

May 10, 1932.

R. C. BAKER

1,858,215

CEMENTING PLUG

Filed Nov. 19, 1929

2 Sheets-Sheet 1

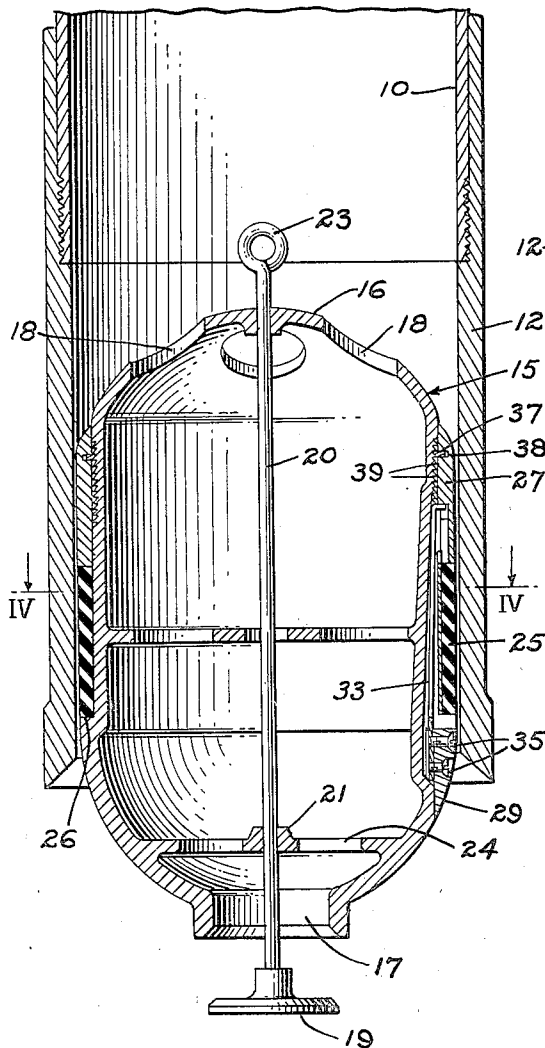


Fig. 1.

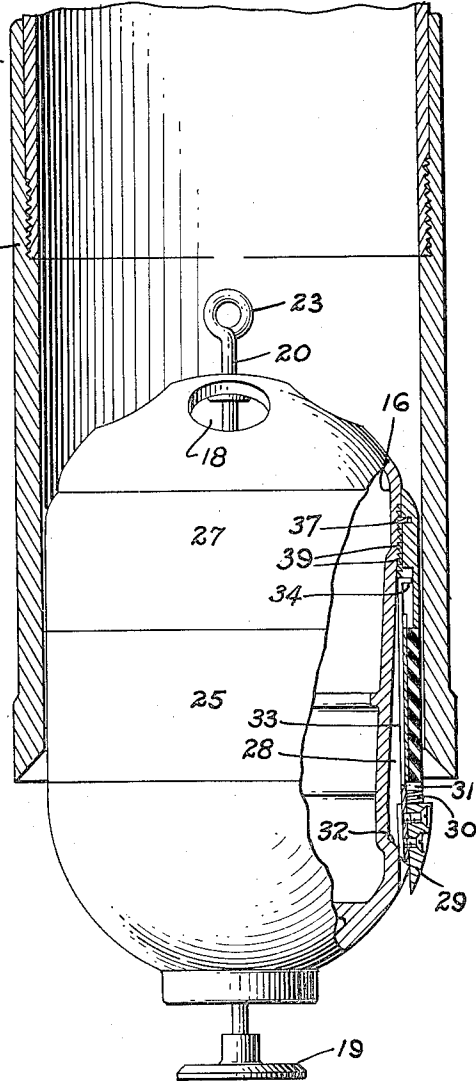


Fig. 2.

