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AUTOMATIC FILL-UP AND CEMENTING DEVICES FOR WELL PIPES

Filed April 13, 1964

2 Sheets-Sheet 1

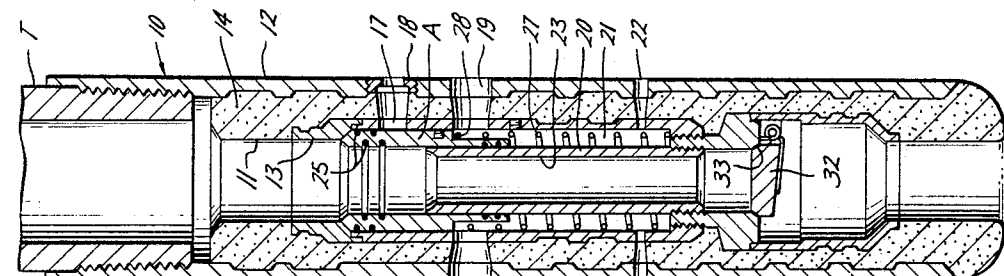


Fig. 3

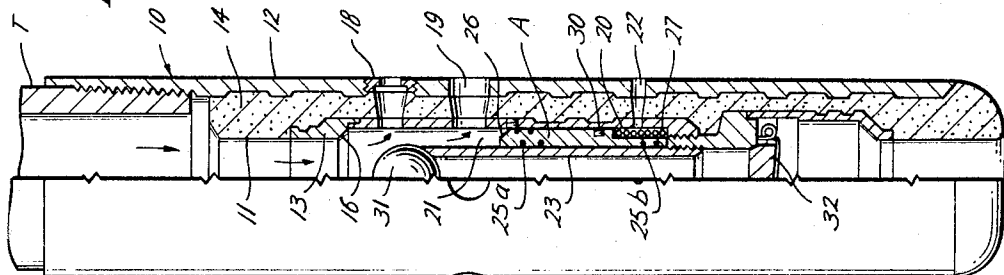


Fig. 2

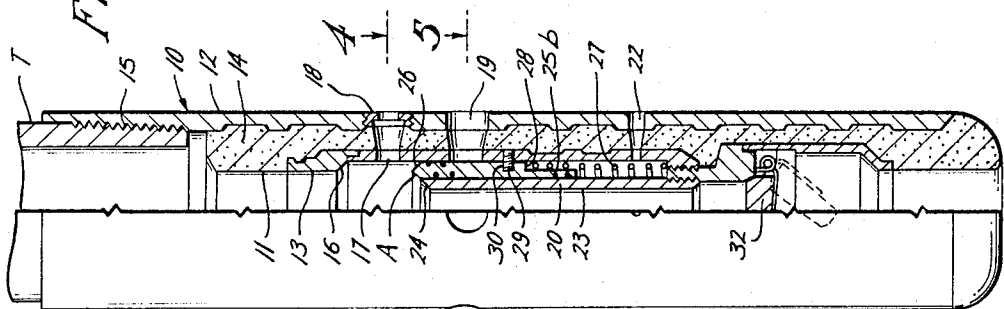


Fig. 1

Fig. 4

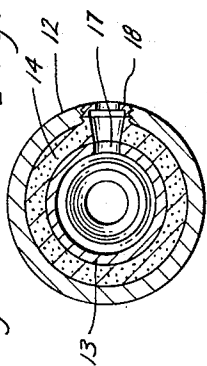
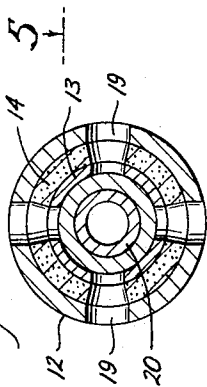


