June 16, 1953 C. C. BROWN **2,642,140**

VALVE

Filed June 25, 1949 2 Sheets-Sheet 1

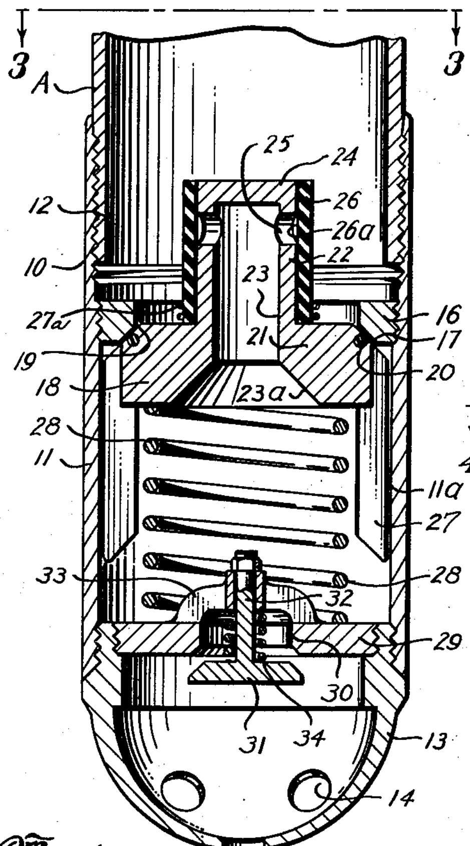

Fig. 1

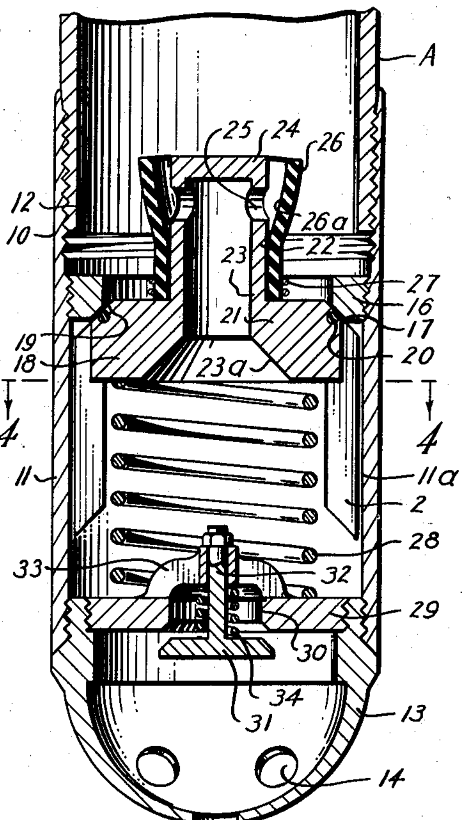

Fig. 2

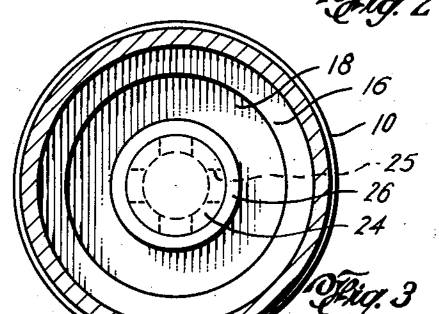

Fig. 3

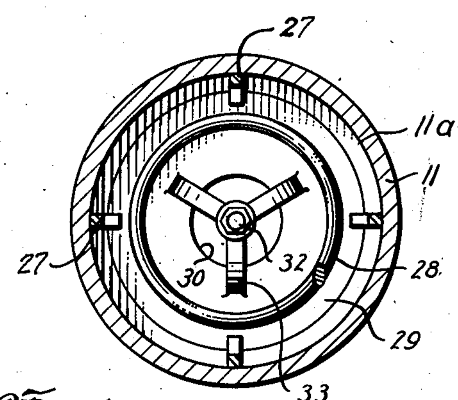

Fig. 4

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VALVE

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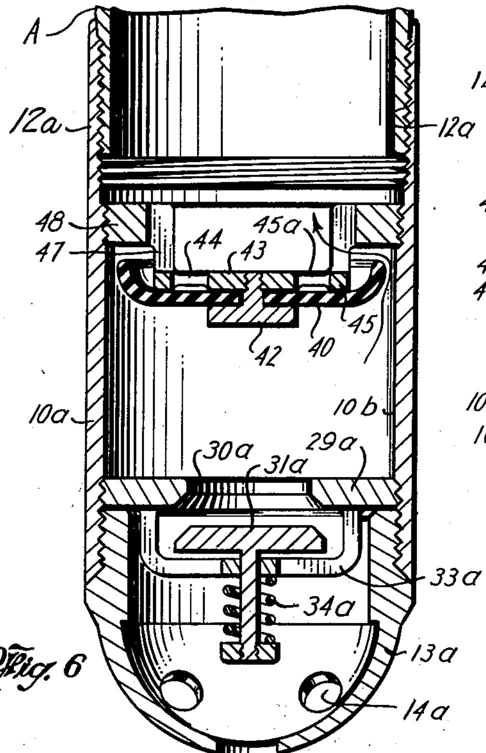

Fig. 6

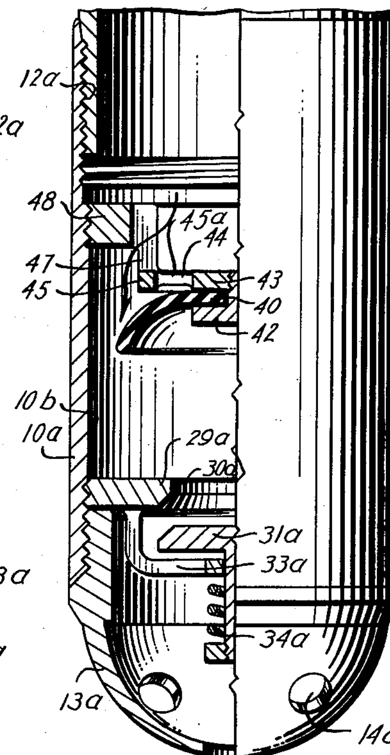

Fig. 7