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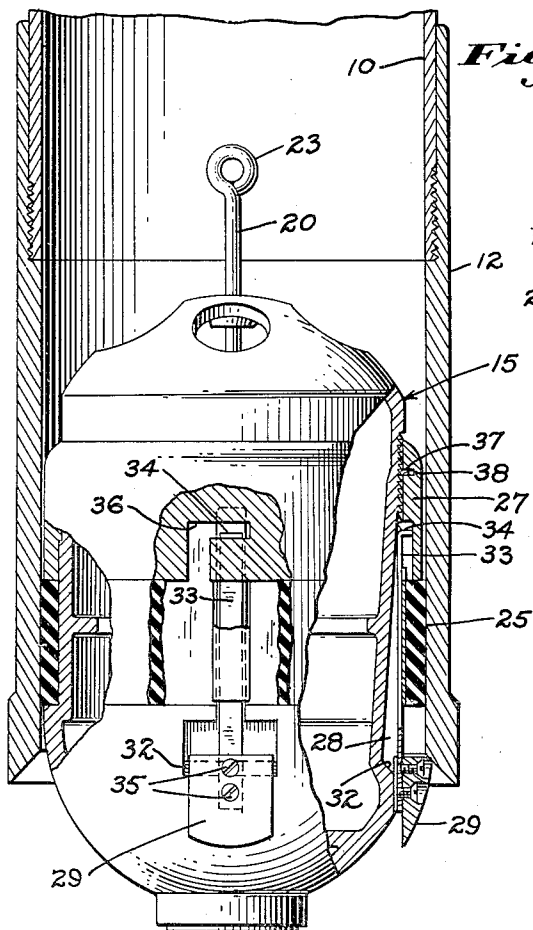


Fig. 3.

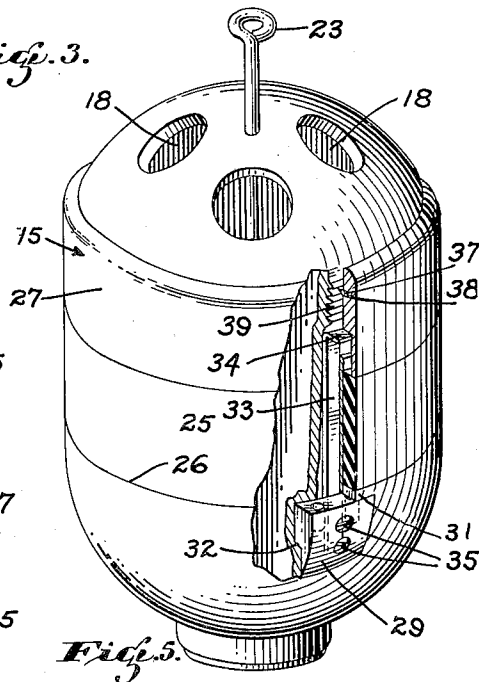


Fig. 5.

Fig. 4.

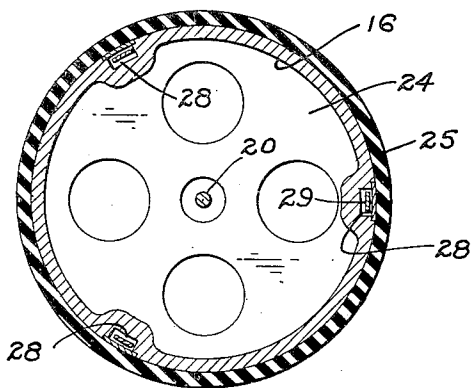
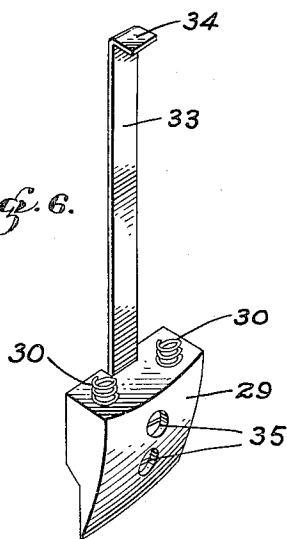


Fig. 6.