Fig. 5



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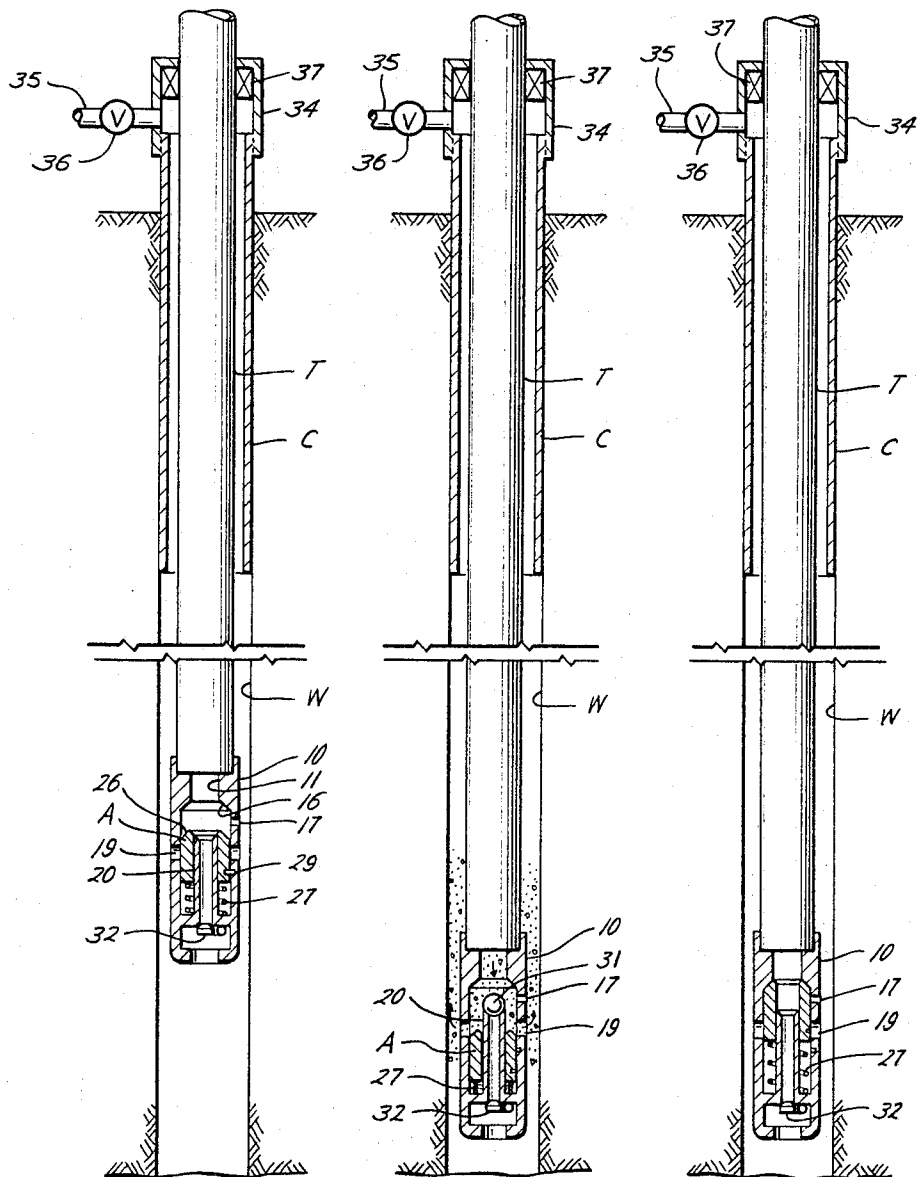


Fig. 6

Fig. 7

Fig. 8

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1

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**AUTOMATIC FILL-UP AND CEMENTING DEVICES
FOR WELL PIPES**

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9 Claims. (Cl. 166—225)

This invention relates to new and useful improvements in automatic fill-up and cementing devices for well pipes.

This invention is an improvement upon our prior co-pending application Serial No. 134,932 filed August 30, 1961 now Patent 3,130,789. The device of the present invention has all of the advantages of our prior device and is particularly advantageous for use with casing and large diameter well pipe.

An object of this invention is to provide an improved fill-up and cementing device wherein circulation may be established downwardly at any time without releasing the releasably held element providing protection against blow-out and automatic filling.

Another object of the present invention is to provide an annular element releasably held in a position allowing filling wherein such annular element is maintained in such position except when intentionally released by the injection of a closure element or when released responsive to excessive filling rates indicative of a blowout condition.

A still further object of the present invention is to provide an improved device having a replaceable fill orifice whereby filling rates of the device may be controlled by using an insert of a size desired for the conditions encountered in the well bore.

