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PLUG BACK TOOL FOR CEMENTING WELLS

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2 Sheets-Sheet 1

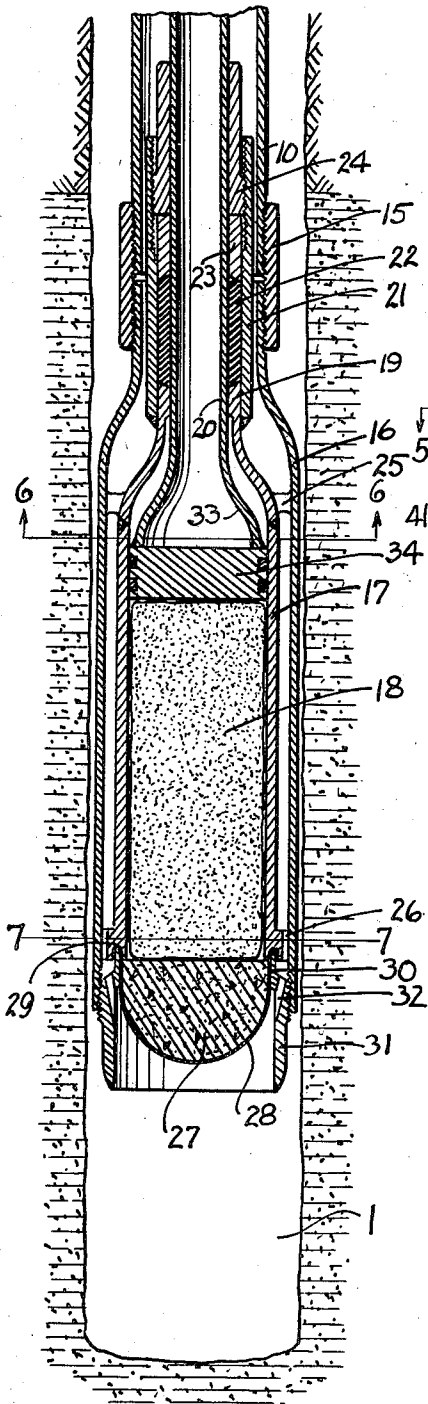


Fig. 1.

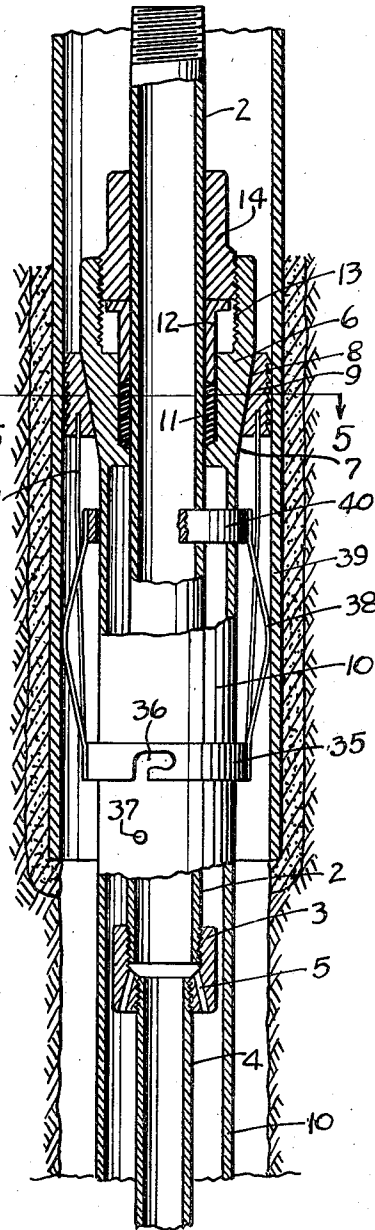


Fig. 2.

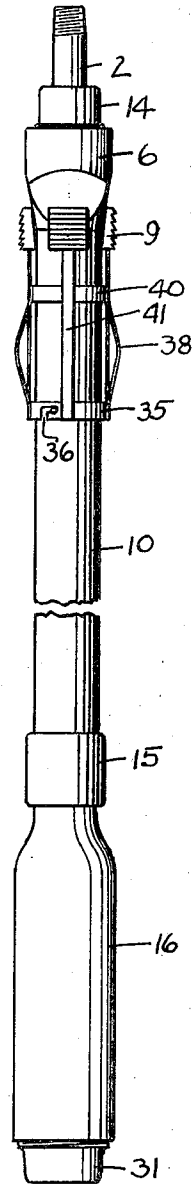


Fig. 3.

