June 16, 1931. F. I. GETTY 1,810,420

SEALABLE FOOT VALVE

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Fig. 1.

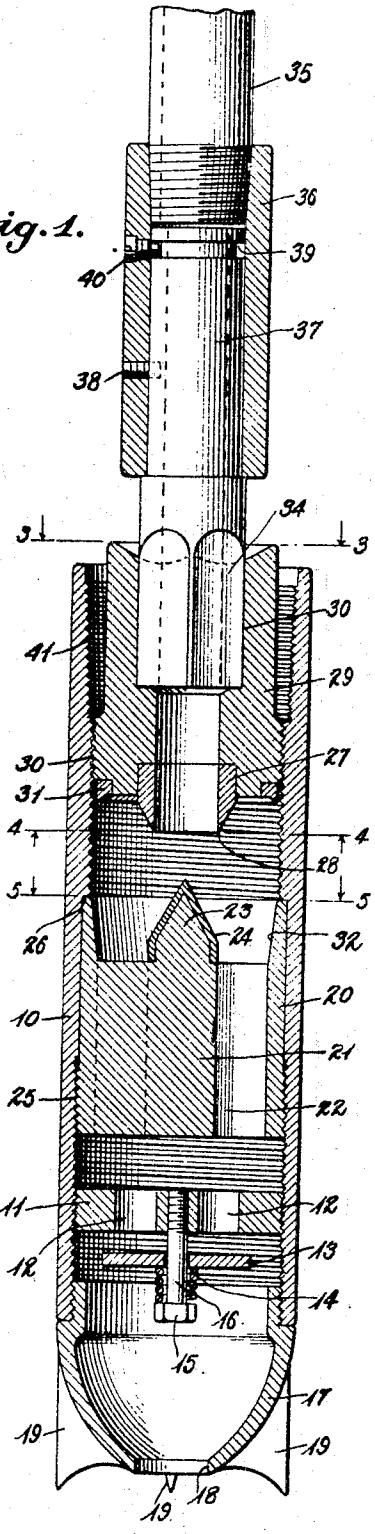
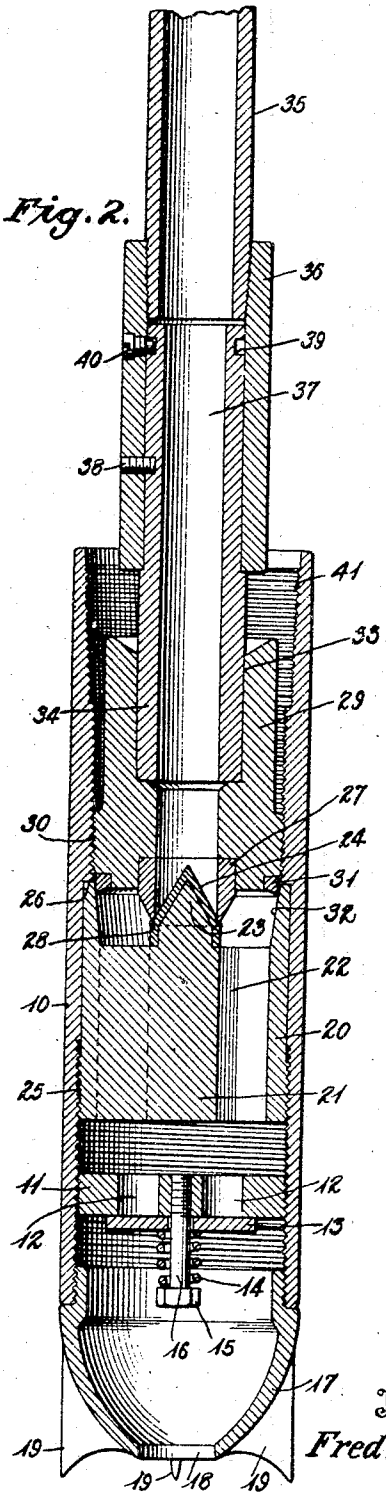


Fig. 2.



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Fig. 3.

