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REMOVABLE BACK PRESSURE VALVE

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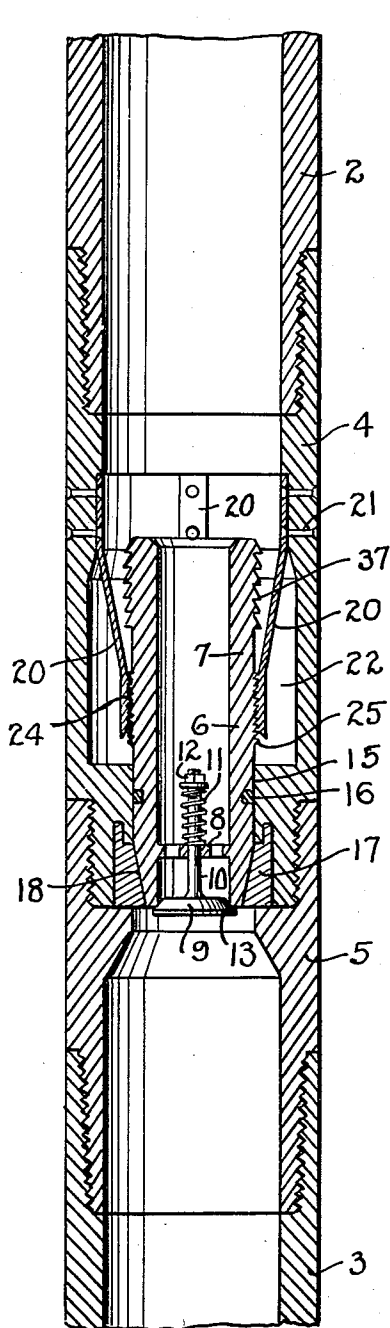


Fig. 1

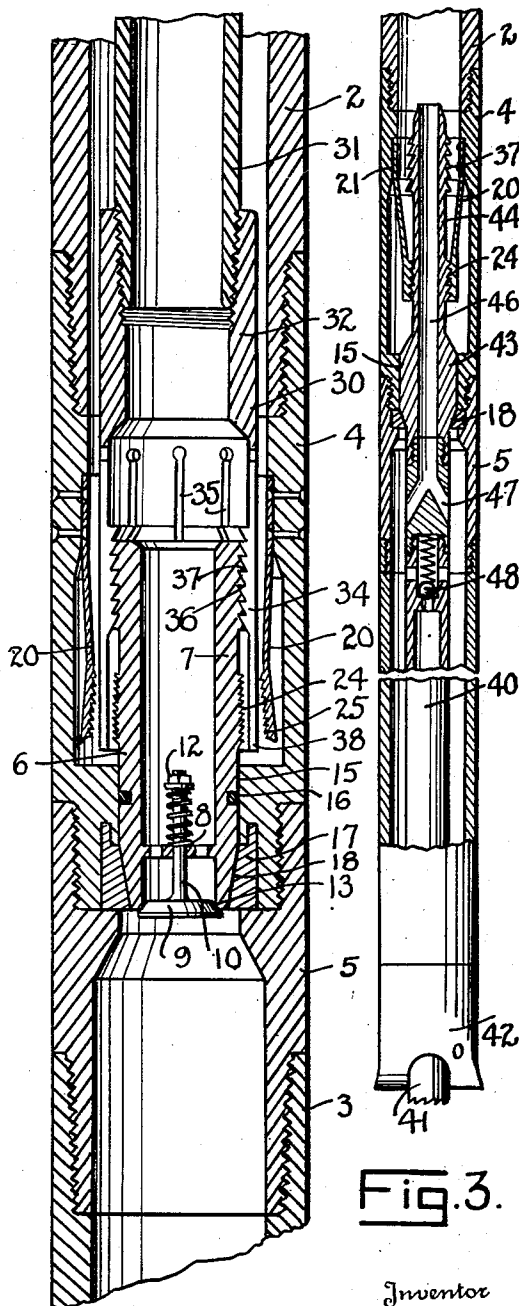


Fig. 2.

Fig. 3.

