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L. SPENCER

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CIRCULATION VALVE FOR CEMENT RETAINERS

Filed March 23, 1940

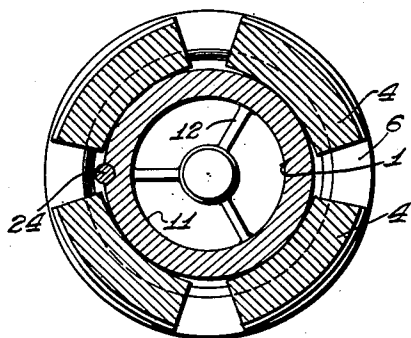
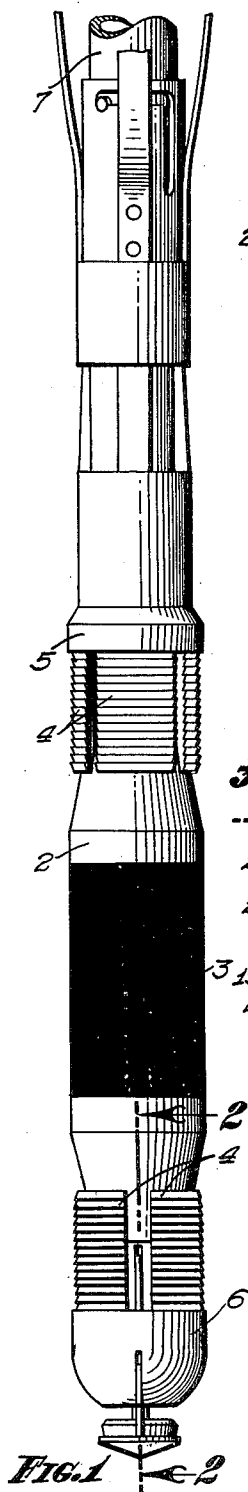


FIG. 5

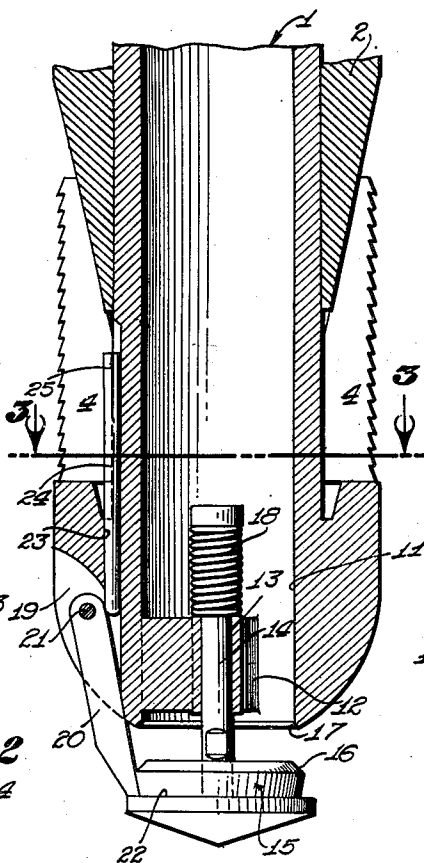


FIG. 2

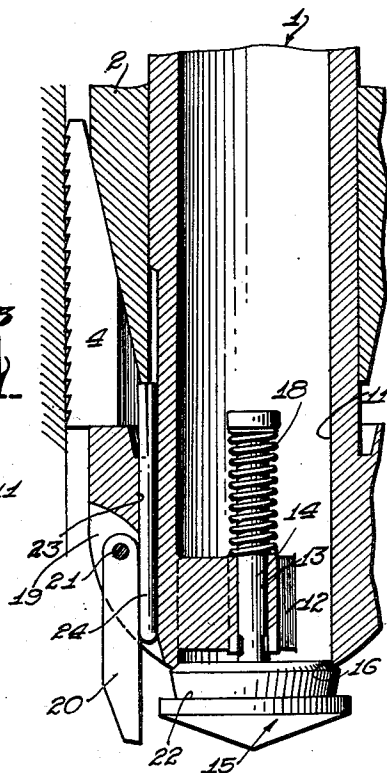


FIG. 4

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## UNITED STATES PATENT OFFICE

