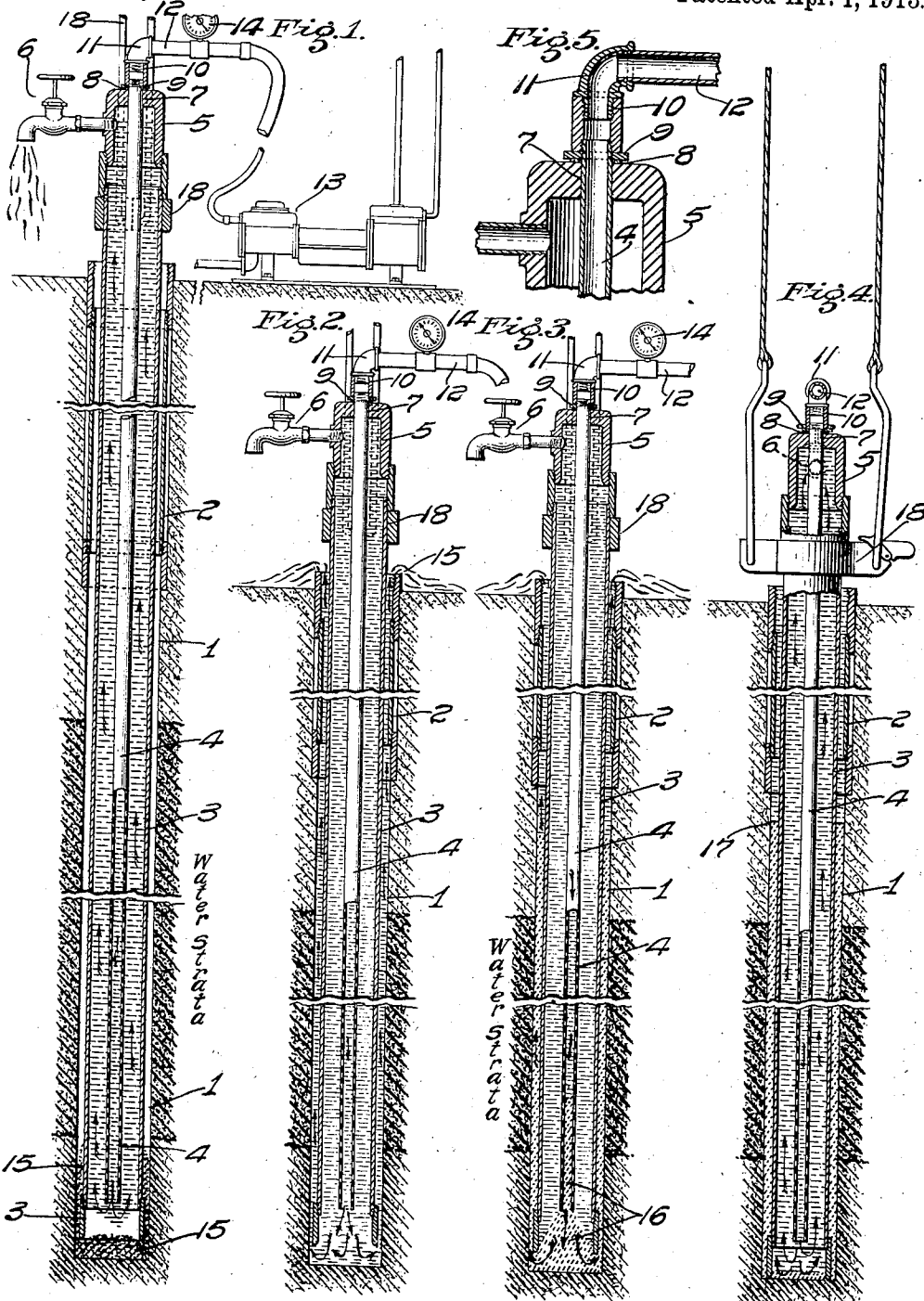


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METHOD OF CEMENTING THE WALLS OF A HOLE.
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1,057,789.

Patented Apr. 1, 1913.



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UNITED STATES PATENT OFFICE.

WILSON B. WIGLE, OF SANTA MARIA, CALIFORNIA.