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REMOVABLE BACK PRESSURE VALVE

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2 Claims. (Cl. 255-72)

The invention relates to an improvement in back pressure valves for use in drilling and pumping of wells. During the drilling operation with the rotary system of drilling it is usual to maintain a circulation of drilling mud downwardly through the drill stem, through the bit, and upwardly through the well bore in order to maintain the walls of the well against caving, to remove the cuttings from the drill bit, and to assist in the drilling operation. In some instances a gas pocket or pressure area is encountered by the drill bit and enormous pressures are released in this way into the well bore. When drilling under these conditions it is desirable to have a check valve or back pressure valve located in the drill stem adjacent the drill bit so that any pressure backing into the drill stem will be cut off and the column of liquid in the drill stem cannot be blown out of the well.

With the advent of wire line core barrels which are of a type wherein the core barrel is dropped into the drill stem and allowed to fall by gravity to the lower end of the drill bit, it became necessary to eliminate the back pressure valve in the drill stem because it would interfere with the operation of such a core barrel. Under other circumstances it is also desirable to have the drill stem free to circulate a maximum volume of drilling fluid and without the interference or restriction of a back pressure valve. With these and other circumstances in mind it is the object of this invention to provide a back pressure valve which may be inserted or removed from the drill stem while the drill stem remains in the well bore.

Another object of the invention is to provide in combination with the drill stem a back pressure valve and a core barrel either of which may be inserted or removed from the drill stem.

It will be understood that because time and expense are necessary in order to remove the drill stem from the well where deep drilling is being carried on, and that the present back pressure valve is of a type which may be dropped into or removed from the drill stem while it is in position in the well bore without removing the drill stem from the well, it is one of the objects of this invention to provide a back pressure valve which may be dropped into the drill stem and which will fall by gravity and be latched in operative position at any desired elevation in the drill stem.

Another object of the invention is to provide a back pressure valve which may be removed from the drill stem when other tools are to be used

therein, or whenever it is desired to have open circulation through the drill stem.

Still another object of the invention is to provide a back pressure valve which will prevent a back flow through the drill stem and remain latched in position.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawing wherein:

Fig. 1 shows a central vertical sectional view of a drill stem with the removable back pressure valve located therein.

Fig. 2 shows the same arrangement as Fig. 1 with a fishing tool engaging the back pressure valve in position to release the latch and to remove the valve from the drill stem.

Fig. 3 shows a vertical sectional view of a drill stem with a core barrel in position.

The pipe 2 is illustrative of one section of a string of drill pipe which is used in the rotary method of drilling.

Disposed between the pipes 2 and 3 is a short section of pipe known as a drill sub 4 which may be of special construction and is arranged to be connected to the pipe 2 and to a tool joint such as 5 which is in turn connected to the lower section of the pipe 3.

The present invention has been embodied in the drill sub 4 and includes the back pressure valve indicated generally at 6. This valve is in the form of a cylindrical metal housing 7 which carries a spider 8 to support the valve member 9. This valve member 9 may be of the usual type wherein the stem 10 projects through a spider 8 and is normally held in closed position by means of a spring 11 which is fixed between the spider 8 and the nuts 12 adjacent the end of the stem. With the arrangement shown the spring tends to normally hold the valve so that it will engage the lower end 13 of the housing 7 which forms a seat for the valve. With this construction it is possible for a flow of liquid to occur downwardly through the spider 8 and to cause opening of the valve. As soon as the downward flow ceases, however, the spring 11 closes the valve and any pressure or flow of liquid upwardly in the stem is thus cut off. The housing 7 is arranged to seat in the restricted area 15 of the drill sub 4 and a packing 16 may be provided at this point to cause a seal and prevent any leakage past the housing 7. Below the restricted area 15 is the back pressure valve housing seat 17. This seat may be of metal or rubber or any suitable composition as desired, depending upon the condi-

tions encountered. It is preferably tapered, however, to cooperate with the tapered lower end 18 of the housing 7.

In order that the housing 7 and the valve will remain in position when back pressure is encountered, the spring latches 20 have been provided. These latches may take any desired form. The spring members have been illustrated as being fixed to the drill sub 4 at their upper ends by any suitable means such as the rivets 21. These fingers extend downwardly in the drill sub into the chamber 22 and normally extend inwardly toward the center of the passage through the drill sub. These fingers are provided adjacent their lower ends with downwardly facing teeth 24 which are arranged to engage corresponding upwardly facing teeth 25 on the outer periphery of the housing 7. A plurality of these teeth are provided so that the valve may move downwardly to a sealing position by virtue of its own weight and also by virtue of the pump pressure occurring upon it.