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PLUG BACK TOOL FOR CEMENTING
WELLS

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9 Claims. (Cl. 166—21)

My invention relates to the placing in deep wells of a plug of cement for the purpose of shutting off the entrance of fluid to the hole at the point where the plug is placed.

5 The usual practice in plugging back wells, or cementing off the lower water-producing sands, consists of pumping a charge of fluid cement down the drill stem or tubing, the landing spot being determined by the amount of water pumped
10 down on top of the cement. The very nature of this operation precludes its use in plugging back a short hole requiring the accurate placement of a small amount of cement without endangering the producing sand. It is also impractical to
15 accurately land the cement at the right spot.

The plug back device here shown has for its object to overcome the above objections and to provide a new and greatly improved method of plugging off a small lower section of sand. It is
20 desired to provide positive placement of a small amount of cement in position where it does not come in contact with the oil producing sand.

It is a further object to accomplish the location of the cement by actual measurement, which
25 eliminates "estimating" the amount of fluid to pump down and it also eliminates the job of actually pumping a definite amount of fluid in order to land the cement at its proper place.

Another very important object is to improve
30 over present methods in the elimination of the time required for the setting of cement slurry—about seventy-two hours. With my device the operation may use quick-setting cement, requiring anywhere from fifteen to thirty minutes to
35 set, thus accomplishing a great saving for the operation.

Another object is to provide a structure whereby the operator can actually measure the height of the cement plug and determine whether it is
40 accurately placed.

Another object is to provide a device whereby the charge of cement may be packed down and pressed solidly into the bottom of the hole by
mechanical means.

It is a further object of the invention to provide a device whereby the cement charge may be
50 formed in a package or container which allows the charge to be handled as a unit and moved positively into the position where it is to set.

In the drawings herewith, Fig. 1 is a central longitudinal section through the lower end of my device shown in position adjacent the lower end
of the well.

55 Fig. 2 is a similar view showing the upper por-

tion of the plug setting device, Fig. 2 being a continuation of the upper end of Fig. 1.

Fig. 3 is a side elevation of my device showing the same removed from the well.

Fig. 4 is a central longitudinal section similar
5 to Fig. 1 but disclosing a slightly different embodiment of the invention.

Fig. 5 is a transverse section on the plane 5—5
of Fig. 2.

Figs. 6 and 7 are transverse sections on the
10 planes 6—6 and 7—7 of Fig. 1.

Fig. 8 is a similar transverse section on the
plane 8—8 of Fig. 4.

In the drawings herewith I have illustrated my device as placing a charge of cement in the lower
15 end of the well bore 1, it being the purpose of the invention to place a charge of cement at the lower end of the well to cut off the entrance of fluid below and around the plug to the well.

My device includes a tubing string 2, which is
20 of uniform diameter to a point within the device which I employ. At the point shown at 3 in Fig. 2 the diameter of the tubing 2 is slightly reduced; the lower reduced portion 4 being connected to
the section 2 by a collar 3. This collar has
25 lateral, downwardly discharging, fluid openings 5 therein.

Slidable on the tubing 2 is a special nipple 6,
said nipple being tapered downwardly at 7 to
30 provide flattened areas shown at 8 in Fig. 5, upon which casing engaging slips 9 may seat. The nipple 6 connects at its lower end with a section of pipe 10 which forms a housing for the
cement-discharging apparatus, as will be later
described.

The inner portion of the nipple 6 is adapted to
35 fit about the tubing 2. There is an enlarged recess at 11 to receive packing to seal about the tubing 2 and a gland 12 above the packing serves to compress the same in the box. The upper end
40 of the nipple is further enlarged to provide a threaded chamber 13 to receive a tubular nut 14 which serves to compress the gland 12 against the packing. The outer pipe or housing 10 is
connected at its lower end by means of a coupling
45 15 to a swaged housing 16, the said housing being of larger diameter than the housing 10.