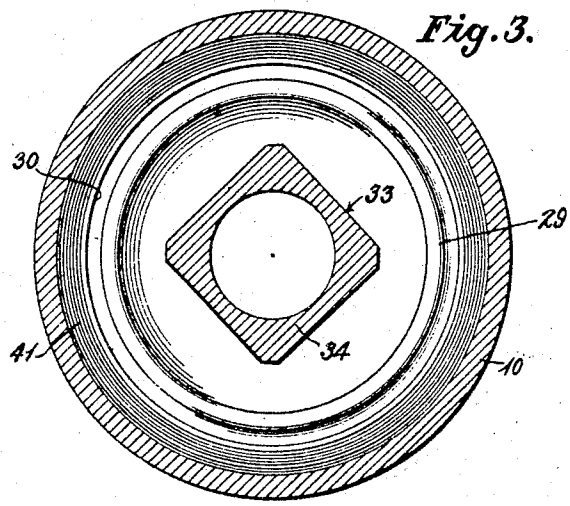


Fig. 4.

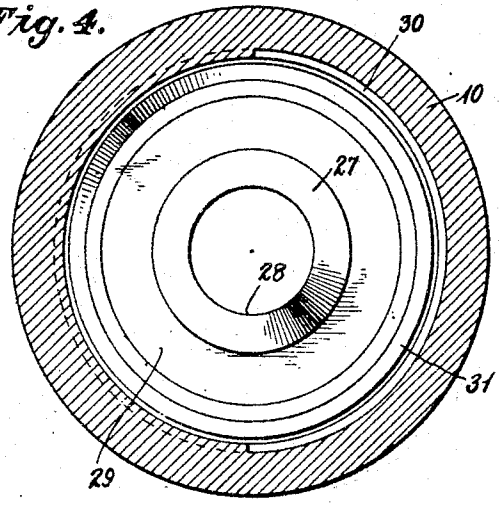


Fig. 5.

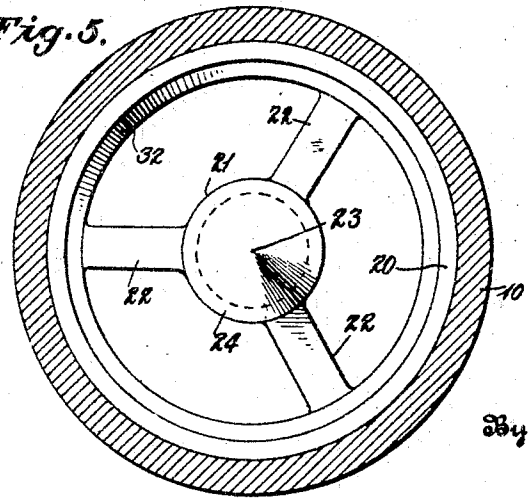
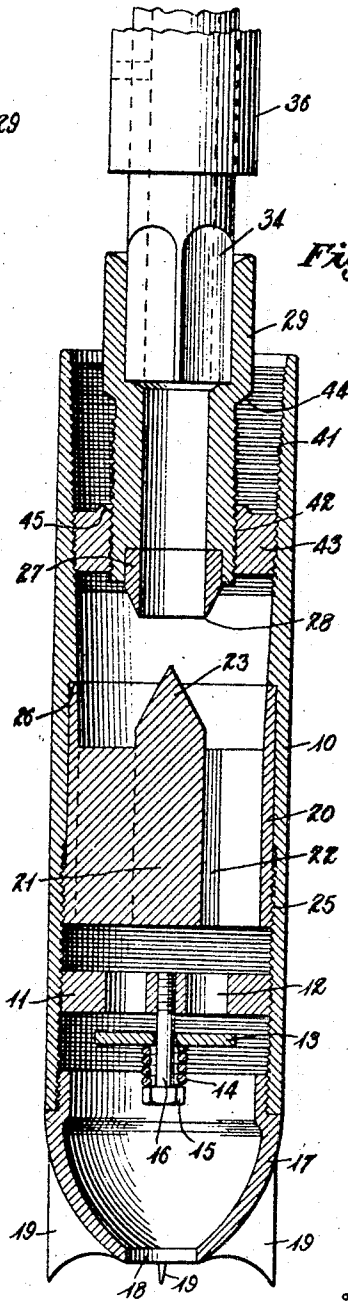


Fig. 6.



