

Sept. 21, 1943.

M. M. VERHEUL

2,329,960

FLOAT VALVE

Filed July 26, 1941

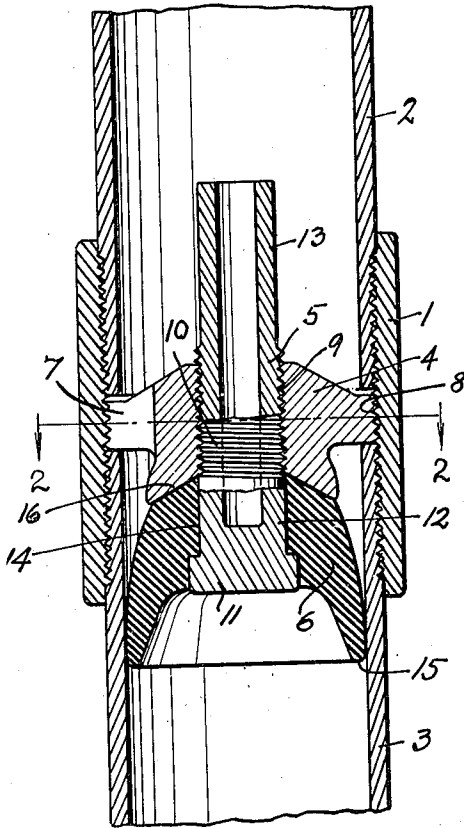


FIG. 1.

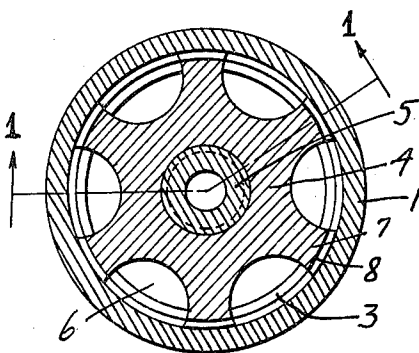


FIG. 2.

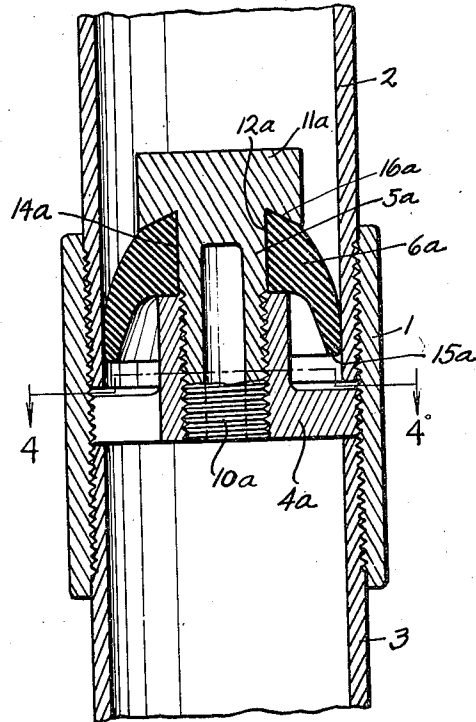


FIG. 3.

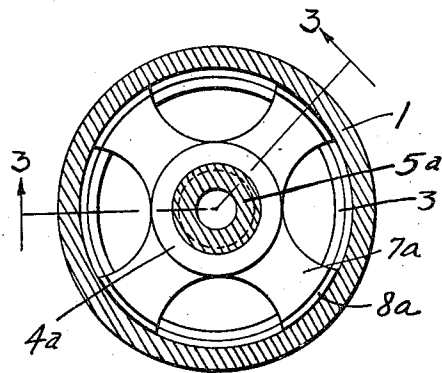


FIG. 4. M. M. Verheul.
Inventor

J. Vincent Martin
and
Ralph K. Browning
Attorneys

UNITED STATES PATENT OFFICE

2,329,960

FLOAT VALVE

Maarten M. Verheul, Houston, Tex.

Application July 26, 1941, Serial No. 404,149

10 Claims. (Cl. 137—69)

This invention relates to back pressure valves and has for its general object the provision of a back pressure valve suitable for use as a float valve for a well casing, or the like.

In the past, various types of back pressure valves have been employed at the bottom of, or at some point within a casing, or the like, as it is being lowered into a well. The purpose of such valve is to prevent flow of fluid, with which such wells are usually filled, into the lower end of the casing. The casing is thus maintained either partially or wholly empty of liquid, with the result that the liquid in the well exerts a substantial buoyant influence on the casing and relieves the hoisting apparatus at the surface of the ground of a large portion of the weight of the casing which it would otherwise have to sustain.

