

April 28, 1959

J. O. MELTON ET AL

2,884,002

DRILL PIPE VALVE

Filed Oct. 14, 1957

2 Sheets-Sheet 1

Fig. 1.

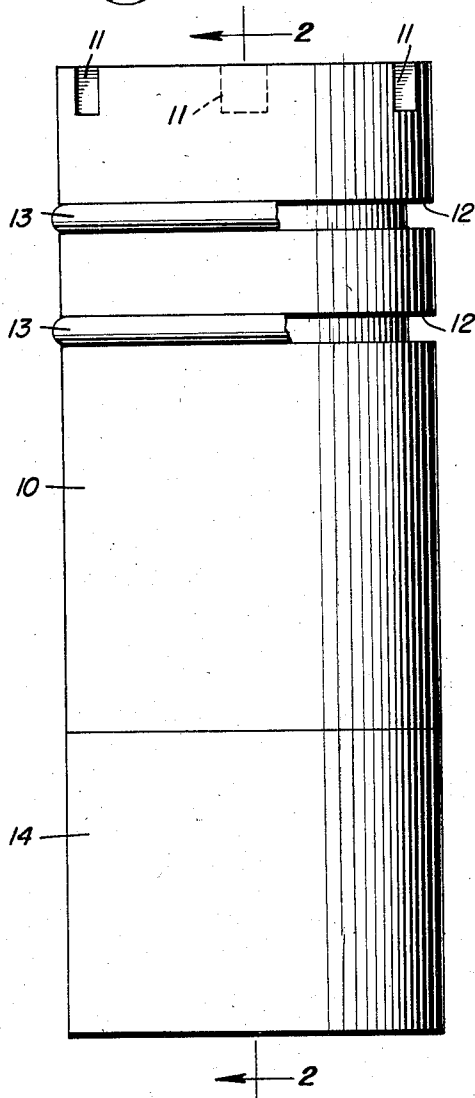


Fig. 2.

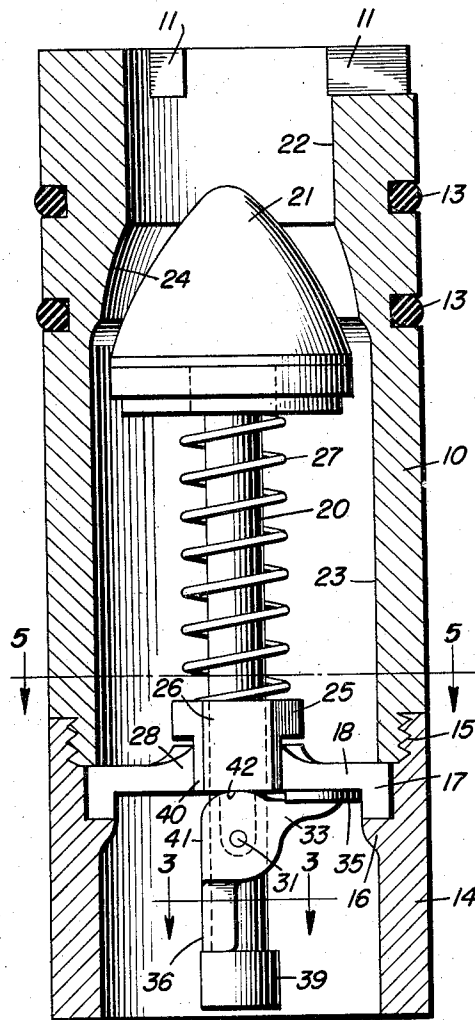
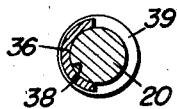


Fig. 3.



INVENTORS
James O. Melton
Irvin M. Carpenter

BY *Stevens, Davis, Miller & Mosher*
ATTORNEYS

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2 Sheets-Sheet 2

Fig. 4.

