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BACK PRESSURE VALVE MECHANISM FOR WELL PIPE

Filed March 26, 1931

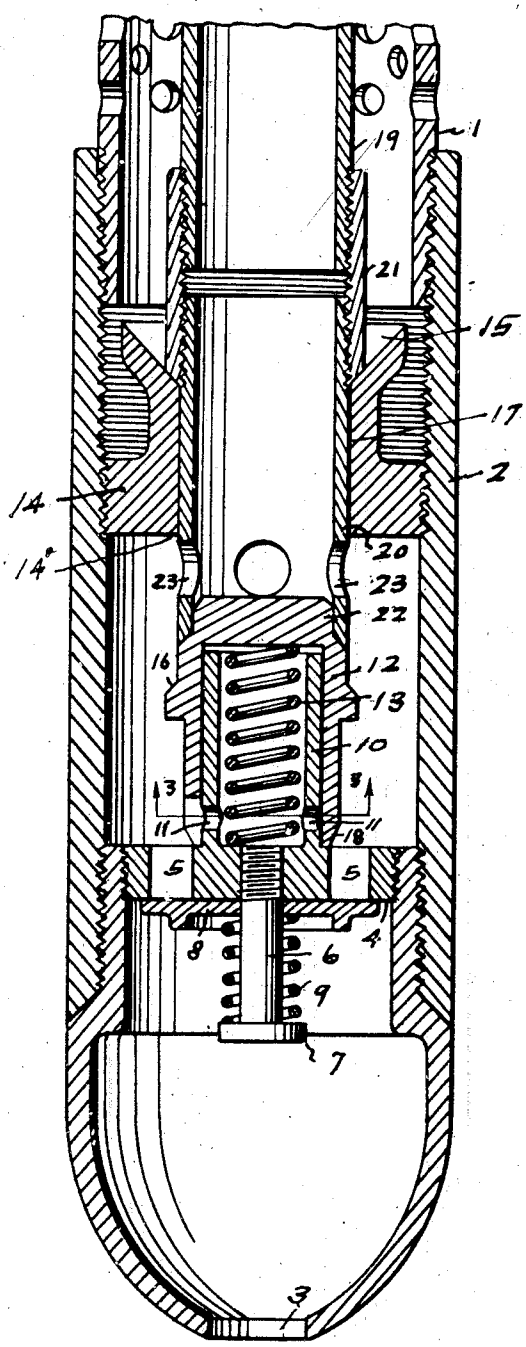


Fig. 1.

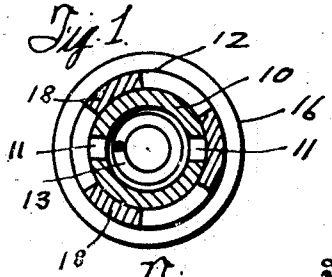


Fig. 3.

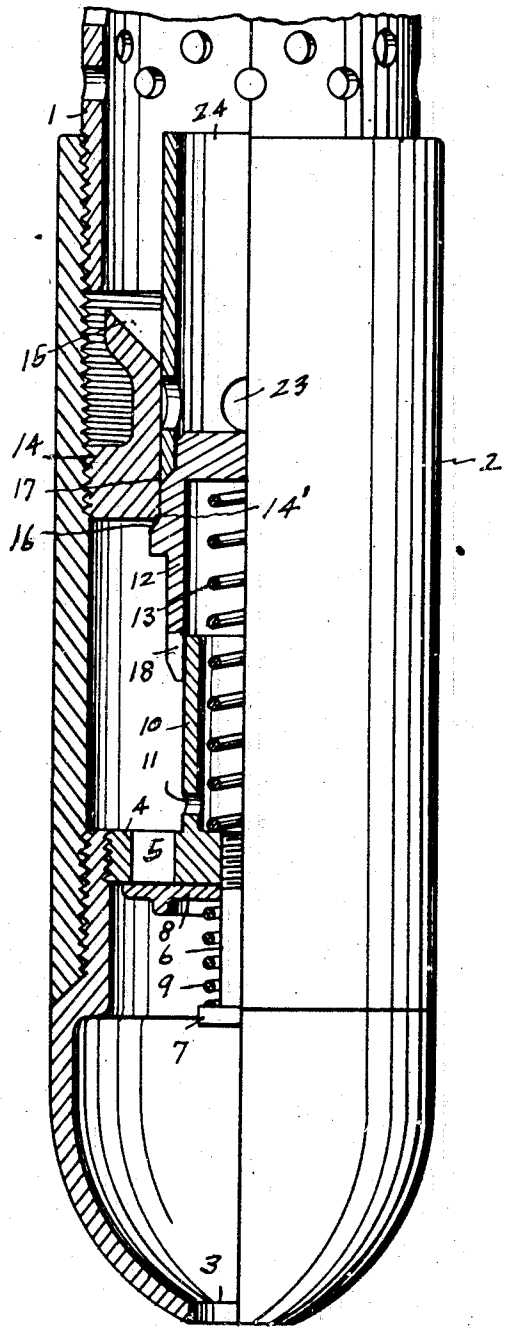


Fig. 2.

