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H. R. IRVINE

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CASING CENTERING DEVICE

Filed June 18, 1927

Fig. 1.

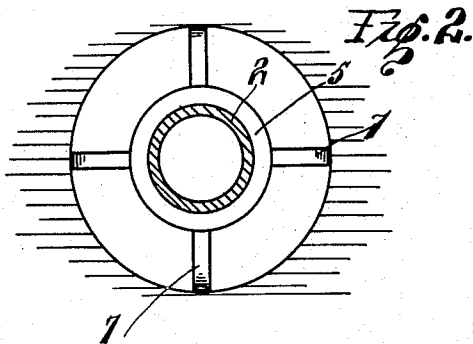
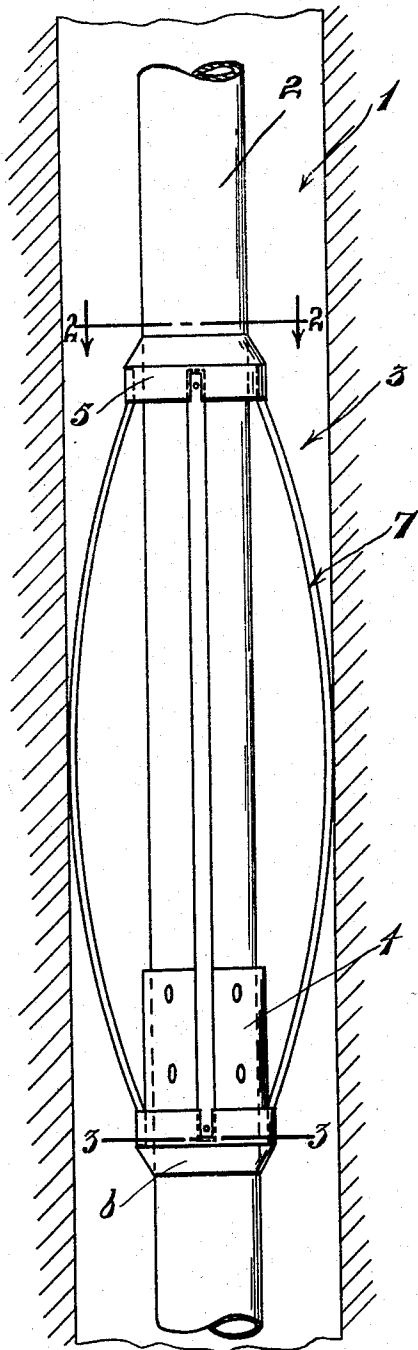


Fig. 3.

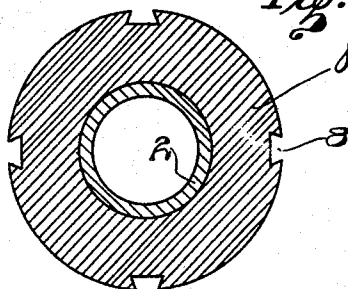


Fig. 4.

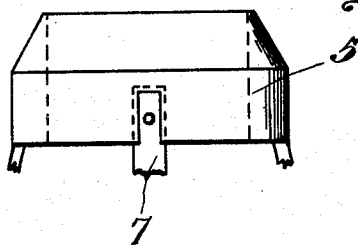
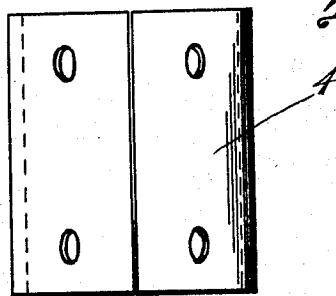


Fig. 5.



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CASING-CENTERING DEVICE

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In the drilling of deep wells, particularly with rotary drilling tools, it is extremely difficult to drill a straight hole. That is, on encountering a hard stratum the hole will gradually veer off at an angle from the vertical, and the resulting angularity of the hole is sometimes very pronounced. When it is necessary to cement the well to provide a water shut-off, casing is set in the hole and cement is poured around the same to a considerable depth and when the cement sets it is impervious to water and prevents the water from passing upwardly into the oil strata. It is obvious that in order to provide a tube water shut-off, the casing should be centered in the hole in order that the cement may pass entirely around the same. Due to the angularity of the hole, as above stated, it frequently occurs that the casing will rest against one side of the hole, thus preventing the cement from passing entirely around the same and it defeats the purpose of the cement, namely, a complete water shut-off.