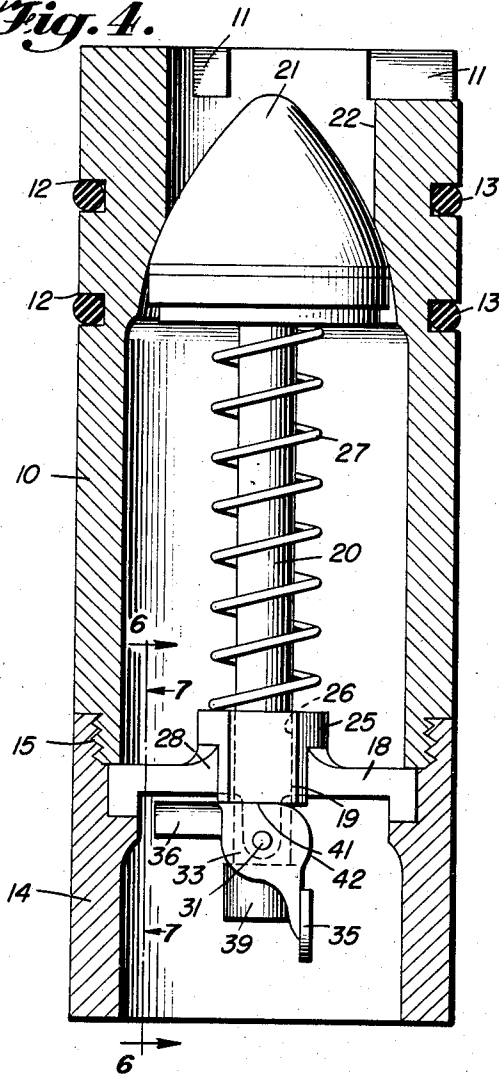


Fig. 5.

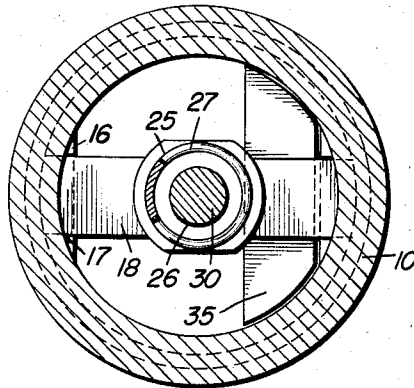


Fig. 6.

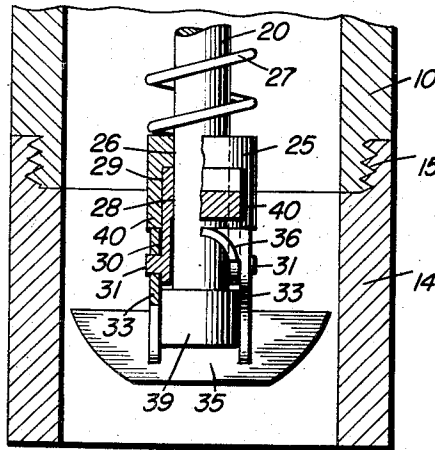


Fig. 8.

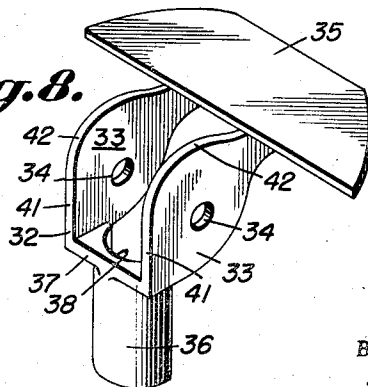
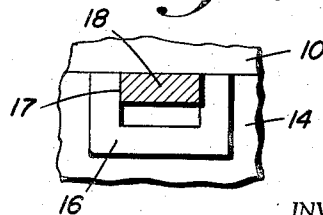


Fig. 7.