After such casings have been located in their desired position within a well and have been cemented or otherwise secured in place, it becomes necessary to remove the valve or valves, thus employed in floating the casing in. For the most part such valves have been removed by drilling them out with a suitable drilling tool lowered through the casing. Difficulty has been experienced, however, due to the fact that most such valves employing moving parts have necessarily been made of a relatively strong and hard material, difficult to drill with ordinary drilling tool. Furthermore, most such valves have parts which are rotatable with respect to the casing when the valves are in place and when these parts are encountered by a drilling tool and the drilling tool rotates, the parts will merely rotate and will not be removed or broken up by the drilling tool.

In still other instances, such valves have been so formed that when partially drilled out, relatively large parts would be left intact to fall to the bottom of the hole and there interfere with further drilling operation, and those parts have in most instances, due to the construction of the valve involved, been necessarily of such a nature that they could not be broken up readily by the ordinary drilling tools.

In view of the foregoing, it is an object of this invention to provide a float valve which may be readily incorporated into an ordinary casing structure and yet which may be easily removed by the ordinary drilling tool when so desired.

Another object of this invention is to provide such a structure which has no rigid moving parts and no parts which are necessarily of such hardness that they will be difficult to drill up with ordinary drilling tools.

Another object of this invention is to provide

such a structure which will not require any special form of casing or casing coupling for the purpose of receiving it.

Another object of this invention is to provide such a structure in which there are no parts which can rotate with the drilling tool when it is desired to break up the valve structure by means of a drilling tool.

Other objects and advantages of this invention will become apparent from the following description, taken in connection with the accompanying drawing wherein are set forth by way of example and illustration, two embodiments of this invention.

In the drawing:

Fig. 1 is a view in longitudinal cross section illustrating a valve constructed in accordance with this invention;

Fig. 2 illustrates a transverse cross section through the structure shown in Figure 1, the same being taken along the line 2—2 of Figure 1;

Fig. 3 is a view similar to Figure 1 but showing a modification;

Fig. 4 is a view similar to Figure 2 but taken along the line 4—4 of Figure 3.

The valves constructed in accordance with this invention are adapted to be mounted within a collar 1 which is an ordinary casing collar having joints of casing 2 and 3 respectively threaded into its opposite ends.

The valve, as illustrated in Figures 1 and 2 consists of a body member 4 which may be referred to as a "spider," a mandrel 5, and flexible sealing cup 6. The spider, in the form shown, consists of an annular portion disposed about the central axis of the casing and having circumferentially spaced radially extending arms 7, the outer ends of which are formed with threads 8 adapted to fit the threaded intermediate section of the casing collar 1. It will be apparent that this spider is intended to be threaded into the collar 1 and to occupy the space which normally exists within the collar between the two casing joints 2 and 3. The openings between the arms 7 are adapted to permit the downward flow of slush or other fluid when so desired.

The interior of the annular portion of the spider is also threaded as shown at 9 to receive the threads 10 on the mandrel 5. It will be noted that the threads 10 in this instance are lefthand threads for a purpose to be presently described.

The mandrel 5 is provided with a lower enlargement 11 forming a head with a relatively smooth cylindrical portion 12 between the head

11 and the thread 10, and with a relatively smooth cylindrical portion 13 above the thread 10. The cylindrical portion 12 is preferably slightly larger in diameter than the threads 10 and the cylindrical portion 13 slightly of smaller diameter than thread 10.

Surrounding the portion 12 of the mandrel is the base portion 14 of the flexible cup 6. This cup extends from such base portion 14 outwardly and downwardly and terminates in a relatively very flexible sealing lip 15, which is of such a diameter that it is normally pressed against the interior of the casing joint 3 to form a seal therewith. It will be appreciated that the cup 6 is prevented from coming off the mandrel 5 by the head 11. The cup is positively held against upward movement by virtue of its abutment against the cup seat 16 on the lower surface of the annular part of spider 4.

It will be seen from the foregoing that the valve just described may be readily inserted into any ordinary casing coupling and that the lip 15 of the sealing cup 6 will prevent any upward flow through the casing. The mandrel may be properly adjusted by means of a wrench or tong, which may be engaged with the part 13 of the mandrel prior to the time that the casing joint 2 is threaded into place within collar 1. Because of the location of the spider 4 and its connection with the casing collar 1, this spider cannot be rotated to the right when it is engaged with an ordinary drilling tool for the purpose of breaking up the valve. Its right hand rotation will be positively limited by the engagement of the arms 7 with the upper end of the casing joint 3. Likewise, the mandrel 5 will be prevented from rotating to the right during such drill operation by virtue of the left hand thread 10. Thus, as the drill tends to rotate the mandrel to the right the mandrel may be rotated to the right only until the part 12 engages the lower surface of the spider 4. Thereafter the mandrel will remain stationary and rotation of the drilling tool will serve to break it up.

