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WELL FLOW CONTROL DEVICE

Filed May 15, 1964

Fig. 1

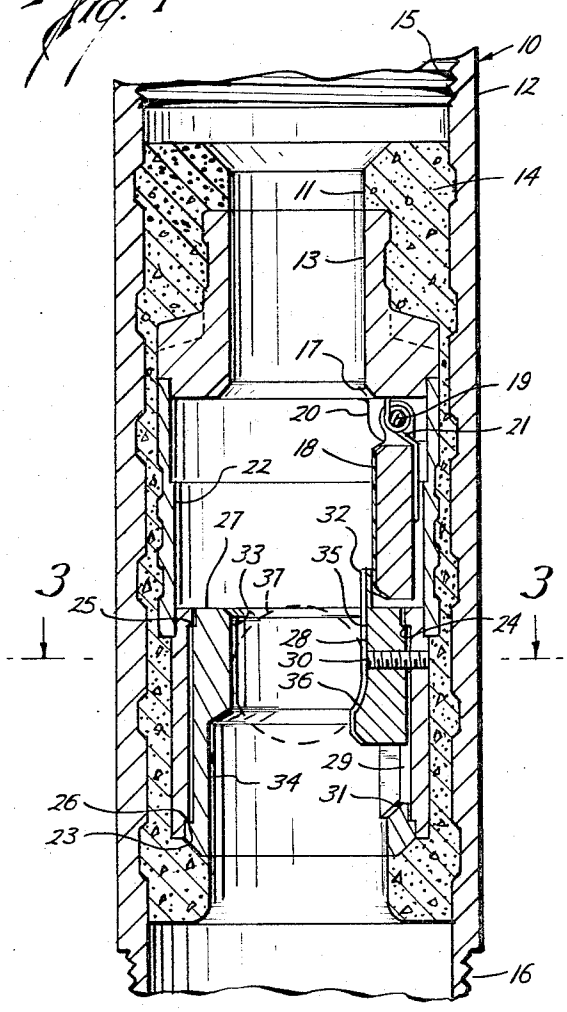


Fig. 2

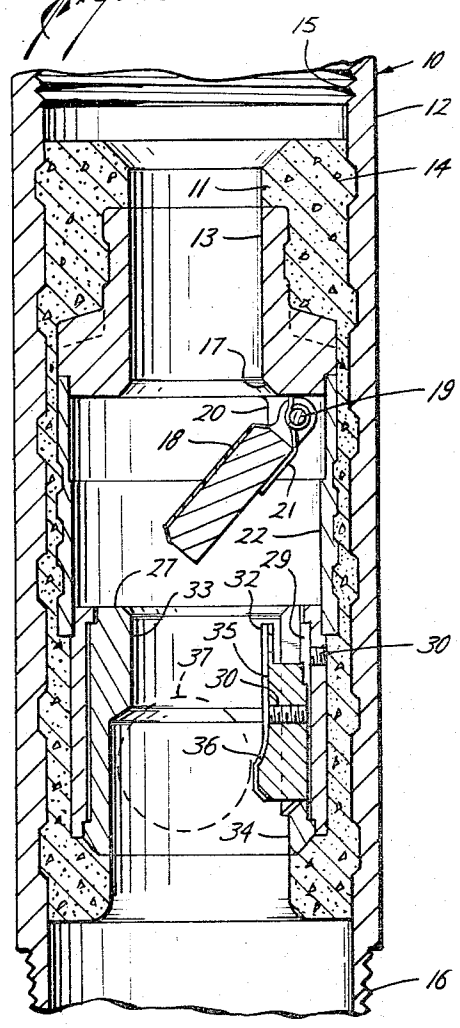
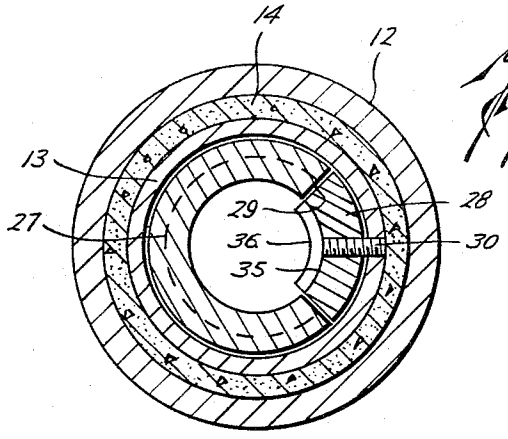


Fig. 3



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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 Patent 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 segment maintaining a back-check valve in inactive position and means associated with said segment for releasing the segment and thereby allowing the back-check valve to become active.

One object is to provide an improved device wherein a releasably held seating segment which maintains the back-check valve in inactive position will be released by receiving an element closing a bore formed partly by said segment and by an annular element and allowing a pressure build-up above the closure element to move the segment to release position in which position the closure element is discharged downwardly below said segment and said annular element.

Another object is to provide an improved device having a releasably held segment maintaining a back-check valve in inactive position wherein the segment provides support for the closure element when the segment is releasably held in its upper position and the segment when in its lower position moves downwardly in the device activating the back-check valve and allowing the closure element to pass through the device.

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 a 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 releasably held segment of the device in its lower or released position and the back-check valve in its active position subsequent to release by the segment.

FIGURE 3 is a horizontal cross-sectional view taken on the line 3—3 of FIGURE 1.