INVENTORS
James O. Melton
Irvin M. Carpenter

BY *Stevens, Davis, Miller & Moskee*
ATTORNEYS

1

2,884,002

DRILL PIPE VALVE

James O. Melton, Norman, and Irvin M. Carpenter, Oklahoma City, Okla., assignors to The Geograph Company, Oklahoma City, Okla., a partnership

Application October 14, 1957, Serial No. 690,066

6 Claims. (Cl. 137—454.2)

The present invention relates to well-drilling equipment and more particularly to a valve, generally referred to as a back pressure valve, which will permit the automatic filling of a drill string with drilling fluid as the string is lowered into the well bore.

In the drilling of bore holes through earth formations in the ground, it is conventional practice to force drilling fluid downwardly through the center of the drill string, then upwardly around the outside of the drill string, and back to the pumping means at the surface. It is also conventional to employ a back pressure valve at the lower end of the drill string to prevent any liquid from flowing in the reverse direction from the well bore into the drill string. In this fashion the drilling liquid (or mud) can flow in but one direction.

However, since the drill string must be removed from the well bore from time to time for the purpose of changing the drill bit, or for other various reasons, it becomes necessary to provide means for temporarily disabling the back pressure valve prior to the reintroduction of the drill string into the well bore; otherwise, of course, if the drill string were lowered into the well bore with the back pressure valve operating in its conventional manner, this valve would effectively prevent any liquid from entering the drill string, such that, when the now empty drill string reached a certain depth below the surface of the ground, the pressure of the fluid in the well bore would cause the drill string to collapse.

The operators and engineers in the field have long recognized the problem stated above and, as a result, several back pressure valves have been designed with means for temporarily disabling them prior to the reintroduction of the drill string into the well bore. In most instances the disabling means referred to above consists of a frangible element which locks the back pressure valve in an open position and retains it in such a position until the drill string has been lowered to the desired depth. At this point, the drilling mud is forced into the interior of the drill string exerting a pressure against the frangible element so as to break the same and thus cause the back pressure valve to return to its normal or conventional mode of operation.

The first and most obvious disadvantage of the above type of valve is that the frangible means has to be replaced each and every time that the drill string is removed from the well bore.

Therefore, a principal object of the present invention is to provide an improved back pressure valve of the type referred to above wherein the temporary disabling means forms a permanent part of the valve unit and wherein said disabling means may be simply manipulated to disable the said valve temporarily, and wherein said disabling means may be thereafter simply disengaged to return the valve to its normal functioning operation.

Another object of the present invention is to provide an automatic back pressure valve of the type referred to above, including the disabling means, wherein said valve

2

is of simple yet rugged construction and which is relatively economical to manufacture.

Other and further objects and advantageous features of the present invention will hereinafter more fully appear from a detailed description of the drawings in which

Figure 1 is an elevational view showing the exterior of the enclosed valve;

Figure 2 is a longitudinal section view taken along line 2—2 of Figure 1 showing the valve in its disabled condition;

Figure 3 is a transverse sectional view taken along section line 3—3 of Figure 2 showing the relationship between the valve stem (or rod) and the disabling means;

Figure 4 is a section view similar to Figure 2 showing the valve in its normal operating condition with the disabling means disengaged;

Figure 5 is a transverse sectional view taken along section line 5—5 of Figure 2 showing the relationship between the valve interior and the disabling means when the valve is disabled;

Figure 6 is a longitudinal and fragmentary section view taken along line 6—6 of Figure 4 showing the relationship between the valve stem and disabling means when the valve is in its normal operating condition;

Figure 7 is a fragmentary sectional view taken along the line 7—7 of Figure 4 showing the relationship between one end of the cross bar and its seat in the side of the valve casing;

Figure 8 is a perspective view on an enlarged scale of the disabling means of the present invention.

Referring to the drawings in detail, reference numeral 10 designates the outer casing of the valve which is received and supported in a lower section of the drill string immediately above the portion thereof supporting the drill bit. Any convenient means for attaching, securing, or receiving said valve casing within a section of said drill string (not shown) may be employed. However, purely for purposes of illustration, there are shown at the top of the valve casing 10 three slits 11, etc. which will fit into corresponding projecting portions of or in the drill string section in which the valve is to be located. Also, there are shown two annular grooves 12, 12 and inter-fitting O-rings 13, 13 which provide a convenient seal against the inside of the associated drill string section.