Within the housing section 16 is a cement
50 bucket 17 within which a sack, of fabric, paper, or other flexible material, containing the cement 18 may be placed. The upper end of the cement bucket is swaged inwardly to provide a neck at 19 which engages closely about the lower end
20 of the tubing. A seal is provided between the upper neck of the bucket and the tubing which

includes a stuffing box 21 with packing 22 therein compressed in position by a gland 23 and a tubular nut 24.

The cement bucket is spaced from the housing 16 by spacing lugs 25 at its upper end and its lower end is provided with laterally extending lugs 26 contacting with the inner wall of the housing. At the lower end of the said housing 16 the cement bucket is closed by a cap 27, which is preferably made up of a plug of cement of somewhat larger diameter than the interior of the cement bucket and held in position closing the lower end of the bucket by a hemispherical shaped gasket 28 of sheet metal, such as copper or other soft material, the upper ends of which are clamped within a groove 29 at the lower end of the bucket by means of a ring 30 formed at the upper end of the shoe 31, screwed within the lower end of the housing. It will be noted that when the shoe 31 is screwed upwardly in the housing the upper ring 30 thereon will serve to clamp the supporting gasket 28 firmly in position, holding the cement plug 27 in position. Holes 32 are provided through the shoe 31 to allow fluid to discharge downwardly around the bucket while the device is going into the well.

The lower end of the tubing 20 within the cement bucket is belled outwardly at 33 and is fastened to a piston 34 resting upon the upper end of the charge of cement 18. This piston forms a sealing fit within the cement bucket and when pushed downwardly by means of the tubing the cement charge will be forced against the plug 27 in such manner as to shear the holding gasket 28 from its position clamped into the lower end of the bucket and allow the plug 27 to be forced downwardly and to thus discharge the cement into the bottom of the hole.

To anchor the housing and bucket in position in the well the upper end of the section 10 referred to has slidably thereon a ring 35. Said ring has a bayonet slot 36 therein to receive a radially projecting pin 37 on the housing 10. There are arms 38 fixed to the ring 35 and bowed outwardly to engage against the interior of the casing 39. At the upper end of the spring arms 38 is a second ring 40, which is also slidable on the cylindrical outer surface of the housing 10.

The slips 9 previously referred to are mounted on the upper ends of arms 41 of steel, said arms being secured at their lower ends to the ring 35 so that the said slips are spaced uniformly above the said ring, and are in registration with the flattened areas 8 of the nipple 6.

When this device is in use it is assembled together in the relation shown in Figs. 1, 2 and 3, the cement 18 enclosed within a sack or container being mounted in position within the device as shown in Fig. 1. While the device is being lowered into the well circulation may be obtained downwardly through the tubing 2 and outwardly through the openings 5 into the housing and through the lower passages 32 in the shoe to the well, and when the bottom of the well is reached washing may be continued until all mud and detritus is washed from the hole. The next step is to anchor the housing in position. This is done by raising the device the proper distance off the bottom of the well and rotating slightly so as to bring the pin 37 into the vertical portion of the bayonet slot 36, after which the lowering of the device will move the housing downwardly away from the ring 35 and bring the dogs 9 into locking engagement between the nipple 6 and the casing 39. It will then be possible to move the

tubing 2 downwardly relative to the housing and cement bucket and force the piston 34 against the cement and, by breaking off the cap 28, discharge the cement downwardly into the bottom of the well. The said charge of cement may be then tamped tightly into position at the bottom of the hole so that it will completely fill and close off the same. The water in the hole mixing with the cement thus discharged will quickly set and serve to plug off the well bottom.

It will be obvious that the exact height of the upper end of the plug relative to the surface may be readily measured through the length of tubing 2 extending upwardly from the cement to the surface. The tubing may rest upon the cement so as to exactly note the position thereof and will serve to inform the operator as to the exact position of the plug.