A particular object is to provide a fill-up device having a sleeve valve element mounted therein, which element has its opposite ends exposed to the same annulus pressure and which is normally held in position, permitting flow into the well pipe, by a releasable means; a predetermined change in the differential pressures acting on opposite ends of the sleeve valve element, which change is caused by a predetermined increase in velocity of flow of fluid entering the pipe, resulting in the release of said releasable means to automatically move the valve to position closing said pipe to thereby protect the well against blowout.

A still further object is to provide a device, of the character described, wherein an orifice permits automatic controlled fill of the pipe during lowering and a back-check valve prevents filling of the well pipe other than through the orifice and allows for the establishment of circulation at any time during lowering and a sleeve valve is associated with the orifice in such manner that a predetermined excessive entry of fluid through the orifice, such as might ultimately result in a blow-out, will affect the sleeve valve and automatically move said sleeve valve to close said orifice to thereby provide protection against blow-out and wherein such sleeve valve also acts as a cementing valve during a subsequent operation; said sleeve valve being of an improved construction to assure a positive and leak-proof seal when in its seated position to prevent back flow of cement or other fluids into the well pipe.

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 and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

2

FIGURE 1 is a transverse vertical sectional view of a fill-up and cementing device, constructed in accordance with the invention and showing the parts thereof in position during lowering of the pipe and normal controlled filling of the pipe and illustrating the parts of the device in position for establishing circulation during the lowering of the pipe in broken lines;

FIGURE 2 is a similar view, illustrating the sleeve valve element of the device in its lowered position which it assumes during the cementing operation;

FIGURE 3 is a similar view, illustrating the sleeve valve element of the device in its upper position closing the fill orifice and cementing ports against back flow of fluid into the pipe;

FIGURE 4 is a horizontal cross-sectional view taken on the line 4—4 of FIGURE 1;

FIGURE 5 is a horizontal cross-sectional view taken on the line 5—5 of FIGURE 2;

FIGURE 6 is a schematic or diagrammatic view of a well bore showing the well pipe having the improved device at its lower end being lowered into the well bore during which time a controlled filling of the well pipe with liquid from the annulus is accomplished;

FIGURE 7 is a view similar to FIGURE 6 illustrating the position of the parts during the introduction of cement into the well bore; and

FIGURE 8 is a similar view showing the sleeve valve element of the device in its back-check position preventing a reverse flow of fluid into the lower end of the pipe.

In the drawings, the numeral 10 designates a cylindrical tubular body having a bore 11 extending entirely there-through. 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. 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. 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 is suitably formed of concrete to allow the device to be lowered downwardly through a well bore. An annular inclined valve seat 16 is provided in the upper interior portion of tubular body 10. Spaced below the annular valve seat 16 is a filling port 17 which is constructed of a predetermined size and which will permit an inflow of fluid from the area outside of tubular body

10 into the bore 11 and then upwardly into the well pipe or tubing T, as will be hereinafter explained. Filling port 17 extends completely through outer body member 12, concrete filler 14 and body member 13. Outer body member 12 is threaded to receive insert 18 which has a bore therethrough of very exact diameter to provide a filling orifice for the purposes as hereinafter more clearly explained. Spaced downwardly from the filling port 17

are a plurality of cementing ports 19 as clearly shown in FIGURE 5. The lower end of tubular member 20 is secured as by threads or otherwise to inner body member 13 and extends upwardly within tubular body 10 forming annular space 21, the upper portion of which is in fluid communication with cementing ports 19. The fluid equalizing openings 22 extend through tubular body

10 into the lower portion of annular space 21 as shown. Tubular member 20 has an annular bore 23 and its upper extremity terminates in inclined valve seat 24.

With small pipe the combined cross-sectional area of the cementing ports 19 should be at least as great as the cross-sectional area of bore 11 or the bore of the well pipe or tubing string T, whichever is smaller, whereby when cement is pumped downwardly through said well

70

3

pipe, the cementing ports 19 do not form a restriction to the flow of cement outwardly into the area around the body 10. With large pipe a port area less than the cross-sectional area of the pipe may be adequate as cement will be introduced to the pipe from smaller surface piping. In any case the cementing port area should not be such as to cause a restriction.