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SEALABLE FOOT VALVE

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Fig. 7.

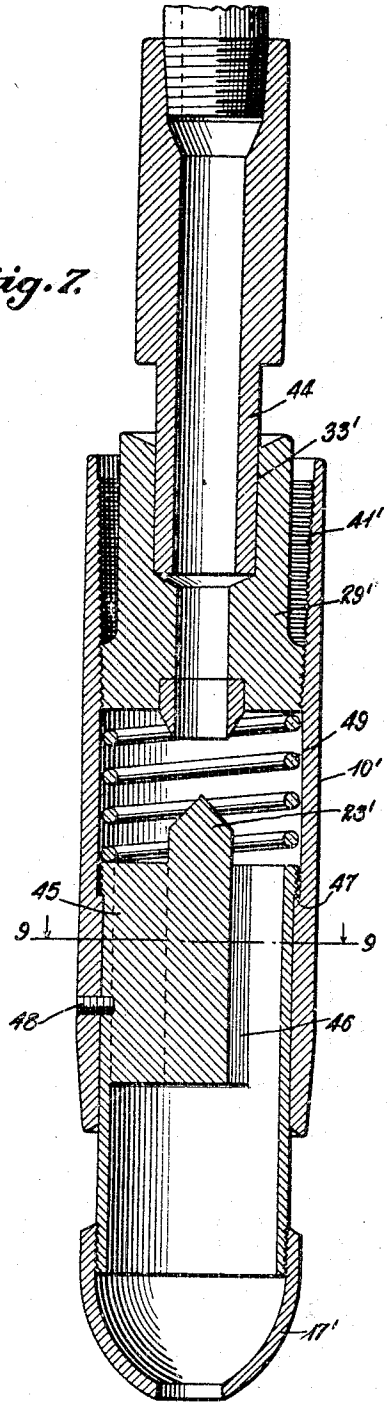


Fig. 8.

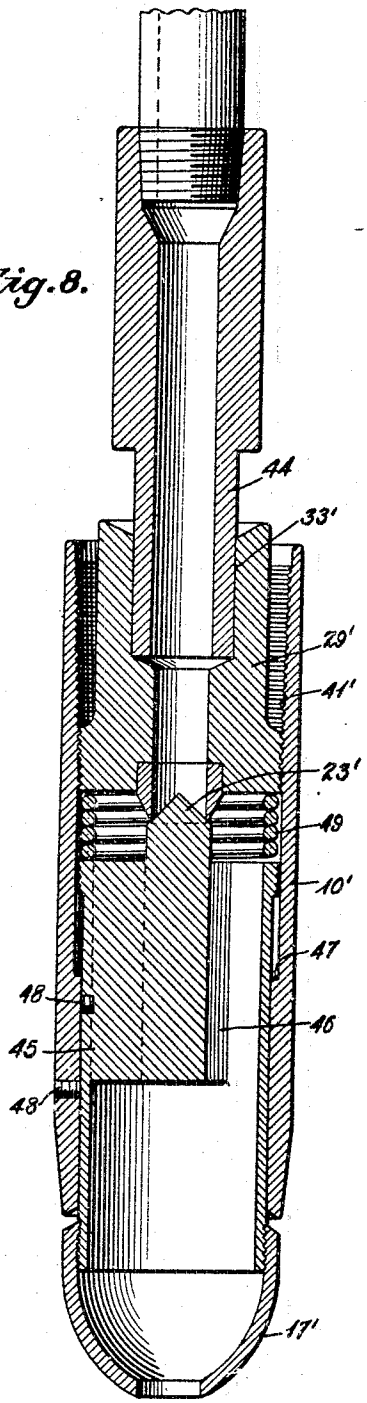
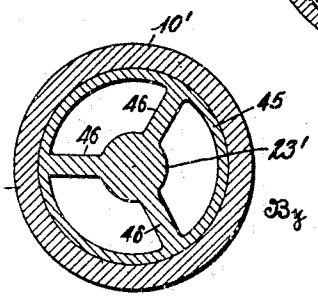


Fig. 9.