In the drawings, the numeral **10** designates a cylindrical tubular body having a bore **11** extending therethrough. The tubular body 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 the shoe on a well string. In the form shown in the figures the device will act as a collar in the well string. Inner body member **13** will be composed of a number of component parts and may be made in 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 **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 shoulders **23** and **24** against which external shoulders **25** and **26** of sleeve member **27** abut. Concrete filler **14** engages sleeve member **27** to retain sleeve member **27** within inner body member **13** as shown. Segment member **28** is positioned within the window **29** in sleeve member **27** and is releasably held in its uppermost position as shown in FIGURE 1 by shear pin **30**. As clearly shown in FIGURES 1 and 2 window **29** which is open at the top of sleeve member **27**, is substantially longer than segment member **28** and when segment member **28** is not held by shear pin **30** it may move downwardly within window **29** until it engages ledge **31** forming the bottom of window **29**. The segment member **28** is provided with an upwardly extending finger **32** which engages flapper valve **18** to hold flapper valve **18** in its inactive position as shown in FIGURE 1 at all times when segment member **28** is releasably held in its upper position by shear pin **30**.

Sleeve member **27** is provided with an upper bore **33** which is substantially the same as the bore **11** through tubular body **10** and a lower bore **34** which is larger than bore **33** for the purposes as are hereinafter more fully explained. Segment member **28** has an inner arcuate surface **35** conforming to the surface of bore **33**. Surface **35** on segment member **28** flares inwardly to form seating surface **36**. Seating surface **36** of segment member **28** is formed to support a closure element **37** such as a ball which is shown in broken lines in FIGURE 1 in position closing the passageway bounded by the bore **33** of sleeve member **27** and the inner arcuate surface **35** of segment member **28**.

The device of the present invention with segment member **28** secured in its upper position to inner body member **13** by shear pin **30** 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 **37** such as a ball or plug is injected into the well string and pumped downward into the device. In FIGURE 1, the closure element **35** is shown in broken lines as a ball sealing the passageway formed by bore **33** of sleeve member **27** and surface **35** of segment member **28** and supported by seating surface **36**. With closure element **37** in this position, an increase in pressure in the well string above the device will exert a downward force on segment member **28** causing shear pin **30** to shear and moving segment member **28** to its lower position wherein seating surface **36** is opposite lower bore **34** of sleeve member **27**. In this position finger **32** will have moved downwardly below flapper valve **18** thereby activating flapper valve **18** and with segment member **28** resting on ledge **31** sufficient area will be provided between bore **34** and seating surface **36** to allow closure element **37** to pass downwardly through the device of the present invention. With flapper valve

18 activated, it will cooperate with seat 17 to prevent upward flow through bore 11. In such position the device of the present invention may be used to cooperate with other devices wherein this device provides a primary or secondary back-check valve to prevent the return flow of well fluids upwardly through the well string.

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 Patent 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 any such device 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 the segment member from its upper to its lower position, whereby flapper valve 18 is released and activated, will pass completely through the device. Upward flow through the device is prevented by the engagement of flapper valve 18 with seat 17. As has been shown, prior to the release of flapper valve 18 by the shearing of shear pin 30 and the movement of said segment member 28 to its lower position fluids may flow through the device in either direction without restriction other than the size of bore 11 through the device. The release and movement of segment member 28 to its lower position cannot accidentally occur but will only occur when a closure element 37 has been seated within bore 33 of sleeve member 27 and pressure exerted thereabove to shear the shear pin 30.

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 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 flow control device adapted to be installed in a well string, comprising

a body having a flow-way therethrough and adapted to be connected to a well string,

said body defining an annular valve seat 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 engagement with said annular valve seat,

an annular element positioned within said body below said flapper valve and having an upper bore and a larger lower bore defining a passageway through said annular element,

a segment member movable only vertically within said annular element from an upper position to a lower position, and

means releasably securing said segment member in its upper position to said body,

said segment member having a projection extending inwardly to define a closure seat in said upper bore when said segment member is in its upper position,

said projection on said segment member being positioned within said larger lower bore in said annular element when said segment member is in its lower position to eliminate said closure seat.

2. A well flow control device according to claim 1, including

a closure element adapted to be dropped through the well string and said flow-way through said body to seat on said projection of said segment member substantially closing said upper bore of said annular element,

said securing means releasing said segment member responsive to a predetermined pressure above said closure element whereby said segment member is moved responsive to such pressure to its lower position,

said lower larger bore and said projection on said segment member when said segment member is in its lower position defining a passageway sufficiently large for said closure element to pass therethrough.

3. A well flow control device adapted to be installed in a well string, comprising

a body having a flow-way therethrough and adapted to be connected to a well string,

said body defining an annular valve seat 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 engagement with said annular valve seat,

an annular element positioned within said body below said flapper valve and having an upper bore and a larger lower bore defining a passageway through said annular element,

said annular element also defining a window,

a segment member mounted for vertical movement within said window in said annular element from an upper position to a lower position,

means releasably securing said segment member to said body member to retain said segment member in its upper position,

said annular element and said body cooperating to retain said segment member within said window,

said segment member having a projection extending inwardly to define a closure seat in said upper bore of said annular element when said segment member is in its upper position,

said projection on said segment member being positioned in said lower bore when said segment member is in its lower position to eliminate said closure seat.

4. A well flow control device according to claim 3, including

a closure element adapted to be dropped through the well string and said flow-way through said body to seat on said projection of said segment member substantially closing said upper bore of said annular element,

said securing means releasing said segment member responsive to a predetermined pressure above said closure element whereby said segment member is moved responsive to such pressure to its lower position,

said lower larger bore and said projection on said segment member when said segment member is in its lower position defining a passageway sufficiently large for said closure element to pass therethrough.

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