The spring action of the fingers tend to latch the valve housing in its lowermost position.

When the back pressure valve is to be positioned it is merely necessary to open the top of the drill pipe and to drop the housing 7 into the drill pipe so that it will fall by gravity through the liquid in the drill stem until it arrives at the position shown in Fig. 1. The latching fingers 20 will ordinarily engage the teeth 25 and latch the valve in position so that drilling may be carried on without danger of a blowout due to back pressure flowing upwardly through the stem.

Fig. 2 shows a fishing tool 30 which may be employed in removing the back pressure valve or the core barrel as desired. This tool 30 may be carried by a string of pipe 31 or it may be connected to a suitable cable or wire line that can quickly be lowered into the well through the drill stem. This tool 30 includes the body portion 32 and a plurality of spring arms 34 which are shown as being formed integrally with the body 32 by providing a plurality of slots 35 therein. These arms 34 are formed on their inner faces with a plurality of upwardly facing teeth 36 which are arranged to engage the downwardly facing teeth 37 on the upper, outer, portion of the valve housing 7. Fig. 2 shows the teeth 36 and 37 in engagement. When an upward pull is exerted on the fishing tool 30 these teeth will tend to pull the valve housing loose from its seat 17 and raise it from the drill stem.

The arms 34 carry the extensions 38 which are of such a length as to project downwardly below the teeth 37 and contact the spring fingers or latches 20. These extensions 38 move the fingers 20 to the position shown in Fig. 2 so as to release the teeth 24 from the teeth 25 to unlatch the back pressure valve housing. When an upward pull is exerted, the extensions 38 prevent the re-engagement of the teeth 24 and allow the back pressure valve to be removed.

It is to be understood that this back pressure valve may be used at any desired elevation in the drill pipe and may be inserted or removed at will,

but that it may be used in combination with a drill stem adapted to receive a wire line core barrel so that the back pressure valve may be used when a coring operation is not being performed, but yet may be removed when the core barrel is to be inserted. The same latches and the same fishing tool may be used for the core barrel and back pressure valve if desired.

Fig. 4 shows a vertical section of the drill stem with a core barrel 40 located in position to form a coring operation. This core barrel is of the construction wherein the lower end 41 may project through the drill bit 42 and has an enlarged portion 43 thereon which carries the tapered portion 18 to be received in the restricted seat 17 in the drill sub 4. The tool joint 5 is the same as shown in Figs. 1 and 2, as is the drill sub 4. The latches 20 engage with the teeth 24 on the sleeve 44 of the core barrel which has its outer surface formed in the same manner as the valve housing 7. The teeth 37 are also formed on the outside of the sleeve 44 so that the fishing tool 30 may be received thereon in order to remove the core barrel and move the spring latches 20 from engaging position in the same manner as previously described in connection with the back pressure valve.

The core barrel may have a central opening 46 downwardly therethrough with the discharge openings 47 at an elevation below the seat 18 so that the water will be discharged outwardly around the core barrel and downwardly through the bit. This arrangement provides for the check valve 48 to be located at the top of the core receiving portion of the core barrel.

The core barrel may be dropped into position and removed from the drill stem in the same manner as the back pressure valve, it being intended that there will be an alternative use of the core barrel and the back pressure valve, but that it is possible for the same latching mechanism to be used for both the valve and the core barrel and the same seat may be employed to form a seal around the outside of the tools.

Having described the invention, what is claimed is:

1. A drill sub to be positioned in a string of pipe, a downwardly tapered seat in said sub, latch means also in said sub and a back pressure valve to be dropped onto said seat and held in position by said latch means, and means on said valve to seal with said seat.

2. In combination with a drill stem, a core barrel, an upper extension thereon, a restriction in the drill stem, an enlargement on the core barrel extension, a plurality of upwardly facing teeth on the periphery of the core barrel extension above said enlargement, spring latches in the drill stem, and a plurality of downwardly facing teeth on said latches to be engaged by said core barrel teeth when the core barrel falls by gravity, so that the core barrel will be latched in its lowermost position with said enlargement seated in said restriction.

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