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UNITED STATES PATENT OFFICE

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SEALABLE FOOT VALVE

Application filed November 17, 1928. Serial No. 320,198.

The invention relates to foot valves of the type particularly useful in oil wells.

It is common practice in bringing in oil wells to provide a "wash pipe" within the screen and liner communicating with a check valve below the screen through which wash pipe water or mud is pumped downwardly, which, passing through the valve, escapes to the surface of the ground through the casing outside of the screen, liner, packer, and drill stem. When the screen has been set and the well has been washed as much as desirable, the function of the foot valve is not further needed and it is desirable to have the valve permanently closed against leakage. It is an object of the present invention to provide means for forming an effectual seal of the foot valve.

It is a further object of the invention in certain embodiments of the same to provide a foot valve which can be effectually sealed by rotating the wash pipe.

Further objects of the invention will appear from the following description when read in connection with the accompanying drawings showing illustrative embodiments of the invention and wherein:—

Figs. 1 and 2 are central vertical sections of one form of the valve in open and closed positions respectively;

Figs. 3, 4, and 5 are horizontal sections upon the corresponding lines of Fig. 1 drawn to an enlarged scale;

Fig. 6 is a central vertical section of the modification;

Figs. 7 and 8 are central vertical sections of a still further modification shown in open and closed positions respectively;

Fig. 9 is a horizontal section on line 9—9 of Fig. 8.

As shown in Figs. 1 and 2, the device comprises a tubular member 10 having a valve seat 11 provided with openings 12 and carrying a valve 13 normally spring pressed to closed position by spring 14 abutting against the head 15 of cap screw 16 carried by the valve seat 11. The valve seat 11 is shown as contained in the tubular member 10 and having threaded engagement therewith. The tubular member 10 is shown as downwardly terminating in a cap member 17 having an opening 18 for passage of washing material and fins 19 are desirably provided to prevent rotation of tubular member 10 when the seal of the valve, to be described, is closed by rotation.

To provide a seal for the valve there is shown a spider comprising a tubular member 20 and a central seal member 21 supported within the tubular member 20 as by arms 22, see Fig. 5, the member 21 upwardly terminating in a cone 23 which is desirably surfaced with a soft metal 24 as babbitt, solder, or the like. As an alternative the entire member 20, 21, 22 may be formed of a soft material, as brass, but a stronger material faced with soft material 24 is at present preferred.

The tubular portion 20 is shown as having screwthreaded engagement at 25 with the interior of member 10 and as seating against a shoulder 26 therein.

To coact with the cone 23 in the sealing of the device, there is shown a cylindrical bushing 27 having a cutting edge 28 and seated in a recess in a revoluble member 29 having screwthreaded engagement with the interior of member 10 whereby upon revolution of member 29 the collar 27 may be screwed to sealing position as shown in Fig. 2, the sharp edges of the bushing, which is desirably formed of hardened steel, cutting into the soft metal 24.

To seal the periphery of member 29 against leakage past the threads 30, there is shown a ring 31 also desirably formed of hardened steel seated in an annular rabbet in the member 29 and adapted to contact with the frusto conical surface 32 of member 10 as also shown in Fig. 2.

For the revolution of member 29 to seal the valve, said member is shown as provided with a squared recess 33 coacting with the plug 34 secured upon the lower end of wash pipe 35. It is customary to remove the wash pipe when the well has been brought in or upon completion of the washing operation and it is also desirable that means be provided for the free revolution of the wash pipe without excess revolution of member 29 when the sealing operation has been com-

pleted. This is for the reason that it is difficult to tell at the surface of the ground how much revolution of member 29 is necessary to complete the sealing operation and an excess revolution of member 29 obviously would severely damage and possibly frustrate the seal. There is therefore provided a coupling 36 screwed upon the end of wash pipe 35 and telescoping with the cylindrical portion 37 of plug 34. To impart revolution to the plug 34, a plug 38 of frangible material as brass is shown having screwthreaded engagement with the coupling 36 and entering an opening in the member 37, which plug will be sheared after sufficient torque has been applied to the member 29 to completely seal the device.