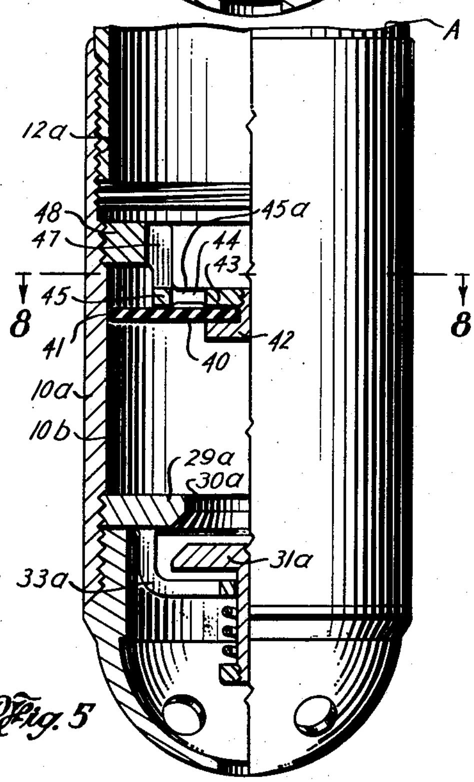

Fig. 5

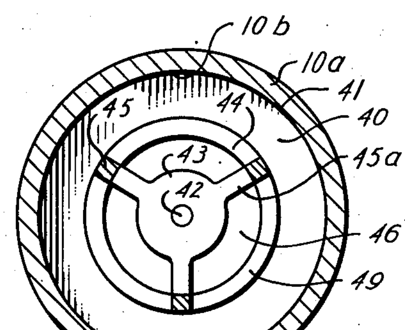

Fig. 8

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UNITED STATES PATENT OFFICE

2,642,140

VALVE

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8 Claims. (Cl. 166—1)

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This invention relates to new and useful improvements in valves and relates particularly to fill-up valves employed for controlling the filling of well pipe as the same is lowered within a well bore.