METHOD OF CEMENTING THE WALLS OF A HOLE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILSON B. WIGLE, a citizen of the United States, residing at Santa Maria, in the county of Santa Barbara and State of California, have invented a new and useful Method of Cementing the Walls of a Hole, of which the following is a specification.

Heretofore a method of shutting off water from oil wells has been practised which consists in injecting liquid hydraulic cement into the annular space between the water-bearing walls and the well casing by inserting into such well casing, tubing provided at the lower end thereof with a packer having an opening therethrough to admit liquid from the tubing to the space inside the well below the packer; said packer being of such diameter and construction as to close the casing and thereby prevent the liquid from rising in the casing, the said injected hydraulic cement being forced up within the annular space between the inside casing and the walls of the well. When said cement has reached the required height, the water is then forced down the tubing to displace the cement in the tubing; and when the operator assumes such displacement has occurred, the casing is lowered to the bottom of the well thereby shutting off connection between the interior of the casing and the space outside the casing, thereby preventing the cement outside the casing from flowing back into the casing. Then the water supply is shut off and the tubing with the packer fixed thereto is withdrawn from the casing. Certain difficulties that arise in said old method of cementing the well may be enumerated as follows: (1.) The cement is liable to leak past the packer and become set inside the casing above the packer, thereby cementing the packer fast so that it cannot be withdrawn when the operation above described has been performed. (2.) In case such cementing of the packer does not occur and the operation is successfully performed to the point at which the operator assumes that the cement has been sufficiently forced out of the casing into the annular space, it sometimes occurs that the operation is stopped too soon thus leaving an amount of cement inside the casing and also inside the tubing so that when the tubing and the packer are withdrawn a quantity of cement is left in the bottom of the well where it becomes set and is an obstacle to the flow

of the gas or oil. I overcome these objections and perform the operation with less labor and expense by omitting the packer at the bottom of the well and providing a packer at the top of the well and then operating in the manner which I will now describe, reference being had to the accompanying drawings in which

Figure 1 is a fragmental elevation partly in section showing an oil well and means for cementing the same by my newly invented method, the view being taken at the time the inside casing has been filled with water and the release valve is open, the air having escaped and the water having begun to flow therethrough. The pump is shown diagrammatically and on a reduced scale. Figure 2 is a view analogous to Fig. 1 but taken at that period of the operation when the release valve has been closed and the water has begun to flow out of the top of the outside casing. Figure 3 is a view analogous to Figs. 1 and 2 illustrating the stage of process at which the annular space between the casing and the walls of the well have been filled to the appropriate height with cement. The water has been pumped down the tubing sufficiently to displace the cement in the tubing, and the casing is about ready to be lowered. Figure 4 illustrates the operation immediately following that illustrated in Fig. 3 when the casing has been lowered to prevent the cement from flowing back into the casing and the release valve has been opened, and water is being pumped down the tubing to wash out from the bottom of the well any remaining cement before it becomes set. A small portion of the liquid cement is shown ready to be washed out. Figure 5 is an enlarged fragmental axial section of the hollow plug and parts connected therewith.

In this novel method, I line the walls of the hole with artificial stone by providing a chamber between the well casing and the walls of the hole, providing an opening from the bottom of said chamber inwardly to the inside of the casing and from the top of the chamber outwardly to the external air; applying a charge of cement inside the casing to cover said bottom opening and forcing said charge of cement up into the chamber from below by pressure on the surface of the cement inside the casing.

In order to cement an oil well by my newly-invented method and means the well

hole 1 will be driven in the usual way, the upper portion thereof being cased, as is customary, with the outer casing 2 which is sunk as low as convenient or desirable.

5 Then the inner casing 3 is inserted and sunk as the work of sinking the well progresses, and this is performed in the usual manner of boring water, oil and gas wells. The casing 3 is of less diameter than the hole and is spaced apart from the walls of the hole
10 to form a chamber between the casing and such walls, there being an inward opening from such chamber below the casing so that liquid cement may be forced into the chamber and upward therein by pressure applied
15 to the surface of the cement in the chamber.