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UNITED STATES PATENT OFFICE

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CEMENTING PLUG

Application filed November 19, 1929. Serial No. 408,311.

This invention relates to an apparatus for use in cementing oil wells and particularly pertains to devices such as I have disclosed in my prior United States Letters Patent #1,078,895 issued November 18, 1913, and #1,392,619 issued Oct. 4, 1921. In these prior patents I have pointed out one method of cementing a well which included depositing a quantity of cement in the bore, securing a plug in the lower end of the well casing and then lowering the casing into the cement so as to displace a quantity of the cement forcing it upwardly around the outside of the casing.

It is the principal object of the present invention to generally improve devices of the character referred to whereby to provide an improved plug for well casings which will be absolutely positive in operation and which will withstand tremendous pressures without releasing.

The present invention contemplates the use of a cylindrical shaped plug adapted to be lowered through a well casing from the upper end and secured in the lower end thereof by spring actuated slips extending over the edge of a casing shoe and having a rubber packing adapted to be expanded into close contact with the casing wall to form a seal.

The plug is designed for permitting the circulation of a fluid through the plug while it is being lowered through the casing.

The invention is illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a side elevation of a cementing plug shown as being lowered through a casing.

Fig. 2 is a side elevation of the plug when it has reached the bottom of the casing showing the operation of the securing means.

Fig. 3 shows the plug as in Fig. 2 after an upward pull has been exerted upon it causing the engagement of the sealing means.

Fig. 4 is a plan section taken on line IV—IV of Fig. 1.

Fig. 5 is a horizontal section taken on line V—V of Fig. 1.

Fig. 6 is a fragmentary perspective view showing the operation of the securing means.

In the drawings 10 indicates a well casing extending into a shaft 11 and having a casing shoe 12 secured at its lower end. When it is desired to cement in the lower end of the casing 10 cementitious material is deposited in the bottom of the shaft 11 by a bailer or otherwise and a device 15 is secured in the shoe 12 at the bottom of the casing. With the device or plug 15 so secured the casing may be lowered into the cement displacing it and causing it to be forced upwardly around the outside of the casing where it will harden and effect a seal. It is with this plug 15 that the present invention is particularly concerned.

The plug is formed with a hollow body member 16 preferably of cast iron and of cylindrical form. The plug terminates at its lower end in a substantially hemispheroidal shape as illustrated. A valve port 17 is centrally disposed in the lower end of the plug and together with a plurality of openings 18 in the top of the plug permits the passage of fluid through the body portion 16 when desired.

A valve 19 is adapted to control the port 17. This valve is secured on a reciprocable valve stem 20 which extends through the center of the body member 16. This valve stem is guided in a guide member 21 within the body member and a guide in the top portion of the body member. The stem 20 terminates at its upper end in a ring 23.

Spiders 24 form an integral part of the body member 16 and serve to strengthen it. It will be noted that the construction of these spiders is such as to allow the free passage of a fluid through the body member.

When running the plug in, a bailer or other tool is attached by fragile means such as wire to the ring 23 on the valve stem. As the plug is forced downwardly through the casing, the weight of the bailer and the downward pressure upon the valve stem 20 causes the valve 19 to assume an open position allowing any fluid in the casing to freely pass through the port 17 and the openings 18 as has been described. When the plug reaches the bottom of the casing it is secured there in a manner hereinafter set forth and as the

bailer is pulled up the valve is closed. The fragile means connecting the bailer to the ring 23 is broken by the upward pull on the bailer when the plug is secured in the shoe and the valve is maintained in its closed position by the external pressure on its under side.

The means employed for securing the plug in the lower end of the casing includes a cylindrical shaped packing rubber 25 conforming to the outer cylindrical surface of the body member 16. The lower end of the packer 25 abuts against an annular shoulder 26 on the body member and its upper end engages the lower end of a slip ring 27 also surrounding the body member 16.