An object of my invention is to provide a casing centering device which will effectively hold the casing in the center of the hole at the time cement is poured, thus insuring that the cement will pass entirely around the casing and will provide a complete water shut-off.

Another object is to provide a casing centering device which yieldably engages the side of the hole, thus insuring that the casing will be centered.

Other objects, advantages, and features of invention may appear from the accompanying drawing, the subjoined detailed description, and the appended claims.

In the drawing:

Fig. 1 is a side elevation of my centering device in position on a section of casing.

Fig. 2 is a sectional view taken on line 2, 2, Fig. 1.

Fig. 3 is a sectional view taken on line 3, 3, Fig. 1.

Fig. 4 is a side elevation of one of the sliding collars.

Fig. 5 is a side elevation of the split sleeve.

Referring more particularly to the drawing:

The numeral 1 indicates the bore made by the drilling tool and 2 the casing which is set in the bore. The casing 2 is of considerably less diameter than the bore so that a space is provided in which the cement may be poured. My centering device 3 is positioned on the casing at any desired position, preferably adjacent the bottom thereof, although a plurality of my devices may be positioned on the casing at intervals. A sleeve 4, which is preferably split, is secured to the casing 2 by welding, or otherwise suitably securing the same thereto, and this sleeve acts as a stop for my centering device, as will be further described.

My centering device 3 comprises an upper and lower collar 5, 6, respectively, which collars encircle the casing and are slidable thereon. The collars 5, 6 are positioned on either side of the sleeve 4 and are adapted to engage said sleeve, thus limiting the movement of the centering device on the casing.

A plurality of outwardly bowed spring arms 7 extend between and are secured to the collars 5, 6. These spring arms are preferably secured to the collars by passing the ends thereof into dove-tailed grooves 8 in the collar, and then welding or otherwise suitably securing the spring arms in the grooves. The spring arms 7 being bowed outwardly engage the side walls of the bore 1 thus holding the casing 2 accurately in the center of the bore.

In moving the casing upwardly or downwardly in the bore, the collars 5, 6 will slide until they engage the sleeve 4, and after a constricted portion of the bore is encountered the spring arm 7 will compress because of the movement of the collars, thus permitting the free passage of the casing without any hindrance from my centering device.

In this connection it is important that the stop or sleeve 4 must be located between the upper and lower collars 5 and 6 respectively. If the stop were not located between the collars, but were located outside the collars, the action of the spring arms 7 in passing through constricted portions of the bore would not be nearly so satisfactory. To illustrate this, let us assume that the stop is located between

the collars, which feature in fact is the main point of this invention. With this arrangement, when the casing 2 passes downward through the well on its way to the location where the cement shut-off is to be made, restricted portions of the well are frequently encountered. At these places the spring arms will usually hesitate because of the constriction, the pipe or casing 2 will slide downward through collars 5 and 6, until stop 4 abuts against the lower collar after which the further descent of the casing will pull the spring arms 7 downward and easily and neatly collapse them to pass through the restriction. On the other hand if the casing and centralizer had been set far down in the well, and for some reason it was desired to again raise it out of the hole before cementing, the same action as above described would occur, but in reverse order. That is, when the spring arms 7 on the rising structure again reach a restricted portion of the bore, consisting perhaps of a boulder, partial cave-in, or some other circumstance, the restriction would hold the spring arms against further ascent until casing 2 slid sufficiently through collars 5 and 6, so that stop 4 would come in contact with the upper collar 5, after which the further ascent of the casing will pull the spring arms 7 easily and neatly upward through the restricted bore, these spring arms freely collapsing to pass the restriction. The spring arms however pass the restriction so nicely, both during ascent and descent, only because they are in both cases pulled and not pushed through the restricted portion of the well. If they were pushed, instead of pulled, as in fact would occur if the stop were located beyond the collars, instead of between them, then on encountering the restriction there would be a substantial possibility that the spring arms instead of folding nicely to pass the restriction, would in fact belly outward, and if this occurred the further forcing or pushing against the spring arms would drive them out into the formation and tend to snap them from the collars, thereupon allowing them to fall ahead of the centralizer into the bottom of the hole. This would be a serious difficulty, the possibility of which all practical well drillers are constantly on guard to prevent. If such a spring arm, being made of hardened steel, should fall to the bottom of the hole prior to cementing, it would be there cemented in place, and subsequently when the cement seal is drilled through to continue the drilling of the well to lower strata, the bit would encounter this steel spring, the edge would immediately be taken off the drill, and a situation would result which would either involve considerable delay in endeavoring to mill up this buried spring, or else in extreme cases the hole might have to be junked and abandoned because of impossibility of drill-