A well pipe, such as well casing, which is to be lowered into a well bore is ordinarily equipped with a back check or cementing valve at its lower portion and said valve is upwardly closing so as to prevent admission of fluid from the well bore into the pipe during the lowering operation and thereby protect against a blowout through the pipe. However, after the pipe is landed in its final position within the bore, cement is pumped downwardly through the pipe and outwardly past the back check or cementing valve into the formation around the lower portion of the pipe to bond the pipe to the sub-surface formation.

As is well known, it is not generally desirable to run the entire pipe string dry and it is therefore the usual practice to fill the bore of the pipe with fluid during the lowering operation. The pipe is ordinarily filled by pumping fluid from the mud pit into said pipe, with the introduction of fluid being carried out periodically, as for example, upon the running of each two or three sections or stands of pipe. The filling operation requires holding the pipe stationary and considerable time is consumed in connecting and disconnecting the pump outlet to the pipe and in actually carrying out the filling operation. Filling of the pipe in this manner results in lost rig time and additional labor on the part of the crew and has the additional disadvantage of possibly sticking the pipe during the time that the pipe is held stationary; also since the pipe is filled from the mud pit at the surface, the particular fluid pumped into the pipe may not be identical to the fluid in the bore hole whereby these dissimilar fluids will subsequently admix which is undesirable.

It is, therefore, one object of this invention to provide an improved fill-up valve for well pipe which will effect filling of the pipe by fluid from within the well bore and which is so constructed that the cementing operation may be carried out in the usual manner after the well pipe has been landed in its final position in the well bore.

An important object of the invention is to provide an improved valve adapted to be mounted in the lower portion of a well pipe and functioning to automatically control filling of the pipe by fluid from the well bore as said pipe is lowered therein; said valve also including a positive back check closure means which prevents a blowout through the pipe in the event excessive pressures develop in the well bore.

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Another object of the invention is to provide an improved valve, of the character described, wherein a flexible valve element which is actuated by the pressure differential thereacross is utilized to open and close the fluid inlet to automatically control the filling of the well pipe as said pipe is lowered within the well bore.

Still another object is to provide an improved fill-up valve for a well pipe which is extremely simple in construction and which employs only a single flexible valve element having its opposite sides exposed to the fluid pressure in the well bore and the fluid pressure in the well pipe, respectively, whereby the valve element is automatically actuated by the differential in such pressures to control filling of said pipe.

A further object is to provide a single flexible valve element for a fill-up valve, of the character described, which is sleeve-like in form and is adapted to be flexed into open and closed positions to open and close the fluid inlet to the well pipe.

Still another object is to provide a fill-up valve wherein a single annular flexible valve element functions to control the filling action and also operates as a cementing valve, with the construction being such that the volume of flow of fluid past the valve differs in accordance with the direction of flow, whereby only a more or less limited volume may pass the valve during filling but a relatively large volume may pass said valve during cementing.

Other and further objects of the invention will appear from the description of the invention.

In the accompanying drawings, which form a part of the instant specification, which are to be read in conjunction therewith and wherein like reference numerals are used to indicate like parts in the various views:

Figure 1 is a transverse vertical sectional view of a fill-up valve constructed in accordance with the invention with the filling valve element in a closed position,

Figure 2 is a similar view with the valve element which controls the filling in an open position,

Figure 3 is a plan view of the valve device,

Figure 4 is a horizontal cross-sectional view taken on the line 4—4 of Figure 2,

Figure 5 is a view partly in section and partly in elevation of a modified form of the invention with the valve element in a fully closed position,

Figure 6 is a transverse vertical sectional view with the valve element being open to allow filling of the pipe,

Figure 7 is a view similar to Figure 5 illustrating the valve element in an open position in a downward direction to allow flow from the interior of the pipe, and

Figure 8 is a horizontal cross-sectional view taken on the line 8—8 of Figure 5.

In the drawings, the numeral 10 designates a valve device or unit which is adapted to be connected in the lower portion of a well pipe or casing string A and which is arranged to control the entry of fluid from the bore of the well as said pipe or casing is lowered through the fluid within said bore. The valve device includes an outer tubular housing or body 11 which is formed with an axial bore 11*a* and an internally threaded box 12 at the upper end of said bore whereby the device may be readily attached to the lowermost section of the well pipe A. The lower end of the body or housing 11 has a perforated plug 13 threaded therein and the wall of said plug is formed with a plurality of openings 14 therein which establish communication between the interior of the body and the well bore.