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BACK PRESSURE VALVE MECHANISM FOR WELL PIPE

Application filed March 26, 1931. Serial No. 525,393.

This invention relates to a back pressure valve mechanism for well pipe.

One object of the invention is to provide a valve mechanism of the character described specially designed for installation in the lower end of a pipe in a well bore to prevent the inflow of fluid into the pipe through the lower end thereof. The mechanism herein described has been specially provided for use in a set shoe of a screen set in a well bore and is designed to permit the passage of fluid downwardly through the screen but to prevent the back flow of such fluid.

In the production of fluid, particularly oil, from wells it is common practice to set a screen in the well and to then wash the screen so as to free it from clogging material. A set shoe is usually attached to the lower end of the screen in which the valve mechanism herein described may be located. When the screen has been set it is common practice to force fluid down through the screen and out of the lower end thereof which fluid returns up on the outside of the screen to wash and unclog said screen. When the washing operation has been completed it is desirable that the lower end of the screen be closed to the end that the well fluid can not enter but will be forced to pass through the screening surface of the screen. The valve mechanism herein described has been provided for the purpose of effectively closing the lower end of the screen to prevent the back flow of fluid therethrough.

A further feature of the invention is to provide a valve mechanism of the character described which is not liable to be held open by clogging material which may collect between the parts but which will effectively close to completely close the valve seat and exclude the passage of fluid therethrough.

With the above and other objects in view, this invention has particular relation to certain novel features of construction, operation and arrangement of parts an example of which is given in this specification and illustrated in the accompanying drawing wherein:—

Figure 1 shows a vertical sectional view of the valve mechanism installed in a set shoe of a well screen.

Figure 2 shows a side elevation partly in section, showing a slightly modified form thereof, and

Figure 3 shows a cross sectional view taken on the line 3—3 of Figure 1.

Referring now more particularly to the drawing wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates a well screen of any selected type, having a conventional set shoe 2 attached to the lower end thereof which has the outlet 3 at its lower end.

Within the lower end of the set shoe there is screwed or otherwise secured a spider 4 having the fluid passageways 5 therethrough and depending from this spider there is a stem 6 having the spring support 7 at the lower end thereof. Slidable on said stem there is a disc like valve 8 which is supported upon a coil spring 9 which surrounds said stem and rests on the support 7. The valve 8 is normally held against the underside of the spider 4 by means of said coil spring 9 and closes the passageways 5. This valve is now commonly used in connection with the well screens as now set and when fluid is forced under pressure down through the passageways 5 the valve 8 will open to permit the passage of fluid downwardly for the purpose stated and will close when the pressure is relieved but on account of its construction, clogging material readily collects between said valve 8 and the spider 4 which prevents the complete closing of the valve 8 thus permitting leakage from beneath up into the screen. In order to assure that such leakage will not occur a valve mechanism has been provided which will now be described:—

Upstanding from the spider 4 and within

the openings 5 there is a tubular nipple 10 which is open at its upper end and which has ports as 11 through its walls adjacent the lower end thereof. Fitted over said nipple there is an inverted cup shaped valve 12 which is mounted on a strong coil spring 13 which rests on the spider 4 within the nipple 10. Spaced above the spider 4 and suitably anchored in the set shoe 2 there is a tubular wash pipe seat 14 whose upper end is flared forming the wash pipe guide 15. The valve 12 has an external, annular, downwardly flared shoulder 16 therearound and above said shoulder the valve is of a diameter to fit closely within the passageway 17 through the wash pipe seat. The lower end of the valve 12 is formed with spaced, depending, legs 18, so positioned that when the valve 12 is in its lower or open position, at least one of the openings 11 will always be open so as to permit the entrance of fluid into the nipple 10 to equalize the fluid pressure on opposite sides of the valve 12.

As shown in Figure 1, the valve 12 is open with the spring 13 under compression and as shown in Figure 2 said valve 12 is closed with its upper end extending up into the passageway 17 through the wash pipe seat. When the valve 12 is in said closed position it will effectively close the passageway 17 so as to prevent any inflow of fluid into the screen from beneath thus serving as an additional closure to prevent the inflow of such fluid should the valve 8 be for any reason held open.