In Figs. 4 and 8 I have shown a slightly different modification of the invention in which the lower housing and cement bucket are altered. In this form the upper end and the anchoring means may be understood as being the same as is shown in Fig. 2, with the exception that the coupling 3' does not have fluid discharging openings therein. The length of the tubing 4' below the coupling passes downwardly through the charge of cement 18' and is fixed at its lower end by being screwed at 42 into a cap 43 of frangible material such as cast iron or the like. Said cap 43 is screwed at 44 into the lower end of the cement bucket 45. It is to be noted in this case that the housing about the cement bucket is entirely eliminated, the cement bucket being attached directly to the lower end of the housing member 10 by means of a coupling 15. The piston 46 is annular in shape and is secured upon the tubing 4' which extends downwardly therethrough as previously noted. The tubing 4' has also secured thereto by welding or other means a sleeve 47 having radially extending vanes or arms 48 which may be used as stirrers or agitators in handling the cement.

In this form of the invention the water employed in washing the hole is forced downwardly through the tubing 4' directly into the well bottom so that it may be washed free of foreign material. The device is then anchored in position and the tubing 4' is forced downwardly so as to fracture the lower cap 43 and permit the discharge of the cement into the bottom of the hole. The agitating members 48 upon the tubing may be used to stir up the cement and assure that it is evenly distributed so as to fill the entire bottom of the hole. While this form of the invention is simpler, the device shown in Figs. 1 to 3, inclusive, is preferred under ordinary circumstances because of its somewhat more positive operation. The advantages of this device lie in the fact that the charge of cement may be of the quick-setting type and may be kept entirely dry and sealed off from the liquid until the moment when it is to be discharged into the bottom of the well. It may then be mixed with the water and tamped in position and will set rapidly so that the plug of cement is in fixed and rigid position before the device itself is removed from the hole. I am thus enabled to place the charge of cement in position at the bottom of the hole and plug off the same quickly and accurately. The further advantages will be obvious to those skilled in the art.

What is claimed as new is:

1. A device for setting cement well plugs including a cement bucket, releasable closure means to seal the lower end thereof, a fluid discharge

pipe extending through said bucket and closure, a piston on said pipe above the cement in said bucket to force out cement, means to anchor said bucket at the desired point in the well, and means

5 including said piston to force said closure and said cement from said bucket.

2. A device for setting cement well plugs including a cement bucket, releasable closure means to seal the lower end thereof, a piston above the

10 cement in said bucket, means to anchor said bucket at the desired point in the well, means to discharge fluid past said cement into the well bore to wash the same, and means including said piston and said discharge means to force said

15 closure and said cement from said bucket.

3. A device for plugging wells with cement including a tubing, a cement bucket, a reduced neck on said bucket having a slidable connection with said tubing, a plug releasably closing the lower

20 end of said bucket, means to seal the upper end of said bucket, means to wash the well below said bucket, and means to anchor said bucket in the well, said tubing being then movable downwardly against said sealing means to force said cement

25 and said plug from said bucket.

4. A device for plugging wells with cement including a tubing, a cement bucket, a slidable connection between said bucket and said tubing, sealing means in said connection, a plug releasably

30 closing the lower end of said bucket, means to seal the upper end of said bucket, means to wash the well below said bucket, means to anchor said bucket in the well, said tubing being then movable downwardly with said sealing means to force

35 said cement and said plug from said bucket.

5. A closed container for dry cement, means to

introduce said container into a well, means including said introducing means to wash the well, and means to seal the upper end of said container and movable longitudinally of said container to open said container and discharge said cement 5 into the well.

6. A closed cement container, means including a tubing to introduce said container into a well, means to anchor said container at the desired level in the well and means operated by said 10 tubing to open said container and force said cement from said container into said well.

7. A cement bucket, a tubing slidably connected with said bucket, means to seal the lower end of said bucket, means operated by said tubing to 15 support said bucket in said well, said tubing being then slidable downwardly to break said seal and discharge said cement into said well.

8. A cement bucket, a tubing slidably connected with said bucket, a frangible seal for the lower 20 end of said bucket, a piston above the cement in said bucket, means operable through said tubing to support said bucket at the desired level in said well, means on said tubing engaging said piston to force said cement and said frangible seal from 25 said bucket.

9. A cement bucket, a tubing slidably connected with said bucket, a frangible seal for the lower end of said bucket, a piston above the cement in said bucket, means operable through said tubing 30 to support said bucket at the desired level in said well, means on said tubing engaging said piston to force said cement and said frangible seal from said bucket, and means to stir said cement and distribute the same in the well hole. 35

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