A valve seat ring 16 having an annular valve seat surface 17 is mounted within the bore 11*a* of the valve body 11 and this ring is preferably threaded into the bore nearer its upper portion and immediately below the threaded box 12. An upwardly closing cementing valve 18 having a bevelled or inclined seating surface 19 is adapted to engage the valve seat 17 to prevent upward flow past said seat into the well pipe. A suitable sealing ring 20 may be mounted in an annular groove in the bevelled surface 19 of the valve to assure a fluid tight seal when said valve is engaged with the seat.

The cementing valve 18 includes a disc-like head portion 21 having an integral upwardly extending cylindrical shank or stem 22 which is disposed axially of the valve head. An axial bore 23 extends through the valve head 21 and valve stem 22 and the lower flared end of the bore communicates with the interior of the valve housing or body below the valve head; the upper end of the bore is closed by an end wall 24 which is preferably made integral with the stem. Radial ports or openings 25 are formed in the upper portion of the wall of the valve stem 22 and when the valve 18 is in its upper or seated position as shown in Figure 1, an upward flow from the interior of the body 11 below the valve may occur only through the axial bore 23 and ports 25 since the valve seating surface 19 is engaged with the valve seat 17 to close upward flow past the valve head.

With the valve 18 in a seated position flow through the ports 25 is controlled by a resilient valve sleeve 26 which is constructed of rubber, rubber compound or other elastic material and which surrounds the tubular valve stem 22. The lower portion of the valve sleeve 26 is securely fastened to the base portion of the stem by means of a wire 27 which is wrapped therearound or by some other suitable clamping means, while the upper portion of said sleeve is unattached and free from the stem. The normal or undistorted size and shape is such that the bore 26*a* of the sleeve has a snug engagement with the exterior surface of the stem 22 and thus, the normal or inherent elasticity of said valve sleeve 26 retains said sleeve in firm engagement with the outer surface of said stem 22 in which position said sleeve closes the ports 25. The external surface of the sleeve is, of course, exposed to the pressure within the well pipe A and is added to the normal elasticity of the sleeve to maintain the same in port-closing position.

The bore 26*a* of the valve sleeve is exposed through the ports 25 to the pressure within the well bore, which pressure enters the lower portion of the tubular valve body 11 through the openings 14 and flows into the axial bore 23 which extends through the valve head 21 and stem 22. When this pressure exceeds the pressure which is holding the valve sleeve in a position covering the ports 25, the upper end of the elastic valve sleeve is distorted outwardly to the position shown in Figure 2 whereby the upper portion of the valve sleeve is urged or moved outwardly to uncover the ports 25 and allow a flow of fluid from the axial bore 23 into the lower end of the well pipe. As noted the fluid in the bore 23 has entered said bore through the openings 14 in the plug 13 and therefore, opening of the ports 25 establishes a communication between the well bore and the interior of the well pipe A whereby fluid from the well bore may enter said pipe. Whenever pressures across the elastic valve sleeve again equalize the valve sleeve will return to its original undistorted position as shown in Figure 1 to again close the ports or openings 25. It will thus be evident that the valve sleeve 26 which functions as the fill-up valve of the unit, as will be explained, is controlled by the differential in pressures acting on opposite sides thereof.