As the screen is lowered into the well the wash pipe 19 having a nipple 20 may be assembled with it, and the valve 12 will be held open by the weight of the wash pipe, as shown in Figure 1. This tubular nipple 20 may be connected to the lower end of the wash pipe by means of an external coupling 21. In assembling the wash pipe with the valve mechanism, the guide 15 will direct the nipple 20 through the passageway 17 and the lower end of the nipple will fit closely over the reduced upper end 22 of the valve 12 and when the coupling 21 lands on the wash pipe seat the nipple 20 will have forced the valve 12 into open position as shown in said Figure 1. The nipple 20 has a plurality of openings 23 which clear the lower end of the wash pipe seat when the wash pipe is in its lowered position. The washing fluid may now be forced down through the wash pipe 19 and out through the openings 23 and on down through the passageways 5, the valve 8 opening to permit this, and said washing fluid will pass on down and out through the opening 3 and up around the screen. When the screen is washed the wash pipe 19 may be pulled upwardly. The lower end of the nipple 20 fits tightly on the reduced upper end 22 of the valve 12 and as the wash pipe is pulled upwardly the valve 12 will be pulled upwardly with it, and the sharp edges around the openings 23 will cooperate with the sharp annular edge 14′ around the lower end of the wash pipe seat and the downwardly flared shoulder 16 will strike with considerable force against the lower end of the wash pipe seat 14 so as to cut away and dislodge any clogging material that may have collected in the openings 23 or that may be between said shoulder 16 and wash pipe seat and a perfect seat will thus be formed between the valve 12 and the wash pipe seat so that there will be no leakage between them and thereafter spring 13 will hold the valve 12 securely closed.

In some cases the screen may be washed without the use of a wash pipe. In such cases when the valve mechanism is assembled a tubular nipple as 24 is assembled with it. This nipple is substantially similar to the nipple 20 and has the openings 23 therethrough. In this form when it is desired to wash the screen after the latter is set in the well the washing fluid is forced under pressure down through the screen and part of this fluid will pass out through the screen but the pressure thereof against the valve 12 will be sufficient to force said valve and nipple 24 downwardly until the openings 23 clear the lower end of the wash pipe seat 14 and the fluid will thereafter be forced on down through the passageways 5, 5, past the valve 8 and through the opening 3 and back up around the screen to thoroughly wash said screen In both forms the nipple 20 serves to protect both the lower end of the wash pipe seat and the upper end of the valve 12 so that the grit in the washing fluid passing downwardly under pressure can not cut away the cooperating portions of said valve or seat to the end that these cooperating parts will form a close fitting joint when the valve is closed to prevent any leakage.

The drawing and description disclose what is now considered to be a preferred form of the invention, by way of illustration only, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. The combination with a screen pipe having a seat adjacent the lower end thereof provided with a fluid passageway therethrough, of a spider beneath said seat having an opening for fluid therethrough, a tubular valve guide upstanding from said spider, an inverted cup-shaped valve working over said guide, a yieldable member supported on the spider and supporting the valve and normally holding the valve in position to close said passageway, said guide having an opening to admit fluid into said guide beneath said valve and legs on the valve to prevent the valve from closing said opening.

2. The combination with a screen pipe adapted to be set in a well bore, of a seat

therein having a passageway for fluid therethrough, a support beneath said seat, a tubular valve guide upstanding from said support, and having an inlet for fluid through the wall thereof, a valve working over said guide and having means thereon to prevent the closing of said inlet, a resilient member normally holding the valve against said seat to close said passageway, a tubular nipple associated with the valve and working through said passageway and having a lateral opening above the valve.

3. The combination with a screen pipe adapted to be set in a well bore, of a seat therein having a passageway for fluid therethrough, a support beneath said seat, a tubular valve guide upstanding from said support, and having an inlet for fluid through the wall thereof, a valve working over said guide, a resilient member normally holding the valve against said seat to close said passageway, a tubular nipple associated with the valve and working through said passageway and having a lateral opening above the valve, and an annular, downwardly flared face on the valve beneath its upper end, engageable against the lower end of said seat.

4. The combination with a screen pipe having a seat therein adjacent the lower edge thereof, said seat having a passageway therethrough for fluid, a valve beneath said seat adapted, when in closed position, to close said passageway, a tube through said seat adapted to engage with and hold said valve open, said tube having a fluid passageway therethrough to permit the passage of fluid from said tube beneath said seat, when the valve is in said opened position, said tube being connected to the valve whereby said valve may be pulled upwardly by the tube against said seat and the tube being detachable from the valve.

5. The combination with a screen pipe having a seat therein adjacent the lower edge thereof, said seat having a passageway therethrough for fluid, a valve beneath said seat adapted, when in closed position, to close said passageway, a tube through said seat adapted to engage with and hold said valve open, said tube having a fluid passageway therethrough to permit the passage of fluid from said tube beneath said seat, when the valve is in said opened position, said tube being connected to the valve whereby said valve may be pulled upwardly by the tube against said seat and the tube being detachable from the valve, whereby upon further upward movement of the tube, the valve, when seated, will be released by said tube.

6. The combination with a pipe adapted to be set in a well bore, of a seat therein having a passageway for fluid therethrough, a support beneath said seat, a hollow valve guide upstanding from said support and having an inlet for fluid, a valve arranged to cooperate with said guide, a resilient member normally holding the valve against said seat to close said passageway, a tube associated with the valve and working through said passageway and having a lateral opening above the valve and an annular face on the valve spaced beneath its upper end engageable against the lower end of said seat.

In testimony whereof I have signed my name to this specification.

LYLE C. TILBURY.