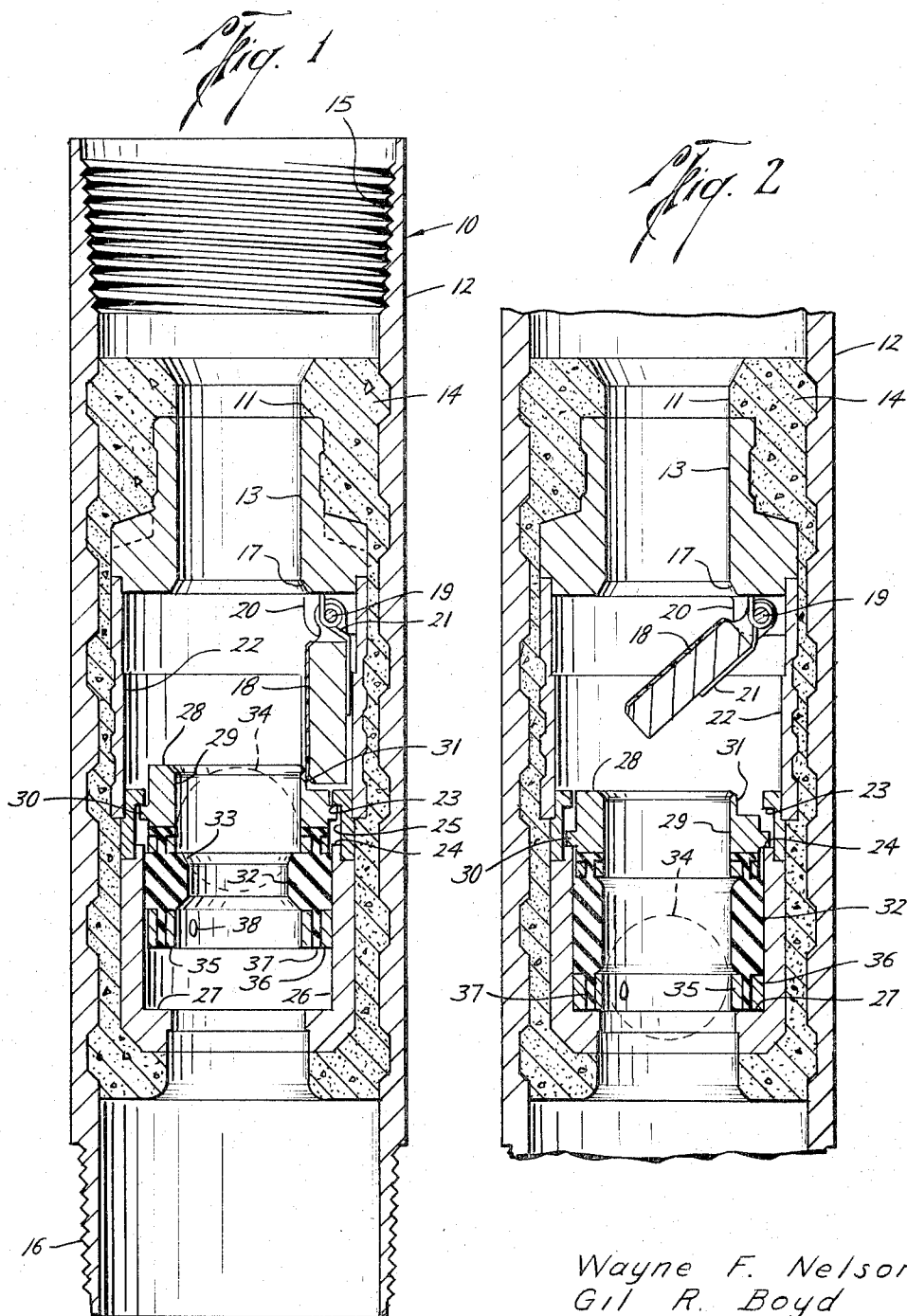


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W. F. NELSON ET AL
WELL FLOW CONTROL DEVICE

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WELL FLOW CONTROL DEVICE

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The present invention relates to an improved release mechanism for a well device.

