

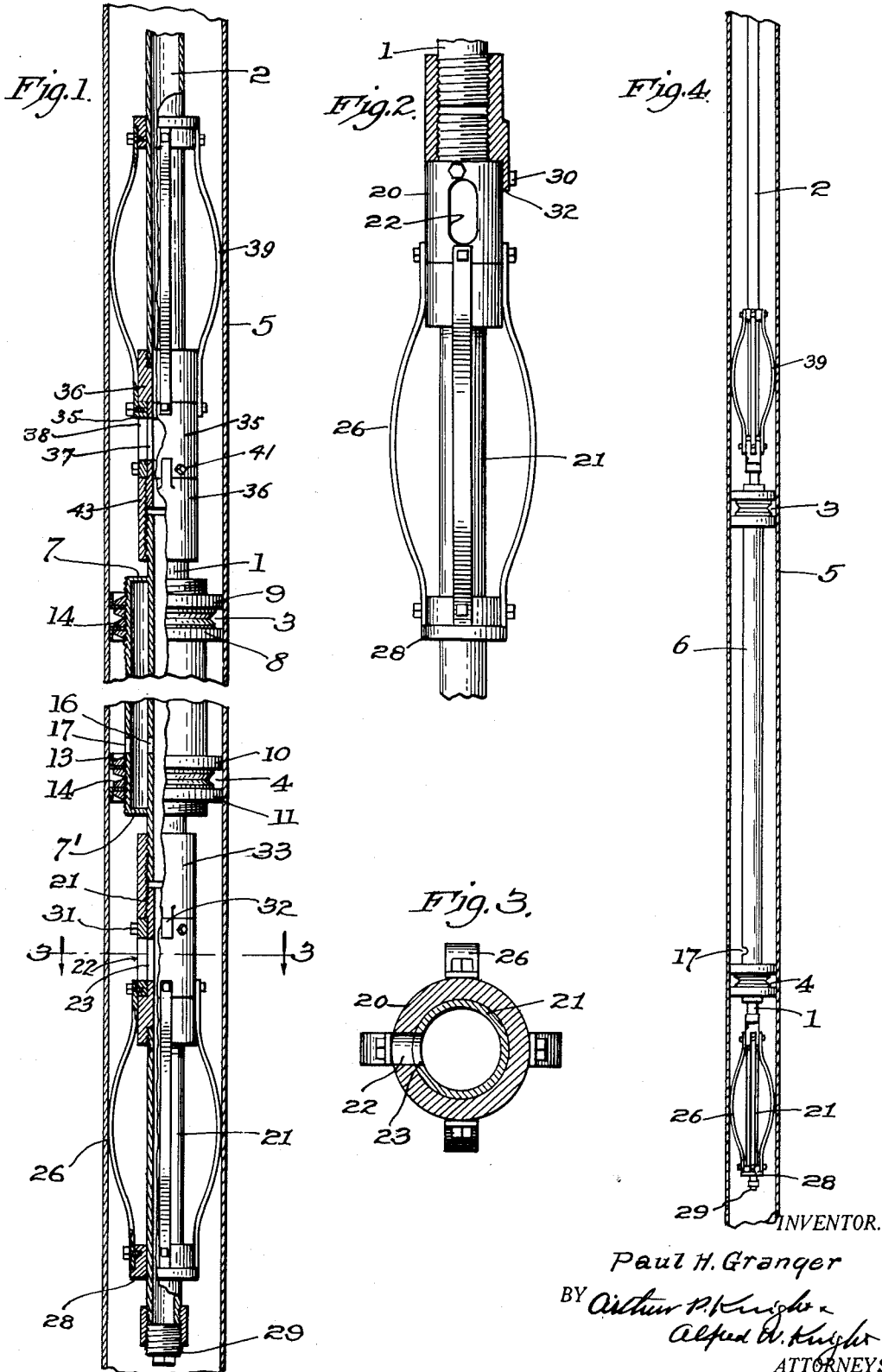
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MEANS FOR LOCATING AND CEMENTING OFF LEAKS IN WELL CASINGS

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MEANS FOR LOCATING AND CEMENTING OFF LEAKS IN WELL CASINGS

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This invention relates to means for locating and cementing off leaks in well casings and the main object of the invention is to provide improved means adapted to be lowered into the well casing and to serve as a means for finding the location of a leak in the casing and for introducing cementing material through said leak into the formation outside the casing so as to cement off or seal the interior of the casing against entry of ground water.