The cementing or upwardly closing check valve 18 is guided in its movement by radially disposed and downwardly extending guide wings or members 27 which are spaced equidistant around the valve head 21 and which have their outer edges engaging the bore 11*a* of the tubular valve body or housing 11. The valve 18 is normally held in its upward or closed position by means of a coil spring 28 which has its upper end engaging the under side of the valve head 21 and has its lower end resting upon a transverse supporting plate or partition plug 13. The supporting plate or partition 29 has an axial opening 30 therein and said opening is adapted to be closed by an upwardly closing check valve 31 having its stem 32 slidable within a guide spider 33 secured to said plate. A coil spring 34 normally holds the check valve 31 in an open position and the strength of the spring is such that so long as a normal pressure is present in the well bore the valve 31 is open. However, in the event that an excessive pressure builds up within the well bore which might tend to create a blowout the valve 31 is automatically closed to positively shut off any entry of fluid from the well bore into valve body 11 and into the well pipe A. It will be evident that such positive shut off will be obtained because the valve 31 is disposed between the fluid inlet openings 14 in the plug and the fill-up valve formed by the sleeve valve 26. The check valve 31 and the cementing valve 18 are both upwardly closing and it is obvious that a cementing operation may be carried on through the well pipe by merely pumping the cement downwardly therethrough, the pump pressure functioning to unseat or open both valves whereby the cement may be discharged outwardly into the well bore through the openings 14 in the plug 13.

In the operation of the device or unit 10, said device is connected to the lower end or in the lower portion of the well pipe string A and is lowered downwardly through the fluid within the well bore. When first introduced in the well bore, the parts will be in the position shown in Figure 1 with the cementing valve 18 in its upper closed position and the back check valve 31 in its lowered or open position. The fill-up sleeve valve 26 will be closed because the inherent elasticity of the valve will hold said valve in tight engagement with the external surface of the tubular stem 22 to cover or close the ports 25.

As the well pipe is lowered through the fluid within the bore the kinetic pressure which is built up due to the movement of the pipe string into the well fluid will result in an impact pressure against the interior of the sleeve valve 26, such pressure acting through the ports 25 against the bore 26*a* of said sleeve valve. Since the upper portion of the sleeve valve is unattached to the stem 22, said upper portion of the sleeve valve will be distorted or expanded outwardly to the position shown in Figure 2, whereby the ports 25 are opened and fluid is admitted from the well bore into the interior of the well pipe A. It is noted that the pressure of the spring 34 on the check valve 31 is sufficient to maintain this check valve open against the normal kinetic pressure which is developed during the lowering operation, whereby said check valve remains open to allow the pressures to act against the interior of the sleeve valve 26 under normal conditions.

An inflow of fluid into the well pipe A continues until a sufficient volume of fluid has been admitted to the pipe to build up the hydrostatic head pressure within the pipe, and when this hydrostatic head pressure, plus the normal inherent resiliency of the sleeve valve 26 which is tending to return said valve to its normal position, is sufficient to overcome the pressure acting against the interior of said sleeve valve, the sleeve valve is returned to its normal undistorted position as shown in Figure 1. In such position the sleeve valve 26 overlies and closes the ports 25 and this shuts off a further inflow of fluid to the well pipe. The sleeve valve 26 remains closed until continued lowering through the fluid column again increases the pressure acting interiorly thereof, and when this occurs the valve 26 is again opened to admit additional fluid. The admission of such additional fluid continues until the head pressure of the admitted fluid plus the normal inherent elasticity of the valve sleeve 26 is again sufficient to overcome the pressure acting interiorly on the bore 26*a* of the valve, whereby the ports 25 are again closed.

The alternate opening and closing of the valve which is controlled solely by the differential in pressures acting thereacross, continues as the pipe is lowered within the well bore and by the time the pipe is landed in its final position the desired volume of fluid has been admitted to fill the pipe in a desired manner. It is obvious that if excessive pressures are developed within the well bore during the time of lowering of the pipe such excessive pressure will be sufficient to overcome the tension of the spring 34 which normally holds the check valve 31 in its open position and the check valve will thus be closed to shut off flow upwardly through the opening 30 in the partition 29 and will thereby close off the admission of any fluid from the well bore into the well pipe. Thus the check valve 31 may, under certain excessive pressure conditions effect a positive shut off of upward flow of fluid into the well pipe to assure protection against a possible blowout during the lowering operation.

After the pipe has been lowered to its final position, cement may be pumped downwardly through the well pipe in the usual manner and acting against the head portion 21 of the cementing valve 18 will function to move said valve downwardly against the pressure of its spring 28, whereby the valve surface 19 is moved away from the valve seat 17. The cement may thus pass downwardly around the valve head 21 and then through the opening 30 in the partition past the check valve 31 to be finally discharged outwardly through the openings 14 in the plug 13. Therefore, after the well pipe has been finally landed in position a cementing operation may be carried out in the usual manner.

