Nov. 26, 1940. O. J. LITOLFF 2,222,750

TESTER AND PACKER

Filed July 29, 1939

Fig. 1.

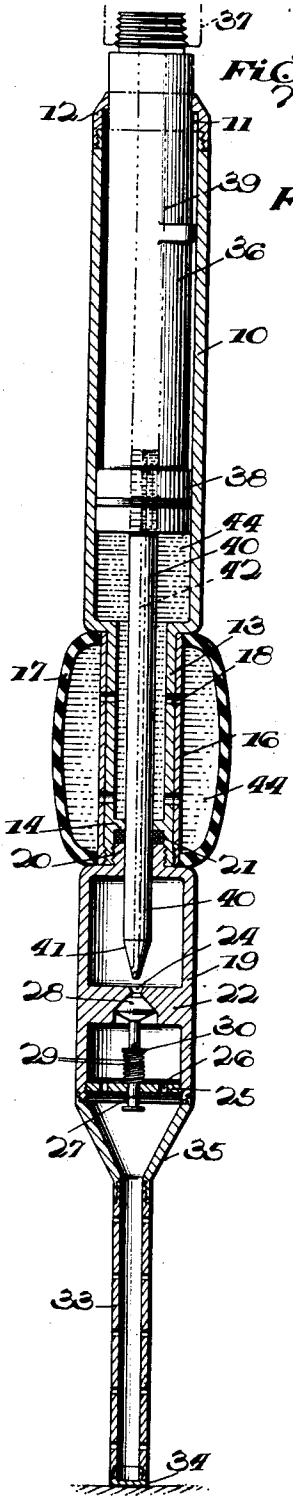


Fig. 2.

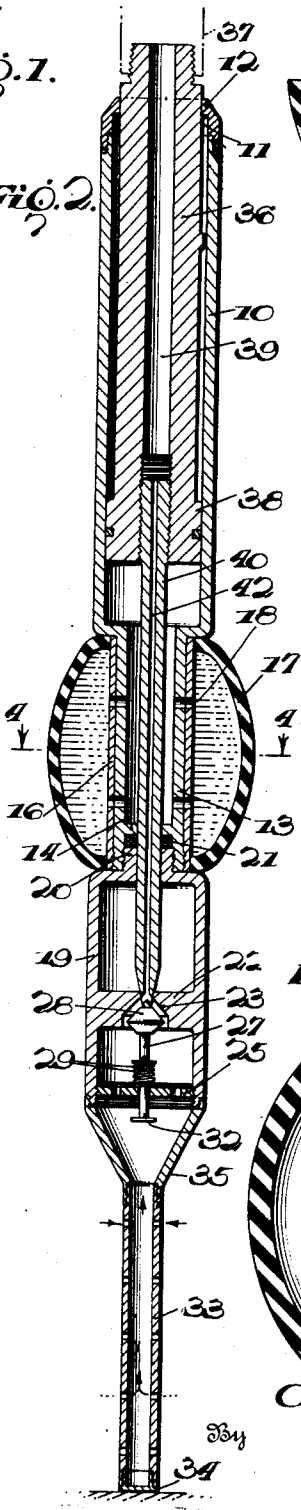


Fig. 3.