The accompanying drawings illustrate embodiments of my invention and referring thereto:

Fig. 1 is a partly sectional side elevation of the device in position in the casing, the casing being shown in section.

Fig. 2 is an elevation of the lower end of the device taken at right angles to Fig. 1.

Fig. 3 is a section on line 3—3 in Fig. 1.

Fig. 4 is a diagrammatic section of the well casing illustrating the manner in which the device is used.

My improved leak-locating and cementing off device comprises a tubular member or body 1 which may be connected to and suspended from the usual string or line of tubing 2 whereby the device is introduced into the casing, supporting upper and lower packing means 3 and 4 mounted on said tubular body in any suitable manner and adapted to make a liquid tight fit with the interior of the casing indicated at 5, and valve means at the lower end of the tubular body whereby communication may be established or cut off as desired between the interior of the tubular body 1 and the space below the lower packing means 4.

The said packing means carried by the tubular body 1 are shown as mounted thereon by means of a barrel or outer tubular member 6 connected at its upper and lower ends to the tubular body 1 by webs 7 and 7'. The upper packing means may comprise an inner packing cup 8 and an outer packing cup 9, the terms "inner" and "outer" being used with respect to the space between the said packing members 3 and 4. Similarly, the lower packing means may comprise an inner packing cup 10 and an outer packing cup

11. The said cups 8, 9, 10 and 11 may consist of leather or other suitable flexible material and are supported on the member 6 by means of screw rings 13 and 14 screwing on said member 6 and clamping the said cups between them as shown. The inner cups 8 and 10 have their flange portions which engage with the casing extending toward the space between the upper and lower cups so as to be forced against the casing by pressure within said space and the outer cups 9 and 11 have their flange portions which engage with the casing extending toward the space outside of the device so as to be forced into engagement by pressure in said outside space.

The tubular body 1 is provided with an aperture 16 near the lower packing means and preferably adjacent the upper packing cup of said lower packing means and the outer tubular member 6 is provided with an aperture 17 also preferably adjacent the upper cup of the lower packing means being, for example, in register with the opening or openings 16.

The valve means for controlling communication between the interior of the tubular body 1 and the exterior thereof may consist of a sleeve 20 having a rotative fit on a portion of a tube 21 secured to the lower end of the tubular body 1 and forming an extension thereof, said sleeve 20 having an aperture 22 adapted to register with an aperture 23 in the tubular member 21 or to be moved out of register therewith by relative rotation of said parts. To enable such relative rotation the sleeve 20 is provided with means for engaging the walls of the casing 5 to prevent rotation of said sleeve, said means consisting, for example, of bow springs 26 secured to said sleeve and adapted to frictionally engage the walls of the casing so as to resist the rotation of the sleeve while permitting rotation of the rest of the tube within the casing. The lower ends of said springs 27 may be connected to a sliding collar 28 adapted to slide vertically on a tubular member 21 in the compression or expansion of the spring. The lower end of the tubular body 1 is closed by a plug 29 or other suitable means. In order to limit

the relative rotation of the tubular member 21 relative to the sleeve 20, said sleeve may be provided with stops 30 and 31 adapted to engage a projection 32 on a sleeve 33 which is connected to the tubular member 21 and is shown as a screw collar connecting said tubular member 21 with the tubular body.

A valve means is also provided at the upper end of the device for establishing communication between the inner tube and the space around the same above the packing means. Said valve means comprises a sleeve 35 mounted to turn on a tube section 36 secured to the upper end of tubular body 1 and to the lower end of the suspending tube 2, said tube section 36 and sleeve 35 having ports 37 and 38 adapted to register in a certain relative angular position of said parts. Friction springs 39 are provided on valve sleeve 35 for engaging the casing to resist rotation of the valve sleeve and stops 40 and 41 on the valve sleeve 35 are adapted to engage a projection 42 on a collar 43 rigidly connecting members 36 and 1, to limit relative rotation of parts 35 and 36.

The method for locating a leak with the above described instrument is as follows: First, from the records or log of the well, the natural water level is noted. The instrument is lowered into the casing indicated at 5 until the two lower cups are past the water level and the upper two cups are above the water level, the valve means 20, 21, at the lower end of the instrument being open at this time so that liquid can pass into the tubular member 1 through the valve ports 22 and 23 and the upper valve means 35, 36 also being open so that fluid can pass freely from the space below the device to the space above the same as the device is being lowered into the casing. When the instrument has been brought to the proper level as above stated at which the lower packing cups are below the predetermined water level, the valves at the lower and upper ends of the instrument are closed by rotating the suspending tube or pipe line 2 so as to move the inner members 21 and 36 until the apertures therein are out of register with the apertures in sleeve 20 and 35 respectively, said sleeves being held from rotation by engagement with the springs 26 and 39 with the walls of the casing 5. A swab is then run in the tubing and if no water comes in the tubing there is no leak. If the water comes in with a certain degree of rapidity as it is swabbed out, it is known that there is a leak.

