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W. T. THOMAS

APPARATUS FOR CEMENTING WELLS

Filed June 8, 1926

FIG. 1.

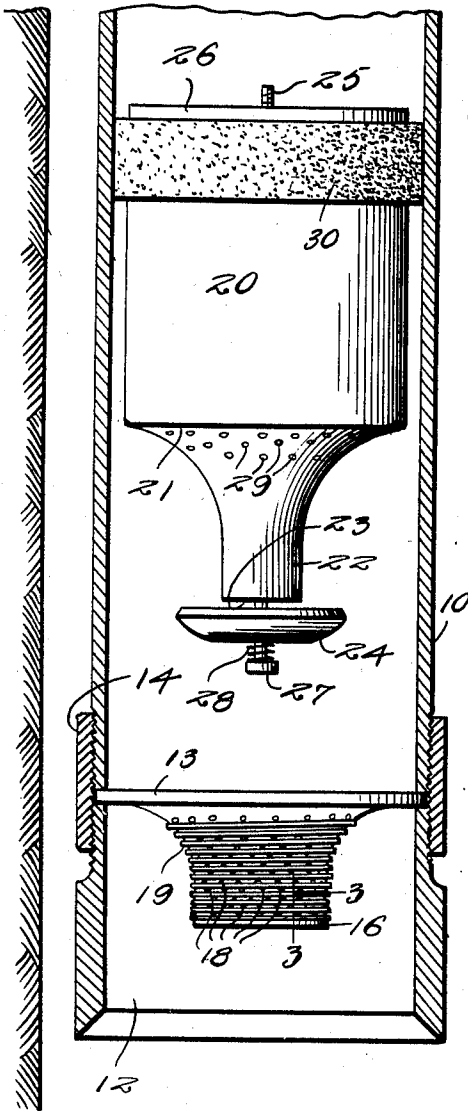


FIG. 2.

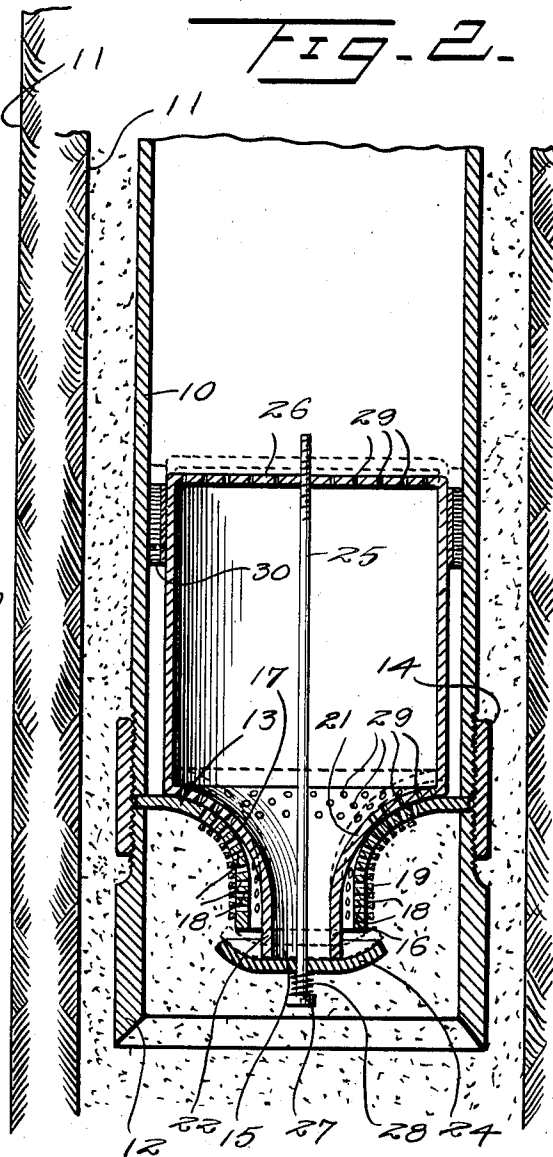
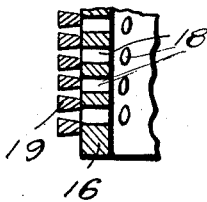


FIG. 3.