Valve casing 10 has a lower section 14 which is threaded thereto as at 15. On the inside of the lower casing section 14 immediately below the juncture between this element and the main section 10 thereof there are provided a pair of diametrically opposed bosses 16, 16 (see also Figure 7) having oppositely aligned rectangular depressions 17 for receiving therein the opposite ends of a cross bar 18. Cross bar 18 has a centrally located hole 19 which serves to locate the lower end of a rod or valve stem 20 which is freely reciprocable through this hole. A bullet-shaped valve head 21 is attached to the upper end of the valve stem 20. At the upper end of the valve casing 10 there is provided an internal bore 22 of reduced diameter relative to the diameter of the main bore 23. The curved surface interconnecting bores 22 and 23 forms a seat 24 for the valve head 21.

Seated on the upper surface of the cross bar 18 is a collar 25 having a hole 26 for permitting passage therethrough of the valve stem 20. As best shown in the Figures 4 and 6, the cross bar 18 is provided with an upwardly projecting portion 28 which fits into a correspondingly shaped recess 29 in the collar 25. A helical spring 27 surrounding the valve stem 20 bears against the lower surface of the valve head 21 and the upper surface of the collar 25 so as to resiliently urge the valve head 21 in an upward direction towards the valve seat 24. Adjacent the mid-portion of the cross bar 18 and projecting downwardly therefrom on opposite sides of the

3

valve stem 20, are a pair of arms 30, 30 having integral and outwardly projecting pins 31, 31.

Referring now especially to Figure 8, the valve disabling means of the present invention constitutes a pivotal flapper 32 having a pair of spaced parallel flat portions 33, 33 in which are located aligned holes 34, 34. The latter are adapted to fit onto the projecting pins 31, 31. At one end of the flapper 32 extending at right angles to the flat portions 33, 33 is a substantially flat vane 35. At the opposite ends of the flat portions 33, 33 is a hollow and semi-cylindrical member 36 which is secured to the members 33, 33 by the cross member 37. The semi-cylindrical member 36 which constitutes a latching means extends at substantially right angles to the plane of the vane 35. The inside hollow surface 38 of the semi-cylindrical member 36 is substantially of the same diameter as the valve stem 20 (see Figure 3). The lower end of the valve stem 20 is provided with an enlarged rounded portion 39 the upper surface of which can engage the outer edge of the semi-cylindrical latching means 36 as shown in Figure 2.

In order to prevent the flapper 32 from vibrating unnecessarily in either of its two positions as represented by Figures 2 and 4, respectively, the collar 25 is provided with two downwardly projecting portions 40, 40 which extend on opposite sides of the cross bar 18 and terminate adjacent the flapper 32, as best shown in Figures 4 and 6. The flapper itself (see Figure 8) has, on its flat portions 33, 33 a pair of straight side edges 41, 41 which, in the Figure 4 position, will coast with the downward projecting portions 40, 40 of the collar 25 to prevent undue vibration of the flapper 32. These flat portions 33, 33 are also provided with curved side edges 42, 42 adjacent the vane 35 which portions will bear against lower edges of extending portions 40, 40, as shown in Figure 2, such that a part of the spring pressure exerted against the collar 25 will also be exerted against the flapper 32 to hold the same in the Figure 2 position.