Such well devices have been secured in a well pipe and are provided with a flapper or back-check valve which is retained in inactive position until released. Such devices are commonly used with automatic fill-up devices such as are disclosed in the Wayne F. Nelson Patents Nos. 2,973,006 issued February 28, 1961 and 3,072,145 issued January 8, 1963.

One object of the present invention is to provide an improved device including a releasably held sleeve maintaining a back-check valve in inactive position and means associated with said sleeve for releasing the sleeve and thereby allowing the back-check valve to become active.

One object of the present invention is to provide an improved device having a releasably held annular element and resilient seat member wherein the annular member holds the back-check valve in inactive position and means associated with said annular element and resilient member for releasing said element and member and thereby allowing the back-check valve to become active.

Another object is to provide an improved device wherein releasably held annular element and resilient seat member will hold a back-check valve in inactive position and will be released by receiving a closure element on said resilient seat member and allowing a pressure build-up thereabove to move said annular element downwardly to release the back-check valve and to move said resilient member downwardly to extended position whereby said closure element is discharged downwardly therethrough.

The construction designed to carry out the invention will be hereinafter described together with other features thereof.

The invention will be more readily understood from the reading of the following specification by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown and wherein:

FIGURE 1 is a transverse vertical sectional view of an improved well device, constructed in accordance with the invention and showing the back-check valve maintained in inactive position.

FIGURE 2 is a similar view illustrating the annular element of the device in its lower or released position and the back-check valve in its active position subsequent to release by the downward movement of the annular element.

In the drawings, the numeral 10 designates a cylindrical tubular body having a bore 11 extending therethrough. Tubular body 10 is composed of outer body member 12 and inner body member 13 which is positioned and held within outer body member 12 by concrete filler 14. The outer body member 12 is internally threaded at 15 to provide means for engaging the device in a well pipe string. The lower end of tubular body 10 as shown in the figures is externally threaded at 16 to provide means for engaging the device in a well pipe string. It should be noted that the lower portion of the device may be formed in concrete to have a snub nose whereby the device may act as a shoe on a well string. In the form shown in the figures the device will act as a collar in a well string. Inner body member 13 will be composed of a number of component parts and may be made in

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parts as shown in the drawings or in any other combination of components which are deemed suitable for economy of manufacture and assembly.

Annular inclined valve seat 17 is provided in the upper interior of inner body member 13. Flapper valve or back-check valve 18 is pivotally mounted on pin 19 which extends between bosses 20 of inner body member 13. Spring 21 or other suitable resilient means is provided to urge flapper valve 18 into engagement with seat 17. The interior of inner body member 13 is enlarged at the point of installation of flapper valve 18 as compared to bore 11 so that when flapper valve 18 is in inactive position, as shown in FIGURE 1, it does not provide any restriction to the flow through tubular body 10. This enlarged area of inner body member 13 is designated by the numeral 22. Below enlarged portion 22, inner body member 13 is provided with downwardly facing shoulder 23 and upwardly facing shoulder 24 defining the upper and lower extremities of cylindrical surface 25. Cylindrical surface 26 extends down from shoulder 24 to shoulder 27 for reasons which will be hereinafter more clearly explained.

Annular element 28 is tubular in shape and is provided with a bore 29 of substantially the same diameter as the bore 11. Annular element 28 has a flange 30 which extends outwardly from its exterior to project into the space between shoulders 23 and 24. Shoulders 23 and 24 therefore limit the vertical movement of annular element 28. In the upper position of annular element 28, flange 30 will engage shoulder 23 and the flat surface 31 on annular element 28 will engage and hold flapper valve 18 in its inactive position. When annular element 28 is moved to its lower position flange 30 will engage shoulder 24 and surface 31 will be moved out of engagement with flapper valve 18 whereby flapper valve 18 will become activated.