From the foregoing, it will be seen that the device provides a means whereby the well pipe or casing may be automatically filled by fluid from within the well bore as said pipe is lowered through said bore. A positive protection against blowout in case of excessive pressures within the bore is provided by means of the check valve 31. The entire structure is such that after the pipe is lowered into position the usual cementing operation may be carried out.

In Figures 5 to 8 a modified form of the invention is shown wherein a tubular valve body 10*a* similar to the body 11 of the first form is provided with an internally threaded box 12*a* at its upper end for connection with the well pipe, while its lower end is closed by a plug 13*a* having openings 14*a* therein. The openings 14*a* establish communication between the interior of the valve body 10*a* and the well bore and the fluid entering said body through the openings flows upwardly past an upwardly closing check valve 31*a* which is mounted in a spider 33*a* secured to the underside of a transverse partition or plate 29*a*. The check valve is adapted to close flow through an axial opening 30*a* within the partition. As in the case in the first form the check valve 31*a* is normally held open by a spring 34*a* so that under normal conditions a free entry of fluid from the well bore and upwardly through the opening 30*a* may occur; however, in the event that the well bore pressures become excessive the tension of the spring 34*a* is overcome and the check valve 31*a* moves upwardly to close the opening 30*a* and thereby shut off any further admission of fluid from the well bore into the body 10*a* and thence into the well pipe A connected with said body.

In this form of the invention the separate cementing valve 18 is completely eliminated and a single distortable valve element or disc 40 is provided. As will be explained the valve element or disc 40 functions not only to control the filling of the well pipe A but also functions as a cementing valve, whereby when desired a cementing operation may be carried out downwardly through the well pipe A and through the tubular valve body 10*a*. As is clearly shown in Figure 5, the valve element or disc 40 has a diameter which is preferably slightly larger than the bore 10*b* of the body 10*a* whereby its periphery 41 will engage and seal with the wall of the bore 10*b* when the disc is in a horizontal or normal or undistorted position, as shown in Figure 5. The inherent elasticity or resiliency of the valve element or disc 40 will tend to maintain the disc in its normal, undistorted position with its peripheral edge engaging and sealing with the wall of the bore 10*b*.

The valve element or disc 40 is mounted by means of a screw 42 on the central collar 43 of a spider member 44. The spider includes an annular ring 45 which is connected through radial legs **45**a with the central collar and the spaces between the legs **45**a form flow passages **46**. The spider member **44** is suspended by a plurality of arms **47** from a supporting ring **48** which is threaded into the upper portion of the bore **10**b and the spaces between the supporting arms **47** provide side passages or flow areas **49**. It is noted that the valve support could be constructed of a collar having a closed bottom and depending from the supporting ring **48**, with the side passage **49** being formed in the wall of said collar and the bottom passages **46** formed in the closed bottom of said collar.

When the valve element or disc **40** is in its normal, undistorted position (Figure 5) with its peripheral edge **41** in sealing engagement with the wall of the bore **10**b and said disc overlying the passages **46**, a flow in either direction through the bore of the body **10**a is prevented. Whenever the pressure acting below the valve element or disc exceeds the pressure acting against the upper surface of said disc the marginal edge portion of the disc **40** is distorted upwardly to the position shown in Figure 6 with the point of fulcrum being at the edge of the ring **45** of the spider member. This upward distortion or flexing of the valve element or disc **40** will permit a flow of fluid upwardly through the body **10**a around the distorted valve disc and through the side flow passages **49** between the supporting arms **47**. Therefore, during lowering of the well pipe A, the kinetic pressure which is developed beneath the valve element or disc will distort or flex said disc upwardly (Figure 6) whereby fluid from the well bore may enter the well pipe. Whenever the hydrostatic head pressure of the admitted fluid plus the inherent resiliency of the disc tending to return said disc to its normal position equals the pressure acting beneath the valve element or disc, said valve element is returned to its initial normal position as shown in Figure 5, in which position said valve closes flow through the side passages **49** as well as through the bottom passages **46**.