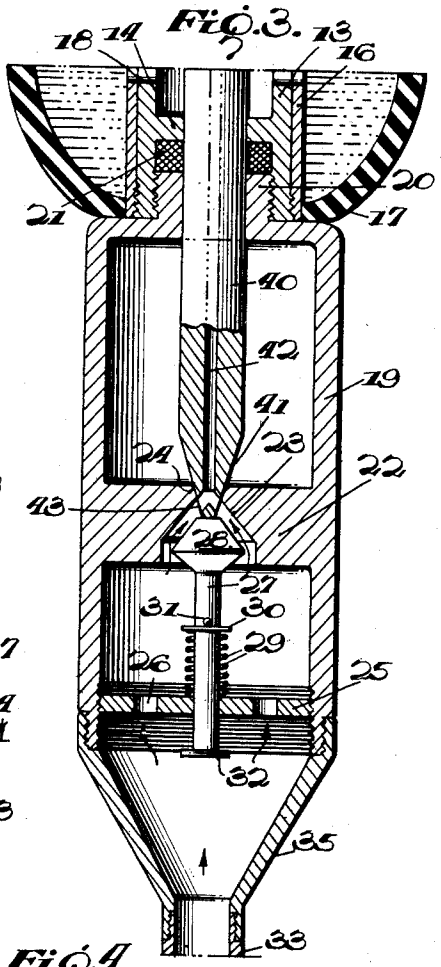
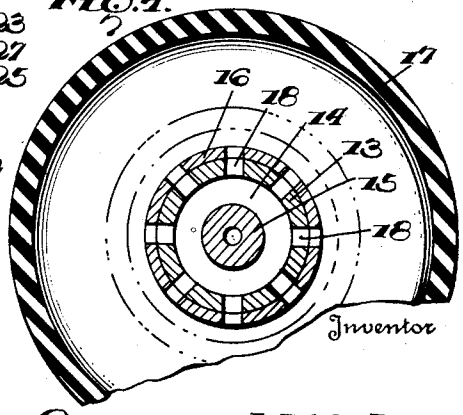


Fig. 4.



Inventor

Osmond J. Litolff.

By C. K. Draper

Attorney

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TESTER AND PACKER

Osmond Joseph Litolff, Metairie, La., assignor to Oil Well Tools, Inc., New Orleans, La., a corporation of Louisiana

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7 Claims. (Cl. 166—1)

The present invention relates to improvements in testers or samplers for casings, formations and the like, and to packers for such testers and for other purposes.

An important object of this invention is the provision of a device of simple construction which may be readily operated to make tests of casings and formations.

A further object of the invention is the provision of a testing device of this character with packing means associated therewith.

Another object of the invention is to provide a self-contained packing device for packing wells or the like.

Still another object of the invention is the provision of a testing device in which the expansion of the packing member may be readily adjusted.

A still further object of the invention is to provide a device of this character which is of simple and inexpensive construction, which is efficient in operation and which may be easily and rapidly operated.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the drawing, which forms a part of this specification and wherein like characters of reference denote like parts throughout,

Figure 1 is a longitudinal sectional view through a device embodying this invention,

Figure 2 is a similar view showing the device in testing position with the packer expanded, and showing the plunger mechanism in section,

Figure 3 is an enlarged detail sectional view through the testing valve and valve operating mechanism, and,

Figure 4 is a transverse section on line 4—4 of Figure 2.

In the drawing, wherein for the purpose of illustration is shown a preferred embodiment of the invention, the numeral 10 designates the elongated cylinder of the tool, provided at its upper end with packing 11 held in place and expanded by means of a cap 12 screw threadedly attached to the upper end of the cylinder. The lower end of cylinder 10 is provided with a reduced tubular extension 13 having a wall 14 adjacent its lower end but spaced therefrom. A central opening 15 in the wall 14 receives a valve operating rod to be hereinafter described. The lower end of cylinder extension 13 is internally and externally screwthreaded.

A packer sleeve 16 is disposed about the cylinder extension 13 having a threaded connection to the lower end thereof and abuts against the bottom of cylinder 10. An expansible packing element 17, of rubber or other suitable material is connected to the removable sleeve 16 at the upper and lower ends thereof. A series of openings 18 in extension 13 and sleeve 16 connect the interior of sleeve 16 with the interior of packing element 17.

A valve casing 19 has a reduced threaded boss 20 disposed centrally of its upper end and adapted to be received in the lower end of extension 13. Suitable packing material 21 is disposed in the lower end of extension 13 between wall 14 and boss 20, and a central opening in boss 20 corresponds with opening 15 in wall 14. A transverse wall 22, of substantial thickness, is disposed substantially midway of the valve casing 19 and is provided with a central valve seat 23 in its lower side. Valve seat 23 is preferably cylindrical at its lower end and its walls converge upwardly to a point adjacent the top of wall 22. An opening 24 extends from the top of the wall 22 into valve seat 23, its walls tapering downwardly to the top of the valve seat.

