May 10, 1932. J. A. HARDCASTLE 1,857,301

APPARATUS AND PROCESS FOR CEMENTING WELLS

Filed July 1, 1929

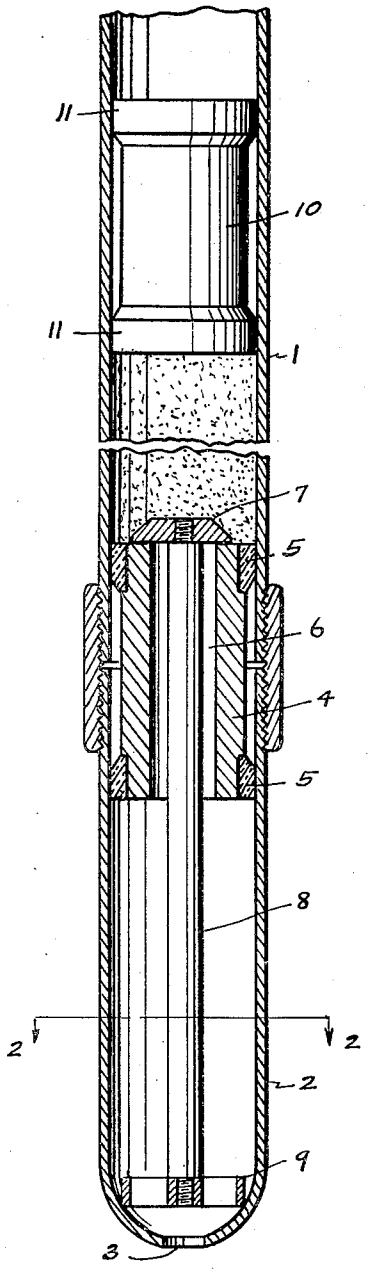


Fig. 1.

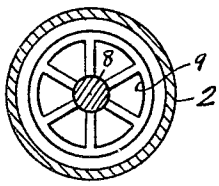


Fig. 2.

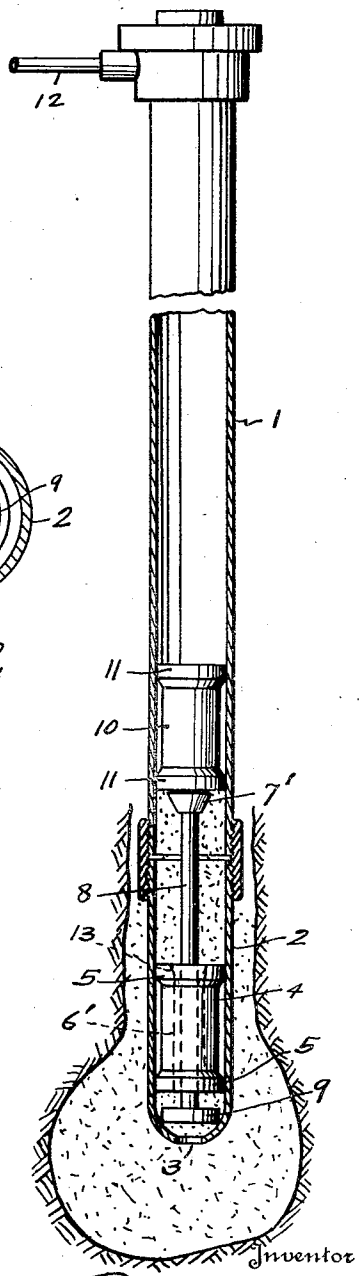


Fig. 3

Inventor

Jasper A. Hardcastle

By Hardway & Cathey

Attorneys

Patented May 10, 1932 1,857,301

UNITED STATES PATENT OFFICE

JASPER A. HARDCASTLE, OF DAMON, TEXAS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-FOURTH TO JESSE H. HARDCASTLE, OF HOUSTON, TEXAS, AND ONE-FOURTH TO R. L. WAXLER

APPARATUS AND PROCESS FOR CEMENTING WELLS

Application filed July 1, 1929. Serial No. 375,040.