The operation of the valve will now be briefly described as follows: Starting from the position shown in Figure 4 which represents the normal operating condition of the valve, and assuming that the lowermost section of the drill string has been raised to the surface, the lower end 39 of the valve stem 20 may be pulled downwardly and the flapper 32 pivoted counter clockwise until the inner surface 38 of the semi-cylindrically shaped member 36 bears against the valve stem 20; at this point, the valve stem 20 is released and the enlarged rounded portion 39 will, through the action of the spring 27, be forced upwardly against the lower edge of the semi-cylindrical portion 36. In this position, the valve stem 20 will be firmly locked in place as shown in Figure 2. Thus, as the drill string is lowered into the ground, the drilling fluid may pass upwardly on the opposite sides of cross bar 18 through the space between the valve head 21 and the valve seat 24 and thence into the main body of the drill string. Although the vane 35 will be occupying a portion of the free cross-sectional area on opposite sides of the cross bar 18, as shown in Figure 6, nevertheless, there remains sufficient open space to permit the passage of the drilling fluid upwardly therethrough as the drill string is lowered into the hole.

When the drill string reaches its lowermost limit where the operator wishes to return the valve to its normal operating condition, the drilling mud is simply pumped downwardly in the drill string. The downward pressure of the flowing fluid will then be exerted against the vane 35 so as to pivot the flapper in a clockwise direction, thus releasing the valve stem 20 from the restraint of the semi-cylindrical latching member 36 and returning the valve to the condition shown in Figure 4. The valve will now operate as a one-way, back pressure valve.

Whereas the instant invention has been described in particular relation to the drawings illustrated herein, other and further modifications, apart from those shown

4

or suggested herein, may be made within the scope and spirit of this invention.

What is claimed is:

1. In a valve of the type described, a hollow valve casing, a valve head, a valve stem supporting said valve head, means on the inner surface of said casing forming a seat for said valve head, means for resiliently urging said valve head toward said valve seat, a radially projecting abutment on said valve stem, a pivotally mounted locking means supported within said casing and having thereon a vane covering a portion of the free internal cross-sectional area of said valve casing when said locking means is in its locking position, said vane being movable away from its position covering said portion of said area when said locking means is pivoted away from its locking position, said locking means including a stem-engaging means for engaging said abutment on said valve stem and for holding said valve head away from said valve seat against the action of said resiliently urging means when said locking means is in its locking position, said stem-engaging means being movable out of engagement with said abutment when said locking means is pivoted away from its locking position.

2. In a valve of the type described including a hollow valve casing, a valve head, a valve stem supporting said valve head, means on the inner surface of said casing forming a seat for said valve head, and a spring means for resiliently urging said valve head toward said valve seat, the improvement which comprises an abutment on said valve stem, and a pivotally mounted locking means supported within said casing and having thereon a stem-engaging means for engaging said abutment and holding said valve head away from said valve seat when said locking means is pivoted to its locking position, said stem-engaging means being movable out of engagement with said abutment when said locking means is pivoted away from its locking position, said locking means also including a vane for covering a portion of the free internal cross-sectional area of said valve casing when said locking means is in its locking position, said vane being movable away from its position covering said portion of said area when said locking means is pivoted away from its locking position, whereby, with said locking means in its locking position, as a stream of fluid is forced through said valve in a direction from said valve head towards said locking means and against said vane, said vane will be forced downwardly such that said locking means will pivot to move said stem-engaging means out of contact with said abutment and said valve is returned to its normal operating condition.

3. In a valve of the type described, a valve casing shaped in the form of a hollow upright cylinder, a valve head, a valve stem attached to said valve head and extending downwardly therefrom, a portion of the inner surface of said casing forming a seat for said valve head, spring means for resiliently urging said valve head upwardly toward said valve seat, a projecting abutment on said valve stem adjacent the lower end thereof, a pivotally mounted flapper supported within said casing adjacent the lower end of said stem and having thereon a vane for covering a portion of the free internal cross-sectional area of said valve casing when said flapper is pivoted to its locking position, said vane being movable out of its position covering said portion of said area when said flapper is pivoted out of its locking position, said flapper having a latching means for engaging said abutment and holding said valve head away from said seat when said flapper is in its locking position, said latching means being movable out of engagement with said abutment when said flapper is pivoted away from its locking position, whereby said valve stem may be urged downwardly and whereby said flapper may be pivoted simultaneously to engage said latching means with said abutment, thereby locking said valve stem in position, and whereby, as a stream of fluid is forced downwardly

5

through said valve and against said vane, said flapper may be pivoted such that said latching means is released from said abutment and said valve is returned to its normal operating condition.