A threaded disk 25 is removably threaded to the lower inner portion of the valve casing 19 and is spaced a substantial distance below wall 22. Suitable openings 26 in disk 25 permit the passage of fluid therethrough while a central opening slidably receives a valve stem 27 having a valve head 28 with upwardly converging walls adapted to seat in valve seat 23 and seal the upper chamber of valve casing 19 from the lower chamber thereof. A coil spring 29 surrounds valve stem 27, engaging the top of disk 25 and pressing against a washer 30 held in place on stem 27 by means of a pin 31 carried by the valve stem. A flange 32, which may be removable, is secured to the lower end of stem 27. It will be seen that spring 29 normally presses valve head 28 upwardly into the valve seat 23.

An elongated, perforated tube or screen 33 is closed at its lower end by a removable cap 34 and has a diameter substantially less than valve casing 19. A tapered connection 35 is threaded to the lower end of casing 19 and to the upper end of screen 33, serving to connect the perforated screen 32 through openings 26 in disk 25 to the lower chamber of valve casing 19.

A piston rod 36 is detachably connected at its upper end by threads or the like to the lower end of the drill stem, pipe or operating member 37, and is provided at its lower end with a piston 38 snugly fitting the inner walls of cylinder 10. A central bore 39 extends completely through the rod 36 and piston 38 and is internally threaded

at its lower end to adjustably receive the threaded upper end of a valve operating rod or plunger 40. Plunger 40 has its lower end provided with a substantially conical tip 41 adapted to extend through opening 24 and into valve seat 23 to unseat valve head 28. A small bore 42 extends from the top of plunger 40 to the tip thereof, branching at its lower end to the tapered sides of the plunger tip immediately adjacent the lower end or point thereof. When the plunger tip 41 is seated in opening 24, the bore outlets 43 are disposed in the valve seat 23, as seen in Figure 3, to form communication between the lower valve chamber and the drill pipe 37 through bores 42 and 39.

Plunger 40 extends from cylinders 10, through extension 13 in spaced relation to the walls thereof, through opening 15 in wall 14, packing 21 and boss 20 into the upper valve chamber. A suitable fluid 44 is arranged in cylinder 10, below the piston, in extension 13 and packing element 17.

When a sample is to be taken, the tool is lowered into the well, hole or casing by means of pipes 37, the valve 28 being closed and plunger 40 being disposed out of contact with the valve. When the bottom of screen tube 33 contacts the bottom of the well, downward movement of screen 33, casing 19 and cylinder 10 is stopped, but piston 38 and plunger 40 continue to move downwardly. The movement of piston 38 relative to cylinder 10 forces fluid 44 out through openings 18 into packing element 17, expanding packing element 17 against the walls of the casing or well and preventing passage of fluid past the packing element 17. Further downward movement of piston 38 forces plunger tip 41 into opening 24, thereby unseating valve head 28, as seen in Figures 2 and 3, and permitting fluid in the well or casing to pass from screen 33 and the lower valve chamber up through bore 42 of the plunger to bore 39 of the piston and then into the pipe 37. When the pipe 37 is raised, valve 28 first closes, preventing escape of fluid from pipe 37, and further upward movement releases pressure in packer 17, permitting the tool to be raised with the pipe 37 and fluid sample. The amount packer 17 is expanded before valve 28 is unseated may be regulated by adjusting the threaded connection between plunger 40 and piston 38.

It will be seen that the action of the packing element 17 and valve 28 is entirely automatic. The packer 17 must expand and close the well or casing before valve 28 is opened, and spring 29 must close valve before the packer 17 is released and the tool raised.

In addition to its value as a sampling device, the tool of this invention may be used merely as a packing element, whenever such an element is needed, as for cementing under pressure. The packing tool may be extracted readily without the necessity of drilling up the packer as has heretofore been necessary.

