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CEMENTING HEAD

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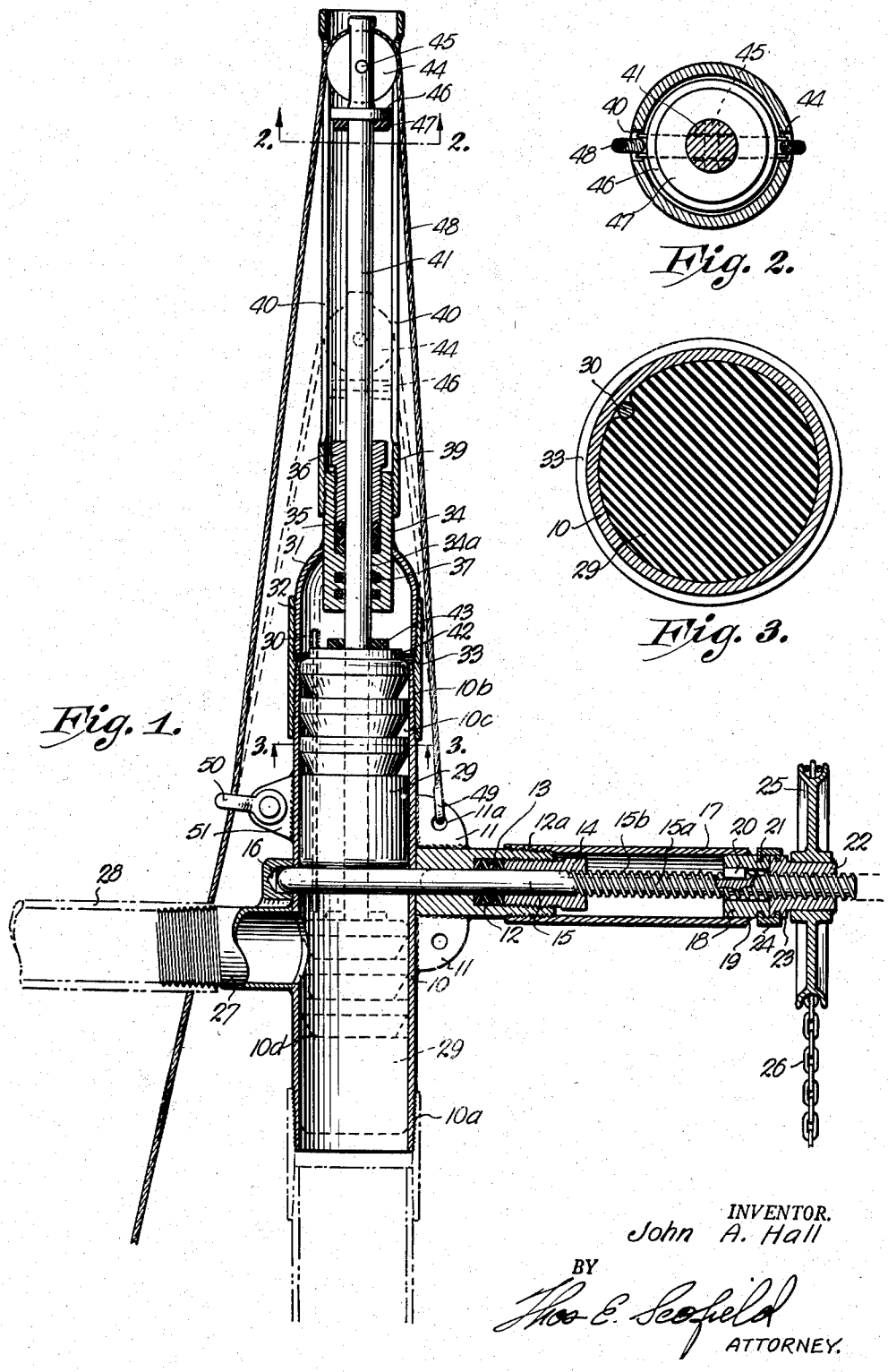


Fig. 1.

Fig. 2.

Fig. 3.

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CEMENTING HEAD

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This invention relates to improvements in a cementing head for use upon the upper end of the casing of an oil or gas well when the well is being cemented.

Therefore, an object of the present invention is to provide a plug containing cementing head having a positive acting mechanical device for moving the cement plug into the casing string from the storage compartment of the head, said device operable satisfactorily even if the head is fouled with preset cement or ice from use in cold weather and does not require extra fluid fittings to the head.

Another object is to provide a plug containing cementing head fitting for the well head which permits the uninterrupted sequence of operations including mud circulation, cement introduction and the placing of the cement in a well bore by introducing mud behind the cementing plug without the removal of the cementing head from the top of the casing or the switching of valves.

Still another object is to provide a cementing head which permits constant reciprocation of the casing string during the steps of mud circulation, introduction of the cement and placing of the cement in the well bore.

Another object of the invention is to be able to use the almost unlimited power of the rig to break loose and force out a plug that is frozen in the head by subzero weather or by prematurely set-up cement.

Another object of the invention is to release the plug or plugs without stopping the circulation cycle whatsoever and without switching any valves whatsoever.

Other and further objects of the invention will appear in the course of the following description.

In the accompanying drawings, which form a part of the instant specification and are to be read in conjunction therewith, an embodiment of the invention is shown and, in the various views, like numerals are used to indicate like parts.

Fig. 1 is an enlarged elevational view of a cementing head embodying the instant invention with parts broken away and parts in section.

