11 and 12.

It frequently occurs that in the setting of various oil tools with slips, the forces exerted by the slips upon the casing 1 may reach the value of several tons and this distorts the casing. In the case where three slips of the ordinary type are used, the casing is stretched into a substantially triangular shape, while, where four of the ordinary slips are used, the casing is frequently stretched into a substantially square cross section, making it extremely difficult to remove such casing or to thereafter pass tools through the distorted portions of the casing. With my slips having the overlapping portions 11 and 12 such distortion is entirely avoided the contact of the slips with the casing being throughout the entire circumference of the casing, the distorting forces are evenly applied throughout the circumference, and there is no opportunity for the casing to stretch out of its true circular shape.

While herein I have illustrated the slips 8 as being associated with a packer, it will be apparent to those skilled in the art that the slip construction and arrangement as shown herein is equally adaptable to other oil-well tools, such as tubing catchers, elevators, and other devices which require an engagement between two pipes or between pipes and tools in oil-well practice.

In Figure 1 I have illustrated the packer and slips as associated with the usual anchors 13 having springs 14 normally engaging the interior walls of the casing 1 and arranged in the manner well-known to those skilled in the oil-well practice to drag on the casing 1 to exert a resistance to the downward movement of the slips 8 when it is desired to separate the same in gripping relation with the interior of the casing 1. The anchor 13 is connected to each of the slips 8 by means of rings 15, there being one of such rings connected to each of the slips as indicated in Figures 1 and 2.

When the packer illustrated herein is to be employed in connection with flow tubing through which oil or gas is adapted to flow from the bottom of the well to the surface thereof the packing rings 3 are placed in the casing 1 to divide the casing into a lower chamber 16 and an upper chamber 17 so that gas or oil may be pumped down through the upper chamber 17 and may be permitted to flow into the flow tubing 2 at a point above the packer. For example, in certain types of wells it is desirable to apply a predetermined pressure in the upper chamber 17 which is not desired to be transmitted to the lower chamber 16, and in such cases a valve is interposed between the upper chamber 17 and the interior of the flow tubing 2. However, such

valves as have heretofore been used are not positive in their operation and when pressure is relieved in the chamber 17 there is a tendency for the gas or liquid in the flow pipe 2 above the packer to flow back into the upper chamber 17 or for the pressure in the chamber 17 to leak through the valve so that when it is again desired to flow the well it is necessary to apply considerable pressure for a considerable length of time before the pressure within the flow pipe reaches the value necessary to make the well again flow.

I propose to use a valve intercommunicating the upper chamber 17 with the interior of the flow pipe 2 constructed as shown in Figures 1 and 4 wherein a bushing 18 is illustrated as being connected to the upper end of the nipple 4, the central longitudinal bore 19 of which constitutes an extension or a section of the flow pipe 2. The bushing 18 is of considerably greater diameter than the nipple 4 through the lower wall of which I provide a plurality of bores 20 extending vertically in parallel relation with the central bore 19. Each of the bores 20 constitutes a port communicating with a radial passage 21 extending into communication with the interior of the central bore 19 while the bore-forming ports 20 extend a considerable distance above the radial opening 21 to form a seat or pocket in which may be located a spring 22 which bears upon the upper surface of a ball 23. Thus the ball 23 is pressed into tight engagement with the port 20 and closes the same in the manner of a check valve which prevents the flow-back of pressure from the interior of the flow pipe 2 to the upper chamber 17 formed in the casing. With this construction it will be observed that not only does the spring 22 tend to seat the ball 23, but such ball will seat by gravity securely upon the port 20 and it has been found in practice that by using this construction substantially no leakage of pressure occurs.

While I have shown and described the preferred embodiment of my invention, it is to be understood that I do not wish to be limited to any of the details shown herein, except as defined in the appended claims.

I claim:

1. In an oil-well packer, a nipple, a plurality of packing rings surrounding said nipple, a pressure cone surrounding said nipple adapted to move along said nipple to compress said packing rings, and slips on said nipple for engaging said cone and a casing in which said packer is placed, said slips having interengaging members thereon distributing the area of contact with said casing throughout the entire inner circumference of said casing.

2. In an oil-well packer, a nipple, a plurality of packing rings surrounding said nipple, a pressure cone surrounding said nipple adapted to move along said nipple to compress said packing rings and slips on said nipple for engaging said cone, a casing in which said packer is placed, said slips having interengaging members thereon distributing the area of contact with said casing throughout the entire inner circumference of said casing, and a check valve interposed between said nipple and said casing immediately above said packing ring, said check valve closing by gravity.

3. In a packer assembly for oil-wells, a plurality of packing rings, means for compressing said rings into engagement with a well casing to divide the well casing into upper and lower chambers, a flow pipe associated with said packing

rings through which oil from the lower chamber may pass, means intercommunicating said upper chamber with the interior of said flow pipe, and valve means associated with said intercommunicating means for closing communication between said upper chamber and said flow pipe and operable by gravity.

4. In the packer assembly for oil-wells, a plurality of packing rings, means for compressing said rings into engagement with a well casing to divide the well casing into upper and lower chambers, a flow pipe associated with said packing rings through which oil from the lower chamber may pass, means intercommunicating a valve for said upper chamber with the interior of said flow pipe comprising a bushing having a longitudinal opening therethrough communicating with said flow pipe, a plurality of bores extending parallel to said central opening, each of said bores comprising a port and intercommunicating the exterior of said bushing with said central opening, and gravity-actuated valves for closing said ports.

5. In a packer assembly for oil-wells, a plurality of packing rings, means for compressing said rings into engagement with a well casing to divide the well casing into upper and lower chambers, a flow pipe associated with said packing rings through which oil from the lower chamber may pass, valve means intercommunicating said upper chamber with said flow tubing including

a bushing having a longitudinal bore extending therethrough adapted to form a vertical section of said flow tubing, a second bore extending from the lower surface of said bushing in a direction parallel to said central bore, a passage intercommunicating said second bore with the interior of said central bore, and a ball valve located in said second bore below said passage adapted to close said second bore by gravity.

6. In a packer assembly for oil-wells, a plurality of packing rings, means for compressing said rings into engagement with a well casing to divide the well casing into upper and lower chambers, a flow pipe associated with said packing rings through which oil from the lower chamber may pass, valve means intercommunicating said upper chamber with said flow tubing including a bushing having a longitudinal bore extending therethrough adapted to form a vertical section of said flow tubing, a second bore extending from the lower surface of said bushing in a direction parallel to said central bore, a passage intercommunicating said second bore with the interior of said central bore, a ball valve located in said second bore below said passage adapted to close said second bore by gravity, an extension of said second bore above said passage, and a spring interposed in said extension engageable with said ball valve to assist gravity in seating said ball valve.

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