While I have shown and described the preferred embodiment of the invention, it is to be understood that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention what I claim and desire to protect by Letters Patent is:

1. In a sampling device, a tool body, an expansible packing element carried by said tool body, there being a sampling chamber in said tool body, a valve normally closing said chamber, and a plunger mechanism associated with said tool body and having a stroke which first expands said packing element and then opens said valve.

2. In a sampling device, a tool body, an expansible hydraulic packing element carried by said tool body, there being a sampling chamber in said tool body, a valve normally closing said chamber, and a plunger mechanism movable longitudinally of said tool body to expand said packing element and then open said valve.

3. In a sampling device, a hydraulic cylinder, an expansible hydraulic packing element associated with said cylinder, a sampling valve casing carried by said cylinder, a valve in said casing which is normally seated, a plunger mechanism slidably disposed in said cylinder and having a valve operating member extending into said valve casing in line with and spaced from said valve, whereby movement of said plunger mechanism will force fluid under pressure from said cylinder into said packing element to expand the packing element, and whereby further movement of said plunger will force the valve operating member into engagement with the valve to unseat the valve.

4. In a sampling device, a hydraulic cylinder, an expansible hydraulic packing element associated with said cylinder, a sampling valve casing carried by said cylinder, a valve in said casing which is normally seated, a plunger mechanism slidably disposed in said cylinder and having a valve operating member extending into said valve casing in line with and spaced from said valve, whereby movement of said plunger mechanism will force fluid under pressure from said cylinder into said packing element to expand the packing element, and whereby further movement of said plunger will force the valve operating member into engagement with the valve to unseat the valve, and means to vary the effective length of the valve operating member.

5. In a sampling device, a tool body having a valve casing therein, said casing having openings to admit fluid, a valve seat in said casing, a valve normally disposed in said valve seat, a sampling tube, a plunger mechanism connected to said sampling tube and extending through said tool body and into said valve casing in line with the valve seat, said plunger mechanism having a bore connecting the tube with the end of the plunger in the valve casing, whereby movement of the plunger mechanism through said tool body will force the plunger end into the valve seat to unseat the valve and place the sampling tube in communication with the fluid in the valve casing, an expansible packing element carried by said tool body, and means operated by the initial movement of the plunger mechanism to expand the packing element before unseating the valve.

6. In a sampling device, a hydraulic cylinder, an expansible hydraulic packing element carried by said cylinder and communicating therewith, a valve casing associated with said cylinder and having a valve seat therein, a spring pressed valve normally disposed in said valve seat, the portion of the valve casing below the valve being in communication with the fluid to be sampled, a tube, a piston connected to said tube and slidably arranged in the cylinder, and a valve operating plunger carried by the piston in line with the valve seat and normally spaced therefrom, there being a bore connecting the end of the plunger through the plunger and piston

with the tube, whereby movement of the piston and plunger towards the valve seat will force fluid under pressure into said packing element and then force the end of the plunger into the valve seat to unseat the valve and permit the fluid to be sampled to pass through the plunger and piston into the tube.

7. In a sampling device, a hydraulic cylinder, an expansible hydraulic packing element carried by said cylinder and communicating therewith, a valve casing associated with said cylinder and having a valve seat therein, a spring pressed valve normally disposed in said valve seat, the portion of the valve casing below the valve being in communication with the fluid to be sampled, a tube, a piston connected to said tube and slidably arranged in the cylinder, a valve operating plunger carried by the piston in line with the valve seat and normally spaced therefrom, there being a bore connecting the end of the plunger through the plunger and piston with the tube, whereby movement of the piston and plunger towards the valve seat will force fluid under pressure into said packing element and then force the end of the plunger into the valve seat to unseat the valve and permit the fluid to be sampled to pass through the plunger and piston into the tube, and means to vary the effective length of the plunger to control the amount the packing element is expanded before the valve is opened.

OSMOND JOSEPH LITOLFF.