ing past the obstruction which this stray spring would set up. In the latter case the loss to the owners of the well would be very great, so great in fact that the possibility of its occurrence would usually deter them from using a cement equalizer wherein the possibility of the spring tearing loose, would be noticed. The service and conditions which such a cement equalizer must stand up against is much greater than the service required of an ordinary sucker-rod guide, or other ordinary types of guide, for the reason that the latter are used only after the drilling of the well is completed, and if a spring should tear loose from them, it would be of little consequence because no further drilling is to be done beyond the place where they would fall.

It is a further important feature of this invention, as set forth by the drawing, that the stop sleeve 4, located between the slidable collars 5 and 6, should be of smaller outside diameter than the outside diameter of collars 5 and 6. In fact it is preferable, as shown by Figure 1, that the combined thickness of the stop sleeve and spring arm should not exceed the thickness of the slidable collars 5 and 6, the object being that when the equalizer is pulled through a very tight place in the well, the spring arms can fold flat and flush against sleeve 4, requiring no greater hole clearance to pass through than is required by collars 5 and 6. This is very important, because diameter is expensive in deep holes, and no projection beyond the surface of the pipe, of more than an irreducible minimum can be tolerated.

In practice, I find it desirable to keep the outside diameter of my slidable collars 5 and 6 equal to or smaller than the outside diameter of the ordinary casing couplings, which those skilled in the art understand are used for screwing the successive joints of casing together. This insures that my centralizer will pass through any restriction that the string of casing would itself pass through with its usual couplings between sections.

Having described my invention, I claim:

1. A casing centering device comprising upper and lower collars slidably mounted on the casing, a stop for said collars, said stop being located between the upper and lower collars, and a plurality of spring arms secured to the upper and lower collars, said arms being adapted to engage the side of the hole to hold the casing in the center thereof.

2. In combination, a pipe adapted to be lowered or raised in a well, and a centralizer on said pipe, said centralizer comprising upper and lower collars and spring arms, both said collars embracing said pipe and being slidable thereon, and said pipe having a stop located between said collars and being adapted to prevent the sliding of said collars past said stop so that whether said pipe is raised or

lowered through said well said spring arms will always be pulled and not pushed through any restricted portion of said well.

3. A casing centering device comprising upper and lower collars adapted to slidably embrace the casing, a plurality of spring arms secured to said upper and lower collars, and a stop sleeve adapted to be secured to the casing between said upper and lower collars to arrest the sliding movement of said collars, the outside diameter of said stop sleeve being smaller than the outside diameter of said collars.

4. A cement equalizer comprising a piece of pipe adapted to be lowered or raised in a well, two cylindrical end members slidably mounted on said pipe, spring arms fastened to said end members, said pipe having a stop located between said end members adapted to prevent the sliding of said end members past said stop so that whether said pipe is raised or lowered through said well said spring arms will always be pulled and not pushed through any restricted portion of said well.

5. A cement equalizer comprising in combination with a piece of pipe, upper and lower cylindrical end members adapted to slidably embrace said pipe, a plurality of spring arms secured to said upper and lower end members, and a stop collar adapted to be secured to said pipe between said upper and lower end members to arrest the sliding movement of said end members, the outside diameter of said stop collar being smaller than the outside diameter of said cylindrical end members.

In testimony whereof, I affix my signature.
HERSCHELL R. IRVINE.

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