A sleeve valve element generally indicated at A is slideable within annular space 21 and, as will be explained, is adapted to coact with the cementing ports 19 and also with the filling port 17. A plurality of O-ring seals 25 are provided on the interior and exterior of sleeve valve element A to seal against the walls of annular space 21 to prevent the loss of pressure contained within annular space 21 below sleeve valve element A. The upper outer edge portion of sleeve valve element A is inclined or beveled at 26 to form a valve seating surface which under certain conditions is engageable with the internal valve seat 16 within the upper end of the body. A coiled spring 27 is preferably confined within the lower portion of annular space 21 with its upper end in engagement with annular shoulder 28 on sleeve valve element A and its lower end engaging the lower end of annular space 21. The spring exerts its force to constantly urge the sleeve valve element A upwardly within annular space 21. It might be noted that although it is preferable to employ the spring 27, it has been found that such spring could be omitted.

The sleeve valve element A is normally retained within annular space 21 in the position shown in FIGURE 1 by a frangible shear pin 29, said pin extending through the wall of inner body member 13 and into a recess 30 in the exterior surface of sleeve valve element A. As will be explained in detail, the strength of shear pin 29 is related to the orifice size of insert 18 in fill port 17 and when shear pin 29 is connected with the sleeve valve element A (FIGURE 1), said sleeve valve element overlies the cementing ports to close the same. Two of the O-rings 25a and b on the sleeve valve element seal with the wall of inner body member 13 and prevent any flow of fluid from the area above sleeve element A outwardly through the cementing ports 19. The length of sleeve valve element A is such that when in the position of FIGURE 1, its upper end is below fill port 17 while its lower end is above equalizing ports 22; obviously, the upper end of sleeve valve element A is spaced downwardly from internal valve seat 16 which is provided in the upper portion of bore 11. With such arrangement, cementing ports 19 are closed and fluid from the area outside tubular body 10 may flow through filling port 17 into the well pipe or tubing string T. The fluid pressure outside body 10 may enter the fluid equalizing ports 22 and is present in the annular space 21 below sleeve valve element A so that, in effect, under static conditions, pressures above and below sleeve valve element A are equalized. The coiled spring 27 is tending to urge sleeve valve element A upwardly but the shear pin 29 which connects sleeve valve element A in the position shown in FIGURE 1 prevents such upward motion.

The pin 29 may be sheared under one of two conditions which may occur. If it is desired to commence cementing, a closure element such as a ball or suitable plug 31 is dropped into well pipe or tubing string T and will seat on inclined valve seat 24 on the upper edge of tubular members 20 as shown in FIGURE 2. Thereafter, if a sufficient pressure is applied to the upper end of sleeve valve element A, as for example, by pumping cement downwardly through the well pipe or string T, the pin 29 will be sheared and such pressure will move sleeve valve element A downwardly to the position shown in FIGURE 2 to uncover the cementing ports 19. Under such conditions, cement may be pumped outwardly through ports 19 into the area outside of tubular body 10 and it is noted that at this time the valve seating surface 26 as well as the upper, outer O-rings 25a and b

4

are below cementing ports 19 and neither the sealing surface nor the O-rings will be affected by the abrasive action of the cement fluid. Upon completion of a cementing operation, the coil spring 27, along with the annular fluid head acting through the annular access ports and on the under side of the piston, will move the piston to uppermost position engaging the internal seat 16 to effectively close any upward flow into the well pipe. The O-rings 25 will assist in effecting a positive back-check seal.

The second condition under which the pin 29 may be sheared to permit a movement of sleeve valve element A is upon a predetermined pressure differential occurring across the sleeve valve element. As has been noted, when the pipe is being lowered with sleeve valve element A connected by shear pin 29 and maintained in the position of FIGURE 1, fluid from outside the body may flow through the orifice member 18 and port 17 into the well pipe. Fluid pressure from around body 10 may also enter annular space 21 through fluid equalizing ports 22 so that under normal filling conditions the pressures across sleeve valve element A are not great enough to shear the pin 29. There will, of course, be a slightly lesser pressure in the area immediately above sleeve valve element A than the static pressure which is acting on the lower end of sleeve valve element A, this being caused by the fact that there is an upward flow in the well pipe. The strength of shear pin 29 is so related to the size of the orifice 18 that under normal filling conditions the parts will remain in the position as shown in FIGURE 1. However, if there is a tendency for a well to blow-out, the velocity of flow through the control orifice 18 will be increased and the upward velocity into the well pipe will increase accordingly to thereby result in a reduction in pressure above sleeve valve element A. By relating the size of orifice 18 to shear pin 29, it is possible to cause a shearing of the pin 29 by the static pressure of the annular fluid head acting through the annular access ports and underneath sleeve valve element A when a predetermined pressure drop occurs above the sleeve valve element. When such predetermined pressure drop occurs, the pin 29 is sheared and the sleeve valve element A is moved to the position of FIGURE 3; in such position, its seating surface 26 engages the internal valve seat 16 and the upper outer O-rings 25a and b seal with the wall of bore 11 of the body above the filling port 17 and an effective back-check or back-flow valve is thus provided.