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CIRCULATION VALVE FOR CEMENT  
RETAINERS

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Application March 23, 1940, Serial No. 325,618

2 Claims. (Cl. 166—12)

My invention relates to circulation valves for cement retainers, and among the objects of my invention are:

First, to provide a valve structure for cement retainers or bridging plugs which is in the nature of a check valve adapted to close against the upward flow of fluid through the cement retainer or bridging plug and which incorporates a novel means for initially holding the valve member open while the cement retainer or bridging plug is being lowered into position within a well bore, said means automatically releasing the valve upon setting the cement retainer or bridging plug;

Second, to provide a circulation valve of this type which is particularly adapted to be incorporated with the type of bridging plug shown in copending application, Serial No. 308,608, or in association with a similar structure adapted to be lowered and manipulated by tubing such as shown in copending application, Serial No. 330,830, filed April 22, 1940;

Third, to provide a valve construction of this class and restraining means therefor which is operative entirely from the outer side of the bridging plug or cement retainer so that the valve member itself may constitute the sole avenue of communication to the interior of the bridging plug or cement retainer from the lower end thereof;

Fourth, to provide a structure of this character which requires no extra manipulation of the bridging plug or setting tool to release the check valve, inasmuch as the release is accomplished by the normal movement of the parts of the bridging plug or cement retainer when setting the same;

Fifth, to provide a restraining means for a circulation valve incorporated in a bridging plug or cement retainer which in no manner interferes with the normal operation thereof; and

Sixth, to provide, on the whole, a novelly constructed circulation valve and restraining means therefor which is particularly simple and economical to manufacture, and positive in its action.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawing, in which:

Figure 1 is an elevational view of a bridging plug or cement retainer, as the case may be, with one form of setting tool therefor shown fragmentarily;

Figure 2 is an enlarged fragmentary sectional view through 2—2 of Figure 1, showing particu-

larly the construction of the valve member and restraining means, the parts being shown in the positions assumed when the bridging plug or cement retainer is being lowered into the well casing;

Figure 3 is a transverse sectional view through 3—3 of Figure 2; and

Figure 4 is a fragmentary longitudinal sectional view similar to Figure 2, but showing the parts in the positions assumed when the bridging plug or cement retainer has been set and the valve is in its normal position to seal against upward flow of fluid therethrough.

Hereinafter in the specification the device to which my valve structure is adapted will be referred to as a cement retainer. The cement retainer and bridging plug are, in most respects, identical, the essential difference being more in their use than in their construction; that is, the cement retainer is usually employed in association with a tubing string for the purpose of pumping cement downwardly through casing to a point below the position in which the cement retainer is set. The cement retainer serves to prevent the cement from back-flowing through the cement retainer and into the casing above, particularly after the pressure has been removed from the tubing string through which the cement was introduced, or the tubing string disconnected from the cement retainer. The bridging plug serves principally to form a false bottom to the well bore and the valve structure serves principally as a means to permit free flow of fluid past the bridging plug when lowering the same into the well bore.

With reference to the drawing, the cement retainer comprises a tubular mandrel 1, upon which is slidably mounted a pair of cones 2. Between the cones is mounted a packing sleeve 3 of rubber or similar material. The cones 2 converge outwardly with respect to each other, that is, in directions away from the sleeve 3 and are adapted to coact with sets of slips 4. The upper set of slips 4 is engaged by a sleeve 5 which is adapted to move downwardly on the mandrel 1 and the lower slips abut against a head member 6 formed integrally with the lower end of the mandrel 1. Thus, upward movement of the mandrel and downward movement of the sleeve 5 causes the sleeve member 3 to compress axially and expand radially to form a sealing connection with the surrounding casing, and the sets of slips ride upwardly on their respective cones to engage the surrounding casing and lock the parts in position. The mandrel 1 is suitably attached to the

lower end of a tubing string 7 in cooperative relation with a suitable setting tool shown fragmentarily.