The spider and the mandrel are both formed preferably of a readily drillable material, such as phenolic condensation products, or other well known plastics. Since none of the parts move with respect to each other, there is no need that these parts be especially hard so that they would offer resistance to being drilled. On the other hand, these parts are preferably relatively friable and easily broken, having only sufficient strength to enable them to withstand force due to the hydrostatic pressures encountered in a well.

It will be seen, furthermore, that fluid pressure from below such a valve will tend to seal the lip 15 all the more tightly against the casing wall but that pressure from above the valve may easily force itself past this flexible lip so that down flow may take place through the casing whenever desired. Such down flow may freely pass between the arms 7 of the spider.

Referring now to the form shown in Figure 3 the principles involved are substantially the same as those shown in the form of Figure 1. In this form, however, the spider 4-a has arms 7-a threaded on their outer ends at 8-a to fit the threads on the interior of coupling 1. The mandrel 5-a has its head 11-a on its upper end instead of on its lower end and is threadedly engaged with the interior of spider 4-a by means of right hand threads 10-a. The spider 4-a has its annular portion extending upwardly somewhat above the arms 7-a and provides a shoulder

at its upper end for the purpose of limiting downward movement of sealing cup 6-a. The base 14-a of the sealing cup 6-a embraces the cylindrical portion 12-a of the mandrel which lies between the spider and the head 11-a, and the flexible lip 15-a of this sealing cup forms a seal against the interior of the upper casing joint 2. The head 11-a on the mandrel provides an abutment 16-a that prevents any upward movement of the cup 6-a.

It will be perceived that the form just described operates in substance much the same as the form shown in Figure 1 except that the sealing cup 6-a is disposed above the spider instead of below it as in Figure 1, and the lip 15-a forms a seal against the interior of the casing joint 2 instead of the casing joint 3.

When a drill is engaged with the valve shown in Figure 3 for the purpose of breaking it up, it will first engage the mandrel head 11-a and will tend to rotate this mandrel to the right. Right hand rotation of the mandrel with respect to the spider 4-a will cease, however, when the threads 10-a are fully engaged. Likewise, right-hand rotation of the spider 4-a with respect to the casing will cease when the arm 7-a of the spider engages the upper end of the casing joint 3. The drill may then break up the various parts and it is to be noted in this instance that the last part to be broken up will be spider 4-a after the other parts have been demolished by drilling.

Having described my invention, I claim:

1. In a casing float valve, a spider having an annular part with arms projecting radially therefrom, said arms being threaded to engage the threads in a casing coupling between the ends of two joints of casing threaded thereto, said annular part having internal threads, a mandrel threadedly engaging said last mentioned thread in the spider and having a head thereon spaced substantially from said spider with a smooth zone adapted to receive tongs, or the like, and a flexible cup shaped valve member surrounding said mandrel and having a lip-like edge yieldably engaging the inner surface of one of said casing joints adjacent said coupling to close the same against flow in one direction but capable of flexing under pressure to permit flow in the other direction.

2. In a casing float valve, a spider member having an annular part with arms projecting radially therefrom, said arms being threaded to engage the threads of a casing coupling between the ends of two joints of casing threaded thereto, said annular part having internal threads and a mandrel member threadedly engaging said last mentioned threads in the spider, and having a head thereon spaced from said spider, a part of said mandrel spaced substantially from said spider having a smooth zone adapted to receive tongs, and a flexible cup shaped valve member surrounding said mandrel and having a lip-like edge yieldably engaging the inner surface of the casing joint adjacent the coupling to close the same against flow in one direction, but capable of flexing under pressure to permit flow in the opposite direction, one of said members having an annular abutment formed thereon shaped to provide a seat for the convex portion of said sealing cup and limit the upward movement thereof.