Resilient seat member 32 is formed integral with or bonded to annular element 28 as shown in the drawings. In its relaxed position, shown in FIGURE 1, resilient seat member 32 is formed to provide annular seat 33 immediately below the lower end of bore 29. Annular seat 33 is adapted to receive a closure element, such as a plug or ball. In FIGURE 1 the ball 34 is shown in broken lines to illustrate seating on annular seat 33. Resilient seat member 32 is made from a material such as rubber which has sufficient resiliency to allow seat member 32 to extend and deform to an extent whereby ball 34 will pass through seat member 32 as is clearly shown in FIGURE 2 and hereinafter more fully explained. Inner and outer cylindrical rings 35 and 36 are formed integrally with the depending cylindrical portion 37 of resilient seat member 32 or bonded thereto.

Releasable securing means is provided to secure rings 35 and 36 to inner body member 13, such as shear pin 38 or other suitable releasable latching means. Shear pin 38 extends through ring 35, depending portion 37 of seat member 32, ring 36 at least through a substantial portion of inner body member 13 in the position as shown in FIGURE 1. It should be noted that in this position the lower surfaces of rings 35 and 36 and depending portion 37 of seat member 32 are spaced a substantial distance above shoulder 27 on inner body member 13 whereby the allowable downward travel of rings 35 and 36 is substantially greater than the allowable downward travel of annular element 28.

Shear pin 38 should be of sufficient size to retain rings 35 and 36, seat member 32 and annular element 28 in their upper position as shown in FIGURE 1 during all normal conditions of running in of the well string.

The device of the present invention with annular element 28, resilient seat member 32 and rings 35 and 36

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secured in their upper position within inner body member 13 by shear pin 38 will be connected as a collar or shoe on a well string and run into the well until it is desired that the device provide a back-check control. At such time, a closure element, such as ball 34, is injected into the well string and pumped downwardly into the device. The ball 34 will enter the bore 29 of annular element 28 and seat on annular seat 33 thereby sealing bore 29 and preventing the transmittal of pressure from above the ball 34 to the lower portion of the device. With ball 34 seated, an increase in pressure in the well string above the device will exert a downward force on closure element 34 which will be transmitted through resilient seat member 32 to rings 35 and 36 causing shear pin 38 to shear and moving annular element 28 downwardly until flange 30 engages shoulder 24. This pressure on ball 34 will distort resilient seat member 32 to extend further downwardly until the interior of seat member 32 is deformed outwardly to allow ball 34 to pass therethrough. FIGURE 2 illustrates the extended position of resilient seat member 32 as above described. In this position ball 34 will be free to move downwardly and out through the bottom of tubular member 10. At the same time the downward movement of annular element 28 will have released flapper valve 18, thereby activating flapper valve 18 so that it may engage annular seat 17 and prevent an upwrd flow of well fluids through bore 11 of tubular member 10.

Ball 34 is released because of the limitation of the downward travel of annular element 28 by shoulder 24 engaging flange 30 and by providing a much longer available downward travel for the rings 35 and 36 and depending portion 37 of seat member 32 which is secured therebetween.

As stated the device of the present invention may be used as a collar in a well pipe string or as a shoe. Also, the device may be used in cooperation with automatic fill-up devices such as are disclosed in the Wayne F. Nelson Patents Nos. 2,973,006 issued February 28, 1961 and 3,072,145 issued January 8, 1963. The flexible valve portion of such devices is used to control the filling of the well pipe and may be used in conjunction with the device of the present invention whereby the flow of fluid from the well bore into the casing is regulated during the running of the device.

From the foregoing, it can be seen that the closure element used to actuate annular element 28 and resilient seat member 32 from their upper to their lower positions, whereby flapper valve 18 is released and activated, will pass completely through the device. With flapper valve 18 released, flow upwardly through bore 11 will be blocked.

The foregoing disclosure and description of the invention is 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 within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A well device adapted for installation in a well string comprising,
 - a body having a flow-way therethrough and adapted to be made up in a well string,
 - an annular valve seat in said body surrounding said flow-way,
 - a flapper valve adapted to engage said annular valve seat and a close flow upwardly through said flow-way,
 - means urging said flapper valve toward said annular valve seat in said body,
 - an annular element positioned within said body and having a central bore therethrough,
 - said annular element including an upper sleeve portion which engages said flapper valve to hold said flapper valve in inactive position and a resilient seat portion

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defining an annular seat projecting into said bore through said element, and means releasably securing said annular element to said body whereby said element is releasably held in position to engage said flapper valve and upon release to allow said annular element to move to a lower position thereby activating said flapper valve.