The operation of the valve element or disc **40** during the filling of the well pipe is the same as has been described with respect to the flexible or distortable valve sleeve **26** of the first form. That is, as the pipe is lowered and the kinetic pressure beneath the valve element **40** is increased, the outer marginal portion of the valve element is distorted upwardly to permit a flow through the side passages **49** to admit fluid from the well bore into the well pipe. As soon as sufficient fluid has been admitted into the well pipe to attain a pressure which when added to the normal resiliency of the valve disc or element is equal to the pressure acting below the element, said element is returned to a normal sealing position to prevent further flow through the passages **49**. It will be evident that the periodic operation of the valve disc to admit fluid into the well pipe will be continued throughout the lowering operation and until the pipe is landed in its final position. During the lowering movement the check valve **31**a will provide a protection against possible blowout in the event the well bore pressures become excessive.

When it is desired to perform a cementing operation following the final landing of the pipe it is only necessary to pump the cement downwardly through the well pipe and the pressure of the pumped cement will act against the exposed upper surface of the valve element or disc **40**. This surface is that portion of the valve element or disc which is exposed not only through the side passages **49** but also through the bottom passages **46** and thus the valve disc will be distorted in a downward direction from the fulcrum point at the peripheral edge of the central collar **43** and mounting screw **42**. Therefore, upon a distortion of the valve disc or element **40** in a downward direction both the side passages **49** and the bottom passages **46** are opened whereby an increased volume may pass the valve disc, whereby an ample volume of cement may be pumped downwardly through the body. The cement will of course pass downwardly through the tubular body **10**a and through the opening **30**a past the check valve **31**a and will finally discharge through the openings **14**a into the well bore. It is therefore apparent that the valve disc or element **40** will function not only to control filling of the well pipe but will also function as a cementing valve for the subsequent cementing operation.

It is pointed out that one of the features of the form shown in Figures 5 to 8 is the arrangement whereby only a certain portion of the valve element or disc **40** is distorted upwardly so that only the side passages **49** are opened during the filling of the well pipe, when only a lesser flow area is required. At this time the valve element fully overlies the bottom passages **46** and the admission of fluid from the well bore into the pipe is only through the side passages **49**. However, when cementing is to be carried out and a greater area passage is desirable the valve element has a greater portion thereof distorted or flexed downwardly to open both the side and bottom passages to provide this increased flow area.

In both forms of the invention a flexible valve element which is capable of being distorted and which is operated by the differential in pressure thereacross is employed. By actuating the valve element by means of the differential in pressures in the well bore and in the well pipe, completely automatic operation is had.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having described the invention, I claim:

1. A fill-up valve device for a well pipe adapted to be lowered within a well bore having fluid therein including, a tubular body adapted to be connected in the lower portion of the well pipe and having a fluid opening therein whereby fluid from the well bore may enter the body and flow into the well pipe, a valve seat in said body, and a cementing valve within the body which is normally closed by seating on said valve seat and is adapted to be unseated to allow a cementing operation to be carried on through the pipe, said valve having an axial flow passage therethrough, a tubular flow stem connected with said cementing valve and having an open lower end com-

municating with said axial flow passage and the lower portion of the interior of the body, whereby pressure fluid from the well bore flowing into the body through the fluid opening may enter the stem, said stem having a closed upper end and having radial ports in its wall which establish communication between the interior of the flow stem and the well pipe so that fluid from the well bore may flow into the well pipe through the tubular stem and ports, and a flexible valve member mounted on the exterior of the stem and actuated by the differential in pressures within the stem and within the well pipe for controlling flow through said ports.

2. A fill-up valve device for a well pipe adapted to be lowered within a well bore having fluid therein including, a tubular body adapted to be connected in the lower portion of the well pipe and having a fluid opening therein whereby fluid from the well bore may enter the body and flow into the well pipe, a valve seat in said body, and a cementing valve within the body which is normally closed by seating on said valve seat and is adapted to be unseated to allow a cementing operation to be carried on through the pipe, said valve having an axial flow passage therethrough, a tubular flow stem connected with said cementing valve and having an open lower end communicating with said axial flow passage and the lower portion of the interior of the body, whereby pressure fluid from the well bore flowing into the body through the fluid opening may enter the stem, said stem having a closed upper end and having radial ports in its wall which establish communication between the interior of the flow stem and the well pipe so that fluid from the well bore may flow into the well pipe through the tubular stem and ports, and a valve sleeve constructed of distortable material surrounding the stem and having its lower end anchored to said stem with its upper end unattached to the stem and overlying the ports, the normal undistorted position of the valve sleeve closing said ports and outward distortion of the valve sleeve moving said sleeve away from the ports to open the same.