The structure above described is, insofar as this application is concerned, conventional, the present invention being directed to a valve provided in the head member 6 and special means for holding the valve open during initial movement of the cement retainer into the well.

The mandrel 1 is provided with a bore 11 which continues through the head 6. A spider 12 is cast or otherwise formed in the lower end of the passage 11 and supports a centrally disposed guide 13 which slidably receives a stem 14 of a check valve 15. The check valve 15 is provided with a valve face 16 which coacts with a valve seat 17 formed at the lower end of the passage or bore 11. A comparatively weak spring 18 is interposed between the upper end of the guide 13 and the upper end of the stem 14 to urge the valve to its closed position shown in Figure 4.

At one side the head member 6 is provided with a slot 19 in which is fitted a journal arm 20 supported by a journal pin 21. The arm 20 extends axially beyond the head 6 and is adapted to fit into a channel 22 formed around the valve member 15 below the valve seat 16. When the lever 20 is in engagement with the channel 22 the valve 15 is held in its open position, as shown in Figures 1 and 2.

The slot 19 is intersected by a longitudinal passage 23 which extends upwardly beyond the head member 6, forming a groove in the outer surface of the mandrel 1. The passage 23 receives a pin 24 which is adapted to be engaged by the end of the lower cone 2 when the cone 2 moves toward the head 6 during the setting operation of the cement retainer. The pin 24 is positioned between adjacent slips 4 so as not to interfere therewith. The upper end of the pin 24 may be split or otherwise deformed slightly so that the pin will frictionally engage the walls of the opening 23 and move no further than urged by the cone 2. The pin 23 is so positioned as to engage the radially inner side of the lever 20 and force its lower end radially outward away from the valve 15, that is, from the position shown in Figure 2 to the position shown in Figure 4.

Operation of my valve structure is as follows: Before the cement retainer is lowered the pin 24 is inserted, as shown in Figure 2, the valve 15 is moved from its seat and the lever 20 is positioned to restrain the valve in its open position. In this connection, it should be noted that, while only one lever 20 is shown, two or more such levers may be provided for engagement on opposite sides of the valve. The cement retainer is suitably connected with a setting tool and with the

tubing string 7 and lowered to the desired position in the well bore. While the cement retainer is being lowered, fluid is free to pass upwardly through the valve and into the tubing string.

When the desired position is reached the setting tool is manipulated to set the bridging plug, that is, the sleeve 5 is forced downwardly and the mandrel 1 is drawn upwardly in such a manner that the packing sleeve 3 expands against the surrounding casing and the slips 4 move along their respective cones 2 for locking engagement with the surrounding casing. In doing so, the lowermost cone 2 and the head 6 move relatively toward each other, forcing the pin 24 along the side of the lever 20 so that the lower end of the lever 20 is urged away from the valve 15, permitting the valve to seat as shown in Figure 4. When this is accomplished, cement may be pumped downwardly through the tubing 7 in the usual manner, but the valve closes against back or upward flow of the cement.

It should be noted that the parts of the cement retainer are preferably formed of cast iron, aluminum alloy or analogous material which is either friable or readily drilled, so that after the cement retainer has performed its function it may be drilled up.

Various changes and alternate arrangements may be made within the scope of the appended claims, in which it is my intention to claim all novelty inherent in the invention as broadly as the prior art permits.

I claim:

1. In a well tool having a tubular mandrel and slip, cone and packing means mounted thereon for securing and sealing said mandrel within a well casing, the combination of: a valve normally closing the lower end of said tubular mandrel; a lever hinged to the outer side of said mandrel and engageable with the exposed side of said valve to hold said valve open; and means arranged along the outer side of said mandrel and engageable by a member of said slip, cone and packing means to urge said lever free of said valve.

2. In a well tool having a tubular mandrel, a head member at the lower end thereof, a cone movable toward said head member and slips interposed between said cone and head member and adapted to be set by said cone, the combination of: a valve member normally closing the lower end of said tubular member; a lever hinged to the outer side of said head member and engageable with said valve member to hold the valve member open; and a device interposed between said lever and said cone for urging said lever free of said valve member when said cone is moved on said mandrel to set said slips.

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