Specific examples of the operative relation between the size of orifice 18 and the strength of shear pin 29 are now set forth. For instance, assuming that a 1/4"-20 screw retaining a sleeve valve element having an effective pressure diameter of 3 1/8" diameter minus the sleeve inner diameter of 2" is to be sheared when 10 pound mud is flowing through the orifice at the rate of 243.55 gallons per minute, then the orifice should be approximately 1 3/16" in diameter. With the same orifice and shear pin and circulating 12 pound mud only 222.28 gallons per minute of mud will be required to shear the shear pin.

As shown in FIGURE 1 the lower portion of bore 11 through tubular body 10 is closed by a spring-loaded back-check valve 32 which engages inclined annular seat 33 formed on the lower interior of inner body member 13. Check valve 32 may be opened during the normal running-in or fill-up operation when desired by stopping the running-in operation and commencing circulation of fluid downwardly through well pipe T. This circulation will flow downwardly through bore 11 and bore 23 causing back-check valve 32 to assume an open position as shown in broken lines in FIGURE 1.

In the operation of the improved fill-up and cementing device, reference is made to FIGURES 6 through 8 in which the device is connected to the lower end of a string T which is adapted to be lowered within the well bore W. A short section of surface casing C is set within the well bore W and has the usual tubing head 34, which is shown schematically mounted at its upper end. The head has

5

6

a fluid outlet 35 controlled by a suitable valve 36 and also includes a conventional packing or seal 37 which seals off the annulus between well bore W and the string T.

The shear pin 29 is positioned to connect tubular body 10 with sleeve valve element A and to dispose said sleeve valve element in position shown in FIGURE 1 and as the string T is lowered the fluid, which is generally drilling mud from the annulus, flows through the orifice 18 and provides for automatic control filling of the tubing string during the lowering operation. By relating the size of the orifice 18 to the strength of shear pin 29, a controlled or predetermined amount of fluid may flow into the tubing and the pressure differential created across sleeve valve element A will be insufficient to shear said pin 29. Thus, during lowering of the string T and with conditions normal, a predetermined amount of fluid is introduced into the tubing to fill said tubing automatically.

In the event that the fluid within the annulus begins to enter the orifice 18 at a rate which might cause a blow-out of the well, the velocity of flow of fluid upwardly in the tubing is increased and this increased velocity results in the reduction in the pressure which is acting against the upper end of sleeve valve element A. The lower end of the sleeve valve element, as has been explained, is constantly exposed to the static fluid head surrounding tubular body 10 and when the reduction in pressure above sleeve valve element A is sufficient, the pressure acting below the sleeve valve element will shear the pin 29 and move the sleeve valve element A to the position shown in FIGURES 3 and 8. In such position, a back-flow of any fluids into the string T is effectively prevented because the seating surface 26 of the sleeve valve element A is in engagement with the internal valve seat 16 within the upper portion of the body. Also, the O-ring seals 25a and b are engaged within the bore 11 of the body in the area between the internal seat 16 and the fill port 17 and thus such port is effectively closed. The pressure below the sleeve valve element maintains it in its back-check sealing position and thus positive protection against blow-out is provided.

In the event that during the lowering of the tubing string the establishment of circulation is desired for such reasons as a desired conditioning of the mud or to wash out a bridge that has formed in the well bore W, the lowering of the string is stopped and the fluid is circulated downwardly through the string T. This circulation will flow through bore 11 of tubular body 10 and through bore 23 of tubular member 20 causing back-check valve 32 to open and allowing circulation to be established through the device. Some circulation may flow through the port 17 but the major portion of the circulation will be downwardly through the device.