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APPARATUS FOR CEMENTING WELLS.

Application filed June 3, 1926. Serial No. 114,492.

This invention relates to apparatus for cementing wells and more particularly to an improvement of that type of cementing apparatus illustrated in my prior patent, No. 1,576,074, granted March 9, 1926, for apparatus for sealing oil wells.

An important object of the present invention is to provide a construction such that improper location of the cement charge which is being placed in the well is absolutely avoided. In cementing wells by the process employed in the patent above referred to and by similar processes, the cement charge is placed within the casing. Upon this charge is placed a plug, the function of which is to maintain the charge in position after it has been forced into such position by hydraulic pressure applied through a pump connected with the casing at the upper end thereof. These plugs, if they fit the casing, often seal above the cement an air pocket, the length of which causes a corresponding displacement of the cement charge, so that it is improperly spaced. Furthermore, the upper surface of the cement mingles with the hydraulic charge, so that the cement is rendered extremely "soupy" and instable, so that it requires a relatively long time for the cement to set and adjacent the lower end of the casing, into which the cement tends to return, there is often a pocket in which the quality of the cement is so poor that a proper setting thereof is not effected by the time the drilling is begun. In accordance with the present invention, means are provided to prevent the formation of an air pocket and to permit the cement to return to a predetermined level and by its own pressure drive therefrom any excess fluid which would tend to cause improper setting thereof.

Furthermore, in setting cement in oil wells by the process set forth in my prior patent, the arrival of the plug at the proper point in the casing is determined by the fact that since no further fluid can flow into the casing, the hydraulic pressure employed for driving the plug and cement downwardly builds up relatively rapidly. The plug once in position is locked in this position, so that it cannot return and provides a perpetual seal, so that when the pump pressure is re-

moved, there is no tendency to back-flow of the fluid employed in providing the pressure against the cement. A further and important object of this invention is to provide a device of this character which, while giving the indication of the arrival of the plug at the proper position in the same manner as in my prior patent, permits the plug to shift after it is engaged with its seat through a predetermined distance, which opens a number of minute openings through which water may pass but in which the cement has a tendency to clog.

These and other objects I attain by the construction shown in the accompanying drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention and wherein:—

Figure 1 is a view partially in section and partially in elevation of cementing apparatus constructed in accordance with my invention, the plug being shown in position above the disk with which it coacts;

Figure 2 is a similar view but in section and illustrating the plug in the position which it initially assumes when engaging the disk in solid lines, and its final position in dotted lines;

Figure 3 is an enlarged detail sectional view through the disk showing the manner of regulating the size of the openings of the disk.

Referring now more particularly to the drawings, the numeral 10 generally designates a casing of a well bore 11 which is to be cemented and 12 indicates a shoe of the casing which is disposed at the lower end thereof. In accordance with my invention, a disk 13 is placed within the casing adjacent the shoe 12 and is preferably held in position by a coupling 14 connecting the shoe with the lower end of the casing. This disk has a central opening 15 in the lower end of a depending neck 16, the upper surface of the connection of the neck with the disk providing a valve seat 17.

This disk is formed with a plurality of minute openings 18 which may have any suitable arrangement and a number of which are formed in the neck 16 of the disk. These openings are preferably about one sixty-fourth of an inch in diameter.

As, however, it is obviously difficult and expensive to provide a great series of openings of this size in the disk, I preferably form in the disk openings of approximately one-eighth of an inch in diameter and then coil upon the under surface of the disk a wire 19 having the space between adjacent coils of the wire such that the apertures formed are but one sixty-fourth of an inch in width. This wire may be of the character ordinarily employed in well screens and of itself forms no part of my invention.