Three recesses 28 are formed longitudinally in the peripheral surface of the body member and are equally spaced about its circumference. These recesses 28 are adapted to receive slips 29. These slips 29 are constantly urged downwardly by springs 30. The springs 30 are disposed in sockets formed in the upper ends of the slips and bear against a shoulder 31 formed in the recesses 28.

Inclined cam faces 32 between the slips 29 and the recesses 28 cause the slips to move outwardly in relation to the body member 16 when the latter are urged downwardly by the springs 30. Connecting links 33 of resilient material having bent or hooked ends 34 are attached at one end to the slips 29 by means of screws 35. The hooked ends 34 of the connecting links engage angular slots 36 in the slip ring 27.

When the slips 29 move downwardly the connecting links move with them and pull the slip ring against the top edge of the packing rubber 25. This pressure of the slip ring causes the rubber to protrude or bulge from the body member 16.

The elasticity of the rubber in this position tends to urge the slip ring back into its normal position which is prevented by a locking ring 37. The locking ring 37 is a resilient contractile split ring disposed in an annular groove 38 formed in the inner cylindrical surface of the slip ring 27. This locking ring 37 is adapted to yieldingly engage with a series of annular wickers 39 machined in the outer surface of the body member 16. The formation of the ring and wickers is such that the ring can move downwardly along the plug but not upwardly.

In operation, a quantity of cement is deposited in the bore and the casing is elevated off bottom above the cement. The slips 29 are held in the position shown in Fig. 1 by the casing walls while the plug is being run in the casing. When the lower end of the plug extends through the bottom of the casing, the slips are urged downwardly by the springs 30 to the position shown in Fig. 2. The cam faces 32 cause radial movement of the slips as they move downwardly to diameter greater

than the diameter of the shoe. It will be seen that when the plug is in this position it cannot be pulled back out of the casing due to the position of the slips. A force exerted upwardly on the plug by means of the valve stem 20, however, will cause the body member of the plug to move upwardly relative to the slips 29. This relative movement causes the connecting links 33 to draw the slip ring 27 downwardly against the rubber packing 25. The rubber packing is thus expanded or bulged into contact with the inner wall of the shoe forming a tight seal between the inner wall of the casing 10 and the plug. This seal is maintained by means of the locking ring 37.

It is obvious that the greater the upward pull on the body member 16 the tighter will be the seal between the packing rubber and the casing wall. When this upward pull results in breaking the fragile means or wire by which the bailer is attached to the valve stem, the plug is left tightly secured and sealed in the lower end of the casing. The casing is then lowered to displace the cement and force it upwardly around the casing. When the cement has set drilling operations are resumed and the drill pulverizes the plug and its parts are removed in a bailer.

While I have shown the preferred form of my invention, it is to be understood that various changes may be made in its construction by those skilled in the art without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A device of the character described comprising a body adapted to be lowered through a string of well casing, a normally contracted expansible member carried by the body, means engageable with the lower edge of the casing to secure the body in its lowered position, said means acting to expand the expansible member against the inner surface of the casing whereby the lower end of said casing will be sealed.

2. A device of the character described comprising a body adapted to be lowered through a string of well casing, an expansible member circumscribing the body, means engageable with the lower edge of the casing to secure the body in its lowered position, said means acting to force said expansible member into sealing contact with the casing when a force is exerted upwardly upon the body, and means for permitting circulation of a fluid through the body while it is being lowered and preventing such circulation when it is in an operative position.

3. In a casing plug, a cylindrical body adapted to be lowered through a well casing and partially project from the lower end thereof, means automatically operating when the plug is partially projected from the lower

end of the casing to engage the lower edge of
the casing and prevent the body from being
withdrawn into the casing, sealing means on
the body, and a connection between the said
5 means and sealing means for actuating the
latter when a withdrawing force is imparted
to the body.

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