4. In a valve of the type described, a hollow valve casing, a valve head, a valve stem supporting said valve head, means on the inner surface of said casing forming a seat for said valve head, a fixed support means secured to the inside of said valve casing and spaced from said valve seat for slidably engaging said valve stem and for holding the same in axial alignment with said casing, means coacting between said valve head and said support means for resiliently urging said valve head toward said valve seat, a radially projecting abutment on said valve stem, and a locking means pivotally mounted intermediate its ends on said support means and having on one end a vane for covering a portion of the free internal cross-sectional area of said valve casing when said locking means is in its locking position, said vane being movable away from said position covering said portion of said area when said locking means is pivoted out of its locking position, said locking means having at its other end a stem-engaging means for engaging said abutment on said valve stem and for holding said valve head away from said valve seat against the action of said resiliently urging means when said locking means is in its locking position, said stem-engaging means being movable away from engagement with said abutment when said locking means is pivoted away from its locking position.

5. In a valve of the type described including a hollow valve casing, a valve head, a valve stem supporting said valve head, means on the inner surface of said casing forming a seat for said valve head, a fixed support means secured to the inside of said valve casing and spaced from said valve seat for slidably engaging said valve stem and for holding the same in axial alignment with said casing, and a spring means coacting between said valve head and said support means for resiliently urging said valve head toward said valve seat, the improvement which comprises an abutment on said valve stem, and a locking means pivotally mounted on said support means and having thereon a stem-engaging means for engaging said abutment and holding said valve head away from said valve seat when said locking means is pivoted to its locking position, said stem-engaging means being movable out of engagement with said abutment when said locking means is pivoted away from its locking position, said locking means also including a vane for covering a portion of the free internal cross-sectional area of said valve casing when said locking means is in its locking position, said vane being movable away from its position covering said

6

portion of said area when said locking means is pivoted away from its locking position, whereby, with said locking means in its locking position, as a stream of fluid is forced through said valve in a direction from said valve head towards said locking means and against said vane, said vane will be forced downwardly such that said locking means will pivot to move said stem-engaging means out of contact with said abutment and said valve is returned to its normal operating condition.

6. In a valve of the type described, a valve casing shaped in the form of a hollow upright cylinder, a valve head, a valve stem attached to said valve head and extending downwardly therefrom, a portion of the inner surface of said casing forming a seat for said valve head, a cross-bar attached to and extending across the interior of said casing below said valve seat, said cross-bar having a hole therein for permitting sliding movement of said valve stem therethrough while maintaining said valve stem in axial alignment with the longitudinal axis of said casing, spring means coacting between an upper portion of said cross-bar and a lower portion of said valve head for resiliently urging said valve head upwardly toward said valve seat, a projecting abutment on said valve stem adjacent the lower end thereof, a flapper pivotally mounted on said cross-bar adjacent the lower end of said stem and having thereon a vane for covering a portion of the free internal cross-sectional area of said valve casing when said flapper is pivoted to its locking position, said vane being movable away from its position covering said portion of said area when said flapper is pivoted away from its locking position, said flapper having a latching means for engaging said abutment and holding said valve head away from said seat when said flapper is in its locking position, said latching means being movable out of engagement with said abutment when said flapper is pivoted away from its locking position, whereby said valve stem may be urged downwardly and whereby said flapper may be pivoted simultaneously to engage said latching means with said abutment, thereby locking said valve stem in position, and whereby, as a stream of fluid is forced downwardly through said valve and against said vane, said vane will be forced downwardly such that said flapper will be pivoted such that said latching means is released from said abutment and said valve is returned to its normal operating condition.

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