To remove the plug 34 with the wash pipe and coupling 36, there is shown an annular groove 39 in the cylindrical member 37 engaging with a cap screw 40 carried by the coupling, the end of the cap screw being adapted to revolve in the annular groove after the plug 38 is sheared and to then withdraw the plug 34 with the wash pipe.

The screen is designed to be screwed into the pipe thread 41 in the tubular member 10.

In the form of the invention shown in Fig. 6, the cylindrical member 29 has screw threaded engagement at 42 with a ring 43, which in turn is firmly seated in the tapered pipe thread 41. A preferably tapered shoulder 44 is provided to contact with a seat 45 carried by the ring 43 when the edge 28 is brought home against surface 24 whereby to prevent leakage past screw threads 42. This form of the device is otherwise similar to that shown in Figs. 1 and 2 with the exception that the annular member 31 of the first two figures becomes unnecessary in the form of Fig. 6 since the tapered threaded connection between the ring 43 and the tubular member 10 will cause a liquid tight seal at this point.

In Figs. 7 and 8 is shown a form of the invention utilizing the cone and ring seal of Figs. 1 to 6 inclusive but adapted to be seated by bringing the weight of the drill stem, liner, and screen upon the foot valve. In this form of the invention there is shown a tubular member 10′ having a wash pipe connection 29′ seated in the tapered pipe threads 41′ provided for connection with the strainer, the connection 29′ being provided with a socket 33′ which in this form of the invention may be formed cylindrical if desired for connection with a wash pipe nipple 44.

Slidably mounted in the lower portion of the cylinder 10′, there is shown a cylindrical member 45 bearing the spider arms 46 supporting the sealing plug 23′, which is desirably formed at its upper end in a manner already described. The member 45 is shown as formed with a shoulder 47 seated against an internal shoulder within the cylinder 10′, and shown as screw threaded upon its periphery for introduction through the lower end of the tapered thread 41′. The over all dimensions of the upper end of the cylinder 45 might be made sufficiently small to pass within the screw threads, but the form illustrated is preferred in order to provide for as large passages as possible between the spider arms 46.

To hold the cylinder 45 in the position shown, there may be provided a frangible pin 48 inserted through the wall of the cylinder 10′ and into an opening in the cylinder 45. A spiral spring 49 is also shown to press the shoulder 47 to its seat, which spring may be omitted if desired as the same is not an essential. In this form of the invention, the pin 48 is of sufficient strength to resist the ordinary pressures upon the lower member 17′ while the screen is being seated, but when the last named member comes into contact with the firm lower end of the bore the weight of the drill stem upon the screen will act to shear the pin 48 and overcome the spring 49, thereby bringing the parts to the position shown in Fig. 8 with the passage through the valve sealed.

By virtue of the cutting edge 28 for provision of a seal, any trash as chips or the like which may become caught in the valve will be sheared when the valve is sealed and will not prevent the device from functioning. By virtue of the structure provided by the invention, the passages may all be formed of ample size for passage of washing fluid. The check valve 11—16 may be omitted if desired, as the same is not essential, and its omission where permissible in the bringing in of a well will have the advantage that the drill stem will automatically fill with water present in the well when the screen is lowered to place, whereas in the presence of the check valve it will be necessary to fill the drill stem from time to time to avoid great hydrostatic pressure of an unbalanced column of water outside of the drill stem.

Minor changes may be made in the physical embodiment of the invention without departing from the spirit thereof within the scope of the appended claims.