In the event that the string T is lowered to final position within the well bore W without there having been any occurrence which might tend to cause a blow-out, the ball 31 is injected into the string T and thereafter cement is pumped downwardly through the string T in the usual manner. Ball 31 will seat on seat 24 as illustrated in FIGURES 2 and 7. The pressure of such cement is applied against the upper end of sleeve element A to shear the pin 29 and moves the sleeve valve element downwardly to the position shown in FIGURES 2 and 7. In such positions the large cementing ports 19 are uncovered and the cement may be rapidly introduced into the annulus to displace the mud or fluid within the annulus upwardly; of course, at this time, the valve 36 in line 35 at the upper end of the annulus is open to permit the displacement of said mud. Upon completion of the cementing operation, the reduction in pressure in the tubing string permits sleeve valve element A to be immediately moved into its seated, back-check position as shown in FIGURE 8. The upward movement of sleeve valve element to back-check position is effected primarily by the pressure acting below the sleeve element and where the coil spring 27 is employed, such spring adds its force to the pressure to assure seating of the valve. It is noted

that during the cementing operation the upper surface of sleeve valve element A is below the cementing ports 19 so that the annular seat 26 and the O-rings 25a and b are not exposed to the abrasive action of the cement. This means that the seat 26 and the O-rings 25a and b will effectively and immediately move into sealing position when the sleeve valve element is moved upwardly.

From the foregoing it will be seen that a simple and effective fill-up and cementing device is provided. By controlling the size of the orifice 18, a predetermined volume of fluid from the annulus will flow into the tubing string during the lowering operation. Under normal conditions, the sleeve valve element A is maintained in the position of FIGURE 1 closing the cementing ports 19 and shear pin 29 remains intact. In the event of any excessive increase in the velocity of the fluid flowing upwardly in the tubing, a pressure reduction occurs above the sleeve valve element A and when such reduction is to a predetermined point in accordance with the strength of shear pin 29, the pin is sheared and the valve is moved upwardly to provide blow-out protection. At any time during the lowering of the tubing when it is desired to re-establish circulation this may be done by stopping the lowering of the tubing and circulating the desired fluid downwardly through the string T. If, on the other hand, the string is lowered into final position without any tendency for blow-out, the sleeve valve element A will remain in the position of FIGURE 1 with the shear pin 29 connecting the same to the body. After injection of the ball 31 to close the bore 23 and upon application of pressure through the cement column which is to be pumped into the well, the pin 29 is sheared to move the sleeve valve element A downwardly and uncover the large cementing ports 19 which permits a rapid pumping of cement into the annulus. Upon completion of cementing, the sleeve valve element A is immediately moved to its back-check or closing position, as shown in FIGURE 3, to prevent any back leakage of cement into said string. Although it has been found that a shear pin or other frangible means is a simple way of latching or holding the valve element in position, other types of latches could be employed. Any latch or holding means which maintains the sleeve valve element A in its position as shown in FIGURE 1 would, of course, be related to the size of the fill port orifice 18 so that the force required to release the sleeve valve element for upward movement under predetermined pressure differential conditions may be controlled. The proper relationship between the orifice 18 and the force required to release the sleeve valve element for movement upwardly may be predetermined and will, of course, be varied in accordance with the particular conditions of the well in which the device is to be used.

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 fill-up device including,
 - a tubular body having means for connecting said body in a well pipe string,
 - said body having an orifice establishing communication between the exterior and interior thereof whereby fluid from the annulus surrounding the body and pipe string may flow through the orifice and into the string,
 - an annular element mounted for movement within the body and movable to a position closing flow into the pipe string,
 - said annular element being subjected to the pressure of the fluid flowing through said orifice into the pipe string,
 - means for subjecting said annular element to the static pressure in said annulus surrounding said body in opposition to the pressure of the fluid flowing through

said orifice into the pipe string whereby a differential pressure is created across said annular element, releasable means for normally holding said annular element in a position allowing flow through the orifice and into the pipe string,

said releasable holding means being released by the differential pressure caused by a predetermined increase in the velocity of flow of fluid passing through said orifice to permit movement of said annular element,

said differential pressure also moving said annular element to a position closing further flow into the pipe string, and

means permitting downward flow through said tubular body and through the central portion of said annular element whereby circulation may be established through said device to the annulus surrounding said body and said well pipe string.