This invention relates to new and useful improvements in apparatus and process for cementing wells.

One object of the invention is to provide an apparatus for applying plastic cementitious material about the lower end of a casing set in a well bore and the invention also comprehends the process whereby said material is applied.

Another object of the invention is to provide means whereby a load of plastic cementitious material, uncontaminated by water or slush, may be lowered into a well and delivered out around the lower end of a casing set in said well to set and form a seal around said lower end of said casing.

In well drilling it is customary to set a casing in the well bore just before the bore is drilled into pay sand, and after the casing has been set it is quite common to form a seal around the lower end of the casing to prevent water from above from reaching the oil bearing strata. This seal is formed by forcing cementitious material in plastic state down through the lower end of the casing, which material is then permitted to set to form said seal and the well is then drilled deeper into the pay sand in the usual way.

It is the prime object of this invention to provide apparatus of the character described by means of which the plastic cement may be lowered down through the casing and discharged out around the lower end thereof at the place it is desired to form the seal and without said material becoming diluted or mixed with slush or water, and the invention comprehends a novel method of lowering said material and discharging it around the lower end of the casing at the place desired.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, and the novel process, an example of which will be described in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 shows a vertical sectional view of the lower end of a well casing, with the apparatus shown therein, in lowered position and with the load of cementitious material ready to be discharged out around the lower end of the casing.

Figure 2 shows a cross sectional view thereof, taken on the line 2—2 of Figure 1, and

Figure 3 shows a vertical sectional view of a modified form of the device, showing the apparatus in the casing with a load of cementitious material discharged around the lower end of the casing and in position to set to form the desired seal.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures the numeral 1 refers to a well casing set in a well bore and the numeral 2 designates a set shoe at the lower end thereof having the discharge opening 3. The numeral 4 designates the lower plunger which is spool shaped in general contour and which has the end packing rings 5, 5, therearound. These packing rings are formed of rubber or other yieldable material and are of a size to fit tightly in the casing. This plunger has an axial bore 6 extending therethrough from end to end. Resting upon the upper end of the plunger and closing said bore there is a valve 7 and depending from said valve through said bore there is a valve stem 8 which extends beneath the plunger and whose lower end carries the spider 9.

The upper plunger 10 is similar in contour to the lower plunger 4 and has the upper and lower end packing ring 11, 11 thereabout formed of rubber or other yieldable material which fit tightly in said casing. This upper plunger is solid.

In use the lower plunger is first inserted into the upper end of the casing and the load of plastic material to be lowered is then poured into said casing and is supported by said lower plunger. The upper plunger is then inserted in the casing above said load and the upper end of the casing is closed and fluid under pressure is then forced into the casing above the upper plunger through the pressure line 12 and said plungers with the load of plastic material between them are thus forced downwardly to lower end of the casing. When the spider 9 is seated against the lower end of the set shoe 2 the down-

ward movement of the valve 7 will be arrested. By the pressure above the plunger 10 is forced on downwardly against the material and this pressure will also move the lower plunger 4 downwardly away from said valve thus opening the bore and thus permitting the material to pass down through said bore and out through the spider and opening 3 around the lower end of the casing. It is to be noted that in the form shown in Figure 3 the upper end of the bore 6′ is flared forming a seat 13 and the valve 7′ is formed to fit in said seat.

After the cementitious material has set the drilling tools are lowered through the casing and the plungers and the lower end of the set shoe as well as the cement set beneath the casing are drilled out and the well is deepened into the pay sand.

Due to the fact that the cementing apparatus has to be drilled out it is constructed, in the main, of wood or cement, or material that can be readily broken up and disposed of by the tool.

The specification and drawings disclose a preferred embodiment of the invention by way of illustration, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. The combination with a casing in a well bore, of an upper plunger and a lower plunger fitted in the casing and spaced apart to receive a load of plastic cementitious material between them, said lower plunger having a vertical passageway therethrough, a valve normally closing said passageway, and means for opening the valve at the lower end of the casing to permit the discharge of said load through said passageway.