I claim:

1. A seal for foot valves comprising, in combination, a central plug having a longitudinal passage past the same, a sealing surface carried by said plug, a ring having a passage therethrough and a cutting edge adapted to contact with said surface, one of said passages in communication with a wash pipe receiving socket and the other thereof with the outlet of the valve, and means to permit relative movement between said plug and ring whereby to close communication between said passages.

2. A seal for foot valves comprising, in

combination, a central plug having a longitudinal passage past the same, a tapered shoulder carried by said plug, the material at said surface being relatively soft, a ring having a passage therethrough and a cutting edge of relatively hard material adapted to bite into said surface, said passages in communication in unsealed position and one of each in communication with a wash pipe receiving socket and the other thereof with the outlet of the valve, and means to permit relative movement between said plug and ring to close communication between said passages.

3. A seal for foot valves comprising, in combination, a tube, a connection for a wash pipe mounted in said tube and having a ring bearing an exposed cutting edge, a spider mounted in said tube supporting a central plug having a tapered surface opposed to said cutting edge, and means to permit relative movement between said ring and plug to bring said edge into contact with said surface.

4. A seal for foot valves comprising, in combination, a tube, a connection for a wash pipe mounted in said tube by means of screw threads permitting of travel of said connection, said connection having a central opening, a ring carrying a cutting edge surrounding said opening, a spider carrying a central plug mounted in said tube, said plug having a sealing surface of relatively soft material engageable by said edge, whereby rotation of said connection may close communication between said opening and the passages between the arms of said spider.

5. A seal for foot valves comprising, in combination, a tube having internal screw threads for connection to a strainer, a wash pipe connection having a non-cylindrical socket and a central passage, said connection mounted in screw threads within said tube, an exposed cutting edge surrounding the interior opening of said passage, a spider formed with a central cylindrical portion and mounted in said tube, said portion bearing a sealing surface exposed to said cutting edge, said edge and surface acting to seal said tube upon rotation of said connection.

6. A seal for foot valves comprising in combination, a tubular valve casing, a central plug member having a longitudinal passage past the same, a sealing surface carried by said plug, an open ring member having an unincumbered passage therethrough, and normally held out of engagement with said plug, means to connect a wash pipe to one of said members and to place the interior of the wash pipe in communication with the passage thereof, one of said members mounted movably in said casing, means for bringing the plug of said plug member and ring together so as to close communication between the two passages.

7. A seal for foot valves comprising in combination, a tube, a connection for a wash pipe having a non-cylindrical socket mounted in said tube by means of screw threads permitting of travel of said connection, a central plug having a longitudinal passage past the same mounted in said tube, an open ring having an unincumbered passage therethrough and through said socket, the said plug and ring being normally spaced apart, but by rotation of the said wash pipe connections are brought together to close communication between the passages.

8. A seal for foot valves comprising, in combination, a tube, a passage longitudinally therethrough, closure provisions mounted centrally within said tube consisting of a plug and a ring, and closure provisions located at the periphery of the plug and ring mountings comprising also a plug and ring arrangement, means for opening and closing the closure provisions simultaneously at the center and at the periphery.

9. A seal for foot valves comprising in combination, a tube, a passage longitudinally therethrough, closure provisions mounted centrally within said tube, closure provisions located at the periphery of the mountings of the central closure elements, means for effecting an opening or a closure simultaneously at the center and at the periphery.

10. A seal for foot valves comprising, in combination, a tube having means for connection to a strainer and a passage longitudinally therethrough, passage closing means mounted in screw threads within said tube, said closing means having a non-cylindrical socket, a plug formed to fit said socket and having an annular groove, a sleeve provided with screw threads for engagement with a wash pipe, means on said sleeve rotatable in said groove and a frangible element to transmit rotation of the wash pipe to the plug whereby to close said passage and adapted to shear to permit subsequent free rotation of said wash pipe.

11. A seal for foot valves comprising, in combination, a tubular valve body, a connection for a wash pipe mounted therein by means of screw threads permitting travel of the connection relative to the tube, said connection having a passage therethrough, an exposed cutting edge surrounding the interior opening of said passage, means engageable by said edge upon travel of said connection to seal said passage, and means to seal said screw threads against leakage.

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