2. A fill-up device including,

a tubular body having means for connecting said body in a well pipe string,

said body having an orifice establishing communication between the exterior and interior thereof whereby fluid from the annulus surrounding the body and pipe string may flow through the orifice and into the string,

a sleeve valve element mounted for movement within the body and movable to a position closing flow into the pipe string,

said sleeve valve element being subjected to the pressure of the fluid flowing through said orifice into the pipe string,

means for subjecting said sleeve valve element to the static pressure in said annulus in opposition to the pressure of the fluid flowing through said orifice into the pipe string whereby a differential pressure is created across said sleeve valve element,

releasable means for normally holding said sleeve valve element in a position allowing flow through the orifice and into the pipe string,

said releasable holding means being released by the differential pressure caused by a predetermined increase in the velocity of flow of fluid passing through said orifice to permit movement of said sleeve valve element,

said differential pressure also moving said sleeve valve element to a position closing further flow into the pipe string, and

means permitting downward flow through said tubular body and through the central portion of said sleeve valve element whereby circulation may be established through said device to the annulus surrounding said body and said pipe string.

3. A fill-up device including,

a tubular body having means for connecting said body in a well pipe string,

said body having an orifice establishing communication between the exterior and interior thereof whereby fluid from the annulus surrounding the body and pipe string may flow through the orifice and into the string,

a sleeve valve element mounted for movement within the body and movable to a position closing flow into the pipe string,

said sleeve valve element being subjected to the pressure of the fluid flowing through said orifice into the pipe string,

means for subjecting said sleeve valve element to the static pressure in said annulus in opposition to the pressure of the fluid flowing through said orifice into the pipe string whereby a differential pressure is created across said sleeve valve element,

releasable means for normally holding said sleeve valve element in a position allowing flow through the orifice and into the pipe string,

said releasable holding means being released by the differential pressure caused by a predetermined increase in the velocity of flow of fluid passing through said orifice to permit movement of said sleeve valve element,

said differential pressure also moving said sleeve valve element to a position closing further flow into the pipe string,

means permitting downward flow through said tubular body and through the central portion of said sleeve valve element whereby circulation may be established through said device to the annulus surrounding said body and said pipe string,

means preventing upward flow through said tubular body and through the central portion of said sleeve valve element whereby all of the filling of the well pipe string flows through said orifice.

4. A fill-up device including,

a tubular body having means for connecting said body in a well pipe string,

said body having an orifice establishing communication between the exterior and interior thereof whereby fluid from the annulus surrounding the body and pipe string may flow through the orifice and into the string,

a sleeve valve element mounted for movement within the body and movable to a position closing flow into the pipe string,

said sleeve valve element being subjected to the pressure of the fluid flowing through said orifice into the pipe string,

means for subjecting said sleeve valve element to the static pressure in said annulus in opposition to the pressure of the fluid flowing through said orifice into the pipe string whereby a differential pressure is created across said sleeve valve element,

releasable means for normally holding said sleeve valve element in a position allowing flow through the orifice and into the pipe string,

said releasable holding means being released by the differential pressure caused by a predetermined increase in the velocity of flow of fluid passing through said orifice to permit movement of said sleeve valve element,

said differential pressure also moving said sleeve valve element to a position closing further flow into the pipe string,

means permitting downward flow through said tubular body and through the central portion of said sleeve valve element whereby circulation may be established through said device to the annulus surrounding said body and said pipe string,

said sleeve valve element being annular in shape and providing a vertically extending passageway there-through,

a check valve mounted in the lower portion of said tubular body preventing flow upwardly through said passageway.

5. A fill-up and cementing device including,

a tubular body having means for connecting said body in a well pipe string,

said body having an orifice located nearer its upper end and establishing communication between the annulus outside the body and string and the interior of the body and string,

said body having cementing ports below said orifice and having equalizing openings spaced below said cementing ports and disposed nearer the lower end of the body,

a sleeve valve element slideably mounted within the body and movable to an upper position closing flow through the orifice and into the pipe string and also movable to a lower position to uncover the cementing ports, and

releasable means for normally retaining the sleeve valve

element in a position intermediate the orifice and the equalizing openings in which position the cementing ports are covered and closed,

said releasable means being releasable by a predetermined force applied to the sleeve valve element, the upper surface of said sleeve valve element being exposed to the pressure of the fluid flowing through the orifice and into the pipe when the sleeve valve element is releasably retained in its intermediate position and the lower surface being exposed to the static pressure of the fluid in the annulus exteriorly of the body, whereby the sleeve valve element is subjected to the pressure differential force on opposite sides thereof,

said releasable retaining means being released by the existence of a predetermined pressure differential across said sleeve valve element which is created by a predetermined increase in velocity of flow through the orifice and into the pipe string in which event the sleeve valve element is moved upwardly to close flow into the string or which is created by an increase in pressure applied against the upper end of the sleeve valve element through the pipe string in which event the sleeve valve element is moved downwardly to uncover the cementing ports.