3. In a casing float valve, a spider having an annular part with arms projecting radially therefrom, said arms being threaded on their outer ends to engage the threads of a casing cou-

pling between the ends of two joints of casing threaded thereto, said annular part having internal threads, a mandrel threadedly engaging said last mentioned threads in the spider and having a head thereon spaced from said spider and a smooth zone spaced substantially from said spider adapted to receive tongs, and a flexible cup shaped valve member surrounding said mandrel, and having a lip-like edge yieldably engaging the inner surface of one of said casing joints engaging said coupling to close the same against flow in one direction, but capable of flexing under pressure to permit flow in the other direction, said mandrel having its head formed with an annular surface receiving and providing a seat for said cup and preventing upward movement thereof.

4. In a casing float valve, a spider having an annular part with arms projecting radially therefrom, said arms being threaded on their outer ends to engage the threads of a casing coupling between the ends of two joints of casing threaded thereto, said annular part having internal threads, a mandrel threadedly engaging said last mentioned threads in the spider and having a head thereon spaced from said spider and a smooth zone spaced substantially from said spider adapted to receive tongs and a flexible cup shaped valve member surrounding said mandrel, and having a lip-like edge yieldably engaging the inner surface of one of said casing joints engaging said coupling to close the same against flow in one direction, but capable of flexing under pressure to permit flow in the other direction, said spider having its lower surface receiving and providing a seat for said cup and preventing upward movement thereof.

5. In a casing float valve, a spider having an annular part with arms projecting radially therefrom, said arms being threaded on their outer ends to engage the threads of a casing coupling between the ends of two joints of casing threaded thereto, said annular part having internal threads, a mandrel threaded into said internally threaded part on the spider from below the same and having a head thereon spaced below said spider and a smooth zone projecting a substantial distance above said spider, adapted to receive tongs, and a flexible cup shaped valve member surrounding said mandrel and having a lip-like edge yieldably engaging the inner surface of one of said casing joints engaging said coupling to close the same against flow in one direction, but capable of flexing under pressure to permit flow in the other direction.

6. In a casing float valve, a spider threaded exteriorly to engage the threads of a casing coupling between the ends of two casing joints threaded thereto, said spider being also threaded internally, a mandrel threadedly engaging said last mentioned thread in the spider and having a head thereon spaced from said spider, the threaded engagement between said mandrel and spider being such that a rotation of said mandrel in a clockwise direction, looking in the direction of flow will not disengage said mandrel from said spider, and a flexible cup shaped valve member surrounding said mandrel between said spider and

said head on the mandrel, and having a lip-like edge yieldably engaging the inner surface of one of said casing joints adjacent said coupling to close said casing against flow in one direction, but capable of flexing under pressure to permit flow in the other direction.

7. In a casing float valve, a spider threaded exteriorly to engage the threads of a casing coupling between the ends of two joints of casing threaded thereto, said spider also having internal threads, a mandrel threadedly engaging said internal threads in the spider, and having a head thereon spaced below said spider, and a part projecting above said spider, the threaded engagement between said mandrel and said spider comprising left hand threads and a flexible cup shaped valve member surrounding said mandrel, and having a lip-like edge yieldably engaging the inner surface of one of said casing joints engaging said coupling to close the same against flow in one direction, but capable of flexing under pressure to permit flow in the other direction.

8. In a casing float valve, a spider threaded exteriorly to engage the threads of a casing coupling between the ends of two joints of casing threaded thereto, a mandrel engaging said spider and secured thereto in a position concentric with respect to said spider, means for preventing said mandrel from rotating in a right hand direction, as seen from above, when fully engaged and secured to said spider and a flexible cup shaped valve member surrounding said mandrel, and having a lip-like edge yieldably engaging the inner surface of one of said casing joints engaging said coupling to close the same against flow in one direction.

9. In a casing float valve, a spider, means for mounting said spider in a casing coupling between two joints of casing threaded thereto, a part of said spider engaging the end of one of said casing joints upon rotation of said spider with respect to said coupling in one direction to limit rotation thereof in said one direction, a mandrel, means on said mandrel and spider for securing said mandrel to said spider and preventing rotation of said mandrel in the same direction when fully engaged, and a flexible cup shaped valve member carried by said mandrel and having a lip-like edge yieldably engaging the inner surface of one of said casing joints engaging said coupling, to close the same against flow in one direction.

10. In a casing float valve, a spider, means for securing said spider in a casing coupling between two joints of casing threaded thereto, a part of said spider engaging the end of one of said casing joints when rotated in a right hand direction with respect to said coupling as seen from above to limit such right hand rotation, a mandrel threaded into said spider from below by a left hand threaded engagement and a flexible cup shaped valve member surrounding said mandrel and having a lip-like edge yieldably engaging the inner surface of one of said casing joints engaging said coupling to close the same against flow in one direction.

MAARTEN M. VERHEUL.