The plug employed consists of a cylindrical body 20 of less diameter than the interior diameter of the casing in which it is to be employed and is formed at its lower end with a head 21 having a neck 22 of a size to extend through the neck 16 of the disk 13 and the opening 15 thereof. The lower end of the neck 22 has an opening 23 in opposition to which is arranged an upwardly cupped washer element 24 formed of flexible material. This washer element is supported by a rod 25 threaded in the upper head 26 of the plug and extending through the neck 22 of the lower head 21 thereof. The lower end of the rod has a head 27 and between this head and the washer a spring 28 is disposed which normally urges the washer upwardly for engagement with and sealing of the opening 23 of the neck. Both the upper and lower heads of the plug may be provided with a series of small openings 29, if so desired. The exterior of the plug adjacent its upper end has preferably secured thereto an annular bristle clump 30, the bristles of which are relatively stiff and engage against the walls of the casing. These bristles serve to brush from the walls of the casing any cement which has a tendency to adhere thereto, so that this cement will not dry upon the walls of the casing and afterwards during the drilling operation flake off.

The method of employing the apparatus is as follows: The disk 13 having been positioned and cement admitted to the well, the plug is dropped in on top of the cement and hydraulic pressure applied to the well to force the cement to its position between the wall of the bore 11 and the casing. When the plug comes into contact with the disk, the washer 24 will pass below the disk and the plug will come into sealing engagement with the seat 17. The sudden rise in pressure will advise the operator of the pump that the plug is in engagement with the disk and pressure is shut off and the well opened. The cement will then tend to return to the casing and the fluid on top of the cement will be forced through the openings 18 and thus permitted to escape from the cement. The cement coming into contact with these openings will seal the

same, preventing loss of any appreciable quantity of the cement. At the same time, liquid or air may move through the interstices of the cement particles to the openings and thus escape.

It is pointed out that at this time, the plug 20 may move upwardly so that this plug does not seal the openings 18, washer 24 coming into engagement with the lower end of the yoke 25 and providing a seal for the large opening 15 of the disk 13 while at the same time limiting upward movement of the plug. While the plug 20 will not seal all of the openings 18, when seated thereagainst, it is advisable that this plug be permitted to move upwardly, as otherwise a complete separation of the water and cement is difficult to obtain. These openings 18 will, of course, permit the passage not only of water but any other trapped fluid, such as air.

Since the construction hereinbefore set forth is obviously capable of a certain range of change and modification without materially departing from the spirit of the invention, I do not limit myself to such specific structure except as hereinafter claimed.

I claim:—

1. In cementing apparatus for oil wells, a disk adapted to be secured within the lower end of the well casing and having a large opening formed therein, a series of minute openings likewise formed in the disk and a plug adapted to be placed upon the cement within the well and to engage with the disk to seal the large opening of the disk and lock the plug to the disk.

2. In cementing apparatus for oil wells, a disk adapted to be secured within the lower end of the well casing and having a large opening formed therein, a series of minute openings likewise formed in the disk and a hollow plug adapted to be placed upon the cement within the well and to engage with the disk to seal the large opening of the disk and lock the plug to the disk, said plug being formed in its upper and lower ends with a series of minute openings.

3. In cementing apparatus for oil wells, a disk adapted to be secured within the lower end of the well casing and having a large opening formed therein, a series of minute openings likewise formed in the disk and a plug adapted to be placed upon the cement within the well having at its lower end means adapted to pass through the opening of the disk when the plug comes into contact with the disk and to seal the disk at the under surface thereof.

4. In cementing apparatus for oil wells, a disk adapted to be secured within the lower end of the well casing and having formed therein an opening for the passage of cement and other openings permitting the passage of fluid but preventing the passage of ce-

ment and a plug adapted to be placed upon the cement and having engagement with the disk sealing the first named opening.

5 5. In cementing apparatus for oil wells, a disk adapted to be secured within the lower end of the well casing and having formed therein an opening for the passage of cement and other openings permitting the passage of fluid but preventing the passage of cement
10 and a plug adapted to be placed upon the cement and having engagement with the disk sealing the first named opening and locking the plug to the disk.

6. A plug for use in cementing oil wells adapted to be placed upon the top of the 15 cement within the well, said plug being of less diameter than the internal diameter of the casing and having projecting outwardly therefrom a circumferential bristle clump the bristles of which are adapted to 20 engage against the interior walls of the casing to remove adhering cement therefrom.

In testimony whereof I hereunto affix my signature.

WILLIAM T. THOMAS.