2. A well device adapted for installation in a well string comprising,
 - a body having a flow-way therethrough and adapted to be made up in a well string,
 - an annular valve seat in said body surrounding said flow-way,
 - a flapper valve adapted to engage said annular valve seat and close flow upwardly through said flow-way,
 - means urging said flapper valve toward said annular valve seat in said body,
 - an annular element having a central bore therethrough and adapted to be positioned within said body in an upper position or a lower position,
 - a resilient seat member secured to said annular element,
 - said resilient seat member forming a seat at the lower outlet of said central bore through said annular element, and
 - at least one ring secured to said resilient seat member below said seat of said seat member,
 - means releasably securing said ring and said resilient member to said body whereby said annular element is releasably held in its upper position,
 - said annular element in its upper position holding said flapper valve in inactive position and in its lower position releasing said flapper valve whereby said flapper valve is activated.
3. A well device adapted for installation in a well string comprising,
 - a body having a flow-way therethrough and adapted to be made up in a well string,
 - an annular valve seat in said body surrounding said flow-way,
 - a flapper valve adapted to engage said annular valve seat and close flow upwardly through said flow-way,
 - means urging said flapper valve toward said annular valve seat in said body,
 - an annular element positioned within said body and having a central bore therethrough,
 - a resilient member secured to said annular element, and
 - means releasably securing said resilient member to said body,
 - said resilient member defining an annular seat projecting into said bore through said annular element,
 - said resilient member when secured by said securing means supporting said annular element whereby a portion of said annular element is in engagement with said flapper valve holding said flapper valve in inactive position,
 - said annular element being movable upon release of said securing means to release said flapper valve,
 - said resilient member being movable upon release of said securing means to pass a closure element seated on said annular seat of said resilient member through said seat by deforming outwardly responsive to pressure above the closure element.
4. A well device adapted for installation in a well string comprising,
 - a body having a flow-way therethrough and adapted to be made up in a well string,
 - an annular valve seat in said body surrounding said flow-way,
 - a flapper valve adapted to engage said annular valve seat and close flow upwardly through said flow-way,
 - means urging said flapper valve toward said annular valve seat in said body,
 - an annular element positioned within said body and having a central bore therethrough,

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said annular element including an upper sleeve portion,
 a portion of which engages said flapper valve to hold
 said flapper valve in inactive position and a resilient
 seat portion which forms an annular seat surround-
 ing said bore through said element,
 an outer flange on said sleeve portion of said annular
 element,
 an internal shoulder within said body,
 said internal shoulder limiting the downward movement
 of said sleeve portion without limiting the downward
 movement of said resilient seat portion, and
 means releasably securing said annular element to said
 body and holding said sleeve portion in position en-
 gaging said flapper valve and upon release of said se-
 curing means said sleeve element being free to move
 to a lower position to disengage from and activate
 said flapper valve.
 5. A well device according to claim 4 wherein,
 release of said annular element responsive to pressure
 above a closure element on said resilient annular seat
 moves said sleeve portion downwardly until said
 flange engages said shoulder and thereafter said resil-
 ient seat portion extends and deforms responsive to
 said pressure to allow the closure element to pass
 therethrough.
 6. A well device, comprising:
 a body having a flow-way therethrough and means for
 connecting said body into a well string,
 said body defining an annular valve seat surrounding
 said flow-way,

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a flapper valve adapted to engage said annular valve
 seat and close flow upwardly through said flow-way,
 means urging said flapper valve toward said annular
 valve seat in said body,
 an annular element having a central bore therethrough
 and adapted to be positioned within said body in an
 upper or a lower position,
 a resilient seat member secured to said annular element,
 said resilient seat member forming a seat at the lower
 outlet of said central bore through said annular ele-
 ment, and
 means releasably securing said annular element and
 said resilient seat member to said body whereby said
 annular element is releasably held in its upper posi-
 tion,
 said annular element in its upper position engaging said
 flapper valve to hold said flapper valve in inactive
 position and in its lower position releasing said flap-
 per valve to its active position.

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