3. A fill-up valve device for a well pipe which is adapted to be lowered within a well bore having fluid therein, a tubular body adapted to be connected in the lower portion of the well pipe and having openings in its lower end establishing communication between the well bore and the lower portion of the body, a valve seat in the body, an upwardly closing cementing valve within the body above the openings and adapted to close by seating on said valve seat, a stem on the upper portion of the cementing valve, said valve and stem having a passage which extends from the lower end of the valve to a point terminating short of the upper end of the stem, and said stem having a radial port extending through the wall from said passage into the area above the cementing valve, whereby communication between the well bore and the interior of the well pipe may be established through the passage and port, and a flexible valve element actuated by the differential in pressures within the well bore and within the well pipe for controlling flow through the port.

4. A fill-up valve device for a well pipe which is adapted to be lowered within a well bore having fluid therein, a tubular body adapted to be connected in the lower portion of the well pipe and having openings in its lower end establishing communication between the well bore and the lower portion of the body, a valve seat in the body, an upwardly closing cementing valve within the body above the openings and adapted to close by seating on said valve seat, a stem on the upper portion of the cementing valve, said valve and stem having a passage which extends from the lower end of the valve to a point terminating short of the upper end of the stem, and said stem having a radial port extending through its wall from said passage into the area above the cementing valve, whereby communication between the well bore and the interior of the well pipe may be established through the passage and port, and a tubular sleeve valve of distortable material surrounding the exterior of the stem and having its lower end anchored thereto, with its upper portion unattached and overlying the port, whereby the upper portion of said sleeve valve may be distorted radially outwardly to open said port.

5. A valve device for a well pipe which is lowered within a well bore having fluid therein including, a tubular body adapted to be connected in the lower portion of the well pipe, said body having an opening establishing communication between the interior of the body and the well pipe thereabove, a valve seat in said body, an upwardly closing valve member coacting with the opening for controlling flow therethrough by seating on said valve seat, a valve element associated with said valve member and including a flexible part which functions to open flow through the opening when the valve member is seated on said valve seat, said flexible part closing flow through said opening when in a normal undistorted position and allowing flow through said opening when flexed from its normal position.

6. A valve device for a well pipe which is lowered within a well bore having fluid therein including, a tubular body adapted to be connected in the lower portion of the well pipe, said body having an opening establishing communication between the interior of the body and the well pipe thereabove, a valve seat in said body, an upwardly closing valve member coacting with the opening for controlling flow therethrough, said valve member having a flow passage therethrough and a flexible valve element associated with said valve member to open and close flow through said flow passage, said valve element closing said passage when in a normal undistorted position to prevent downward fluid flow and opening said passage when flexed from its normal position to permit upward fluid flow.

7. A valve device for a well pipe which is lowered within a well bore having fluid therein including, a tubular body adapted to be connected in the lower portion of the well pipe, said body having an opening establishing communication between the interior of the body and the well pipe thereabove, a valve seat in said body, an upwardly closing valve member coacting with the opening for controlling flow therethrough by seating on said valve seat to close flow through said opening, said valve member having a flow passage therethrough, and a flexible valve element associated with said valve member to open and close flow through said flow passage, said valve element closing said passage when in a normal undistorted position to prevent downward fluid flow and opening said passage when flexed from its normal position to permit upward fluid flow, said valve element having one side exposed to the pressure of the fluid in the well bore exteriorly of the well pipe and having its opposite side exposed to the pressure of the fluid within the bore of said pipe.

8. A valve device as set forth in claim 6, wherein the flexible valve element is a tubular sleeve

element anchored at its lower end to said valve member and having its upper portion overlying the communication-establishing opening.

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