6. A fill-up and cementing device including,

a tubular body having means for connecting said body in a well pipe string,

said body having an orifice located nearer its upper end and establishing communication between the annulus outside the body and string and the interior of the body and string,

said body having cementing ports below said orifice and having equalizing openings spaced below said cementing ports and disposed nearer the lower end of the body,

a sleeve valve element slideably mounted within the body and movable to an upper position closing flow through the orifice and into the pipe string and also movable to a lower position to uncover the cementing ports,

releasable means for normally retaining the sleeve valve element in a position intermediate the orifice and the equalizing openings in which position the cementing ports are covered and closed,

said releasable means being releasable by a predetermined force applied to the sleeve valve element, the upper surface of said sleeve valve element being exposed to the pressure of the fluid flowing through the orifice and into the pipe when the sleeve valve element is releasably retained in its intermediate position and the lower surface being exposed to the static pressure of the fluid in the annulus exteriorly of the body, whereby the sleeve valve element is subjected to the pressure differential forces on opposite sides thereof,

said releasable retaining means being released by the existence of a predetermined pressure differential across said sleeve valve element which is created by a predetermined increase in velocity of flow through the orifice and into the pipe string in which event the sleeve valve element is moved upwardly to close flow into the string or which is created by an increase in pressure applied against the upper end of the sleeve valve element through the pipe string in which event the sleeve valve element is moved downwardly to uncover the cementing ports, and

means permitting flow downwardly and preventing flow upwardly through the tubular body and the interior of said sleeve valve element.

7. A fill-up and cementing device including,

a tubular body having means for connecting said body in a well pipe string,

said body having an orifice located nearer its upper end and establishing communication between the

exterior and interior thereof whereby fluid from the annulus surrounding the body and the well pipe string may flow through the orifice and into the string,

a tubular member positioned within said tubular body, said tubular member being secured at its lower end to the interior of said tubular member and extending upwardly through a substantial portion of said tubular member forming an annular space between said tubular body and said tubular member,

said body having cementing ports below said orifice and having equalizing openings spaced below said cementing ports and establishing communication between the exterior of said tubular body and the lower portion of said annular space,

a sleeve valve element slideably mounted within said annular space and movable to an upper position closing flow through the orifice and into the pipe string and also movable to a lower position to uncover the cementing ports,

releasable means for normally retaining said sleeve valve element in a position intermediate the orifice and the equalizing openings in which position the cementing ports are covered and closed,

a seat on said tubular member,

means cooperating with said seat to close flow through said tubular member for cementing,

said releasable means being releasable by a predetermined force applied to said sleeve valve element, the upper surface of said sleeve valve element being exposed to the pressure of the fluid flowing through the orifice and into the pipe when the sleeve valve element is releasably retained in its intermediate position and the lower surface being exposed to the static pressure of the fluid in the annulus exteriorly of the body, whereby the sleeve valve element is subjected to the pressure differential forces on opposite sides thereof,

said releasable retaining means being released by the existence of a predetermined pressure differential across said sleeve valve element which is created by a predetermined increase in velocity of flow through the orifice and into the pipe string in which event the sleeve valve element is moved upwardly to close flow into the spring or which is created by an increase in pressure applied against the upper end of the sleeve valve element through the pipe string when said seat on said tubular member is closed in which event the sleeve valve element is moved downwardly to uncover the cementing ports.

8. A fill-up and cementing device according to claim 7 including,

resilient means positioned in said annular space and urging said sleeve valve element toward said upper position.

9. A fill-up and cementing device according to claim 7 including,

a downwardly facing seat within the lower portion of said tubular body and

a back-check valve engaging said seat to prevent flow upwardly through said seat whereby all of the filling of the well pipe string flows through said orifice.

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