2. The combination with a casing in a well bore, a spaced plungers in said casing forming a trap between them for plastic cementitious material, the lower of said plungers having a passageway therethrough through which the trapped material may be discharged beneath the lower plunger, a valve normally closing said passageway, a stop at the lower end of the casing, means engageable with said stop and effective to open said valve.

3. The combination with a casing in a well bore, of a pair of plunger in the casing spaced apart, plastic cementitious material in the casing between said plungers, the lower of said plungers having a passageway through which said material may pass beneath the lower plunger, a valve closing said passageway, a valve stem attached to said valve and whose lower end depends beneath said lower plunger.

4. The combination with a casing in a well bore, of a pair of plungers in the casing spaced apart, plastic cementitious material in the casing between said plungers, the lower of said plungers having a passageway through which said material may pass beneath the lower plunger, a valve closing said passageway, a valve stem attached to said valve and whose lower end depends beneath said lower plunger, and a stop at the lower end of the casing against which said stem is adapted to engage to lift the valve and open said passageway.

5. The combination with a casing in a well bore, of a pair of plungers in the casing spaced apart, plastic cementitous material in the casing between said plungers, the lower of said plungers having a passageway through which said material may pass beneath the lower plunger, a valve closing said passageway, a valve stem attached to said valve and whose lower end depends beneath said lower plunger, and means for introducing fluid under pressure into the casing above the upper plunger.

6. The combination with a casing set in a well bore and whose lower end is provided with an outlet, of means for confining a load of plastic cementitious material in the casing, means for introducing fluid under pressure into the casing above said confining means to force said confining means and the confined load downwardly through the casing, an upwardly opening valve for opening said confining means at the lower end of the casing to permit the discharge of said load downwardly through said outlet.

7. The combination with a casing set in a well bore, of an upper and lower means in the casing spaced apart to provide a space between them for the reception of a load of plastic cementitious material, said lower means having a passageway for the outlet of said material beneath the lower means, said lower means including a valve and having a valve seat, with which the valve cooperates and also having a passageway controlled by the valve, said means, and the load between them being movable downwardly through the casing as a unit, means adjacent the lower end of the casing for lifting said valve from its seat to permit such discharge of said load.

8. The combination with a casing set in a well bore, of an upper plunger and a lower plunger in the casing spaced apart to provide a space between them for the reception of a load of plastic cementitious material, said lower plunger having a passageway for the outlet of said material beneath the lower plunger, a valve controlling the passageway, said plungers and the load between them being movable downwardly through the casing as a unit, means for opening said valve adjacent the lower end of the casing to permit such discharge of said load, means for stopping the downward movement of the lower plunger after said valve is opened to effect such discharge by the further downward movement of the upper plunger.

9. A bottom separator for cementing wells, including a body member, packing means on said member, there being a passage from one end to the other of said member, a valve controlling said passage, and means on said valve for opening said valve when a barrier is reached.

10. A bottom separator for cementing wells, including a body member, packing means on said member, there being a passage from one end to the other of said member, a valve controlling said passage, and means on said valve responsive to hydraulic pressure thereon for opening said valve when a barrier is reached.

11. A bottom separator comprising a tubular plug having a passage longitudinally thereof, packing members adapted to be forced into the well ahead of a charge of cement and on said plug normally engaging the well casing, a valve controlling said passage, a stem on said valve in said passage, and means on said stem to limit the opening movement of said valve, said stem projecting through said plug to assist in opening said valve.

12. In an apparatus for cementing wells, a casing, a pair of freely movable plugs adapted for placement above and below a charge of cement, a valve in the lowermost plug, a barrier carried by said casing adjacent the point to be cemented and arranged to release said valve whereby the charge of cement may be discharged through said lowermost plug.

13. An apparatus to charge cement into wells including a casing, a pair of independently movable separators adapted for insertion into said casing above and below a charge of cement, a valve in the lowermost separator, a valve actuating means supported in said casing whereby the charge of cement is released, said valve actuating means being adapted to limit downward movement of both separators.

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

JASPER A. HARDCASTLE.