When the inside casing has been sunk to the depth assumed to be below all the water strata, tubing 4 will be inserted and lowered
20 in the inner casing until the lower end of the tubing is nearly at the lower end of the inner casing 3, and the bore of the inner casing 3 will be closed by a hollow plug 5 having a release valve 6 at one side and
25 having an orifice 7 in its top through which the tubing 4 is extended. A packing ring 8 for said orifice 7 is provided around the tubing 4 and is held in place by a washer 9 which in turn is held down by a collar 10
30 screwed on to the top of the tubing 4 and connecting said tubing with a fitting 11 into which a pipe 12 discharges. The weight of the tube holds the packing sealed. Said pipe 12 is connected with a pump 13 by
35 which liquid may be pumped through the pipe, and fitting into the tubing. A pressure gage 14 is provided in the pipe to indicate the hydraulic pressure applied to the top of the tubing.

40 The apparatus above described constitutes the means for conducting the process now to be described.

It usually occurs that the lower end of the casing 3 is plugged by accumulations 15 of clay or other earthy material in the well.
45 To conduct the operation of cementing the water strata the operator will first open the release valve 6 and will pump water through the tubing 4 into the inner casing 3 until the
50 water practically fills the inner casing and the hollow plug, and flows from the release valve 6. He will then close the valve and the pumping will be continued until the pressure in the tubing is sufficient to break
55 through the obstructions 15 around the inner casing and wash the obstructing material out through the top of the outer casing as suggested in Fig. 2. The water supply is then shut off from the pump and
60 liquid hydraulic cement 16 is supplied thereto, and the pump operated to force said liquid hydraulic cement 16 down through the tubing 4 to the bottom of the inner casing as indicated in Fig. 3. The release valve
65 6 being closed and the liquid cement being

heavier than the water which fills the inside casing 3, such water forms a packing that prevents the liquid cement from rising in such casing and the cement can only find
70 accommodation for itself by flowing out through the space under the casing and thence up into the space around the inner casing inside the well hole 1 in which space the liquid cement will continue to rise being
75 forced up by hydraulic pressure on the surface of the cement charge in the casing as the pumping continues until it reaches an appropriate height as indicated at 17 in Fig. 4.

The operator may determine by the indicator of pressure gage 14, approximately the
80 height to which the liquid cement rises around the inner casing; and when he is satisfied that the appropriate height has been reached, the pump will be cut off from
85 the liquid cement supply and will be connected again with the source of water supply. Then the pump will again be operated until the hydraulic pressure exerted through the water in the tubing forces the liquid cement down out of the tubing and up into the space between the inner casing and the walls of the hole.

For convenience, during all the process hereinbefore described, the inner casing has
95 been supported by the usual elevators 18 by which the inner casing will now be lowered to the position shown in Fig. 4, to shut off the passage from the inside to the outside of the inner casing and the pump may then be
100 stopped. When the inner casing has thus been lowered, its lower end resting on the bottom of the hole, the pump 13 may again be operated with the release valve 6 open and the water pumped down through the
105 tube 4 to wash the liquid cement out from the bottom of the hole and up between the inner casing and up through the inner casing thus preventing any accumulation of any cement at the bottom of the hole.
110

It is understood that this invention may be used in any case where it is desired to cut off from the well any stratum the product from which is desired; as, for instance, in
115 artesian wells, strata bearing one character of fluid may be cut off from strata producing pure water or any other desirable fluid produced by lower strata. It is also understood that other liquids than water may be employed to form the packing inside the
120 casing.

I claim:

The method set forth of cementing the walls of a hole, which method comprises forming an annular chamber adjacent said
125 walls, forming an annular space within said annular chamber, pumping fluid into the annular space, closing the annular space against the atmosphere, increasing the pressure in the annular space, forcing
130

liquid cement to the bottom of the annular space until it rises to the appropriate height in the annular chamber, and again pumping fluid into the annular space to force all of the liquid cement down out of the annular space and up into the annular chamber.

In testimony whereof, I have hereunto set my hand at Santa Maria, California, this 8th day of October, 1909.

WILSON B. WIGLE.

In presence of—

GEO. V. WARREN,
F. G. McBRIDE.