If there is no leak at the first station, then it is desirable to move the instrument down to a point less than the distance between the two sets of cups. To do this the tubing is first turned and the valves opened, same are left open until the second station is reached. The tubing is again turned and the valves closed. The swab is run as in previous operation. If

a leak is found, the valves are opened and the instrument may be moved short distances, closing the valves and swabbing until one set or the other set of cups, passes the leak.

It will be understood that the instrument may be of any desired length, for example, one hundred feet more or less so as to provide for examining a defined length of the casing at each setting.

When the leak has been located, as above described, the same instrument can be advantageously used at the same time in cementing off the leak, it being desirable for this purpose that the instrument be so positioned that the leak in the casing is located as near as possible to the lowermost cup by reasons hereinafter set forth. In using the device for cementing off the casing, mud is preferably first forced down through the pipe line 2 and tubular member 1 and apertures 16 and 17 so as to fill the space from the lower cup to the top of the leak in the casing with mud, it being understood that the space within the casing and between the top of the leak and upper packing means 3 is occupied by incompressible liquid so as to hold the mud down and prevent it from entering this space, then cement is introduced on top of the mud standing in the tubing and caused to flow out through the apertures until the cementing operation is completed and finally more mud may be forced down on top of the cement so as to eject as much as possible of the cement from the instrument. In all of these operations the presence of the incompressible liquid in the space between the instrument and the casing and between the top of the leak and the inner member of the packing means prevents any mud or cement from entering this space and limits the presence of solid material to the extreme lower portion of the instrument so that the instrument may be withdrawn after the cementing operation with a minimum of cementing material therein and without leaving any plug of cement in the casing.

The method above described therefore permits the casing to be cemented off while permitting the instrument to be readily removed and brought to the surface and also does away with the usual bridging, and after cementing, the usual setting up of drilling equipment and the drilling out of the cement and bridging material operations which have heretofore been necessary to clear the casing of cement and the usual bridging material.

In lowering the device it is desirable to have the lower and upper valves open so as to provide a by-pass which permits a natural level to be maintained in the tubing above the indicator. The combination of this set of by-passes make it possible to use cups facing in opposite directions and to permit the movement of said device up or down without destroying the cups. This is very necessary as

the hole in the device must be as nearly opposite the leak in the casing as it is possible to get it. This device takes advantage of the incompressibility of fluid commencing at a point of leak in the casing and extending to cup 8. This body of incompressible fluid does not permit either said mud or cement or both from raising nearer to the top cup which faces inwardly than at the top of the leak in the casing which is previously located. Therefore, it is essential that said leak in the casing is located near the lowermost cup facing inwardly at which point the holes 16 and 17 in the wall of the device is a hole through which either the cement or mud or both is forced.

I claim:

1. An instrument for the purposes set forth comprising a tubular body provided with upper and lower packing means, each packing means comprising an inner member adapted to tighten under pressure existing between the packing means and an outer member adapted to tighten under pressure from the outside, said tubular body being provided with opening means establishing communication between the interior thereof and the space around said tubular body between said upper and lower packing means a suspending pipe on which said tubular body is supported, and adapted for supply of fluid material to the interior of said tubular body through said suspending pipe, valve means comprising a sleeve rotatably mounted on the tubular body above the upper packing means and provided with a valve aperture, valve means comprising a sleeve rotatably mounted on the tubular body below the lower packing means and provided with a valve aperture, each of said valve means being provided with means for frictionally engaging with the casing to prevent rotation of said valve means, said tubular body being provided with apertures cooperating respectively with the apertures in the aforesaid valve means on partial rotation of the tubular body within the first-named valve means to open or close communication between the interior of the tubular body and the spaces below and above the packing means on the tubular body and within the casing and means for limiting the relative rotative movement of the tubular body within the aforesaid valve means.

2. A construction as set forth in claim 1 wherein said opening means is located adjacent the lower end of the space between the upper and lower packing means.

In testimony whereof I have hereunto subscribed my name this 26th day of September, 1929.

PAUL H. GRANGER.