Fig. 2 is a view taken along the lines 2—2 in Fig. 1 in the direction of the arrows.

Fig. 3 is a view taken along the lines 3—3 of Fig. 1 in the direction of the arrows.

In Fig. 1 is shown a cementing head embodying the present invention mounted at the top of a casing string mounted in the well bore of an oil well. This head permits mud to be circulated in the well and the circulation thereof interrupted without removing the head from the casing. It also permits introduction of the cement, insertion of the cement plug or plugs behind the column of cement and the application of mud pressure behind the plug to force the cement into place in the well bore without the removal of the cementing head from the casing string. By performing this sequence of steps without the removal of the cementing head from the top of the casing string, and by not having any valves on the head to switch, there need be no interruption of the

reciprocation of the casing string during the steps of the cementing process.

Referring to Fig. 1, the cementing head consists of a hollow body portion **10** screw threaded at its bottom end at **10***a* for attachment to the top of the casing and screw threaded at its top at **10***b* to receive its upper sealing end members which will be later described. Welded or otherwise fastened to the outside of the body **10** are brackets **11**. Stuffing box **12** having threads **12***a* is held by brackets **11** and contains packing **13** held in place by stuffing box nut **14**. Rod **15** extends through nut **14**, packing **13**, stuffing box **12** and body portion **10** and seats in recess **16** formed in the opposite side of the body from the stuffing box. Rod **15** divides body **10** into an upper plug chamber **10***c* and a lower chamber **10***d*. Rod **15** has threaded stem **15***a* which has key slot **15***b* therein. Stuffing box threads **12***a* are engaged by the internally threaded end of hollow shaft **17**. Bearing **18** is welded to shaft **17** at **19**, keyed to stem **15***a* at **20** and has thrust collar groove **21** thereon. Key **20** prevents rotation of rod **15** around its axis. Bearing **18** does not engage the threads **16**. Nut **22** is threaded to stem **15***a* and has thrust collar groove **23** thereon. Grooves **21** and **23** on bearing **18** and nut **22** are engaged by thrust collar **23** to permit rotation of nut **22** relative bearing **18**. Nut **22** is encircled by and is fixedly attached to wheel or chain sheave **25** which is engaged by endless chain **26**. Rotation of wheel **25** will thus back rod **15** off from or insert rod **15** in recess **16**, depending on the direction of rotation thereof.

Threaded nozzle **27** is connected into lower chamber **10***d* and to this nozzle may be screwed fitting **28** which, preferably, is connected to a T head into which, preferably, lead suitably valved mud and cement lines from conventional mud and cement sources to permit alternate controlled input of mud or cement into the body portion **10**. This latter arrangement is not illustrated as it involves only conventional apparatus.

A cement plug **29** is placed in the upper chamber **10***c* above the rod **15** before the cementing head is mounted on the top of the casing string. One or more rods **30** are welded to the inside of body **10** to provide a fluid by-pass past plug **29** (see Fig. 3).

Adaptor shell **31** has threads **32** and is attached to threaded upper body portion **10***b* by collar **33**. Upper packing box **34**, having opening **34***a*, is welded into the top of adaptor **31** and has packing **35** sealed therein by hollow packing nut **36**. O rings **37** are positioned in grooves **38** in packing box **34**. Hollow shaft **39**, having opposing slots **40** running essentially the length thereof, is threaded to the outside of packing box **34**. Cement plug drive rod **41**, having thrust pad **42** at the lower end thereof, extends through packing box **34**, nut **36** and shaft **39**. Resilient seal **43** is mounted above pad **42**. Rod **41** is bifurcated near its upper end to receive pulley **44** mounted on pin **45**. Guide plate **46**, having an outer diameter slightly less than the inner diameter of shaft **39**, is fixed to rod **41** below pulley **44** and has rubber bumper **47** mounted therebelow. Cable **48** is attached to bracket **11** through hole **11***a* by eye **49**, passes through slots **40** in shaft **39**, loops over pulley **44** and threads eye **50** on stud **51** welded to body **10**. The portion of shaft **39** extending above the top of rod **41** when the latter is in extended position serves to protect the rod from the rig hook and other rig apparatus above the cementing head.

Before proceeding with a description of cementing operations as carried on with the equipment shown in the figures, it should be understood that the well has been drilled to the desired depth and mud has been circulated to thoroughly clean the debris from the well bore. Contemplating a cementing operation, a cement shoe is

attached to the lower end of the bottom section of well pipe and the casing is run into the well in the usual manner. Along the exterior of the casing are applied scratcher and centralizer elements. These abrading devices are arranged at proper intervals to maintain the casing centrally in the well bore and clean the wall of the well when the string is reciprocated as hereinafter described. After the casing has been run into the well, the cementing head, shown in Fig. 1, is mounted at the top of the casing.

A fitting **28** is attached to the horizontal nipple **27** of the body portion **10** and the previously described, but not shown, mud and cement input hose or apparatus attached thereto. The rod **15** is seated in the recess **16**. The cement plug **29** has been placed in the upper chamber **10***c* of the cementing head before mounting the head on the casing.

To begin the operation, mud fluid is charged through the fitting **28** into the lower compartment **10***d* of the head through the nozzle **27**. The mud fluid entering the head below the rod **15** is directed downwardly through the casing string and out of the bottom of the casing into the well bore surrounding the casing. The mud fluid also by-passes the plug **29** in the cementing head by means of rods **30**, thereby equalizing the pressure on each side of the plug and uniformly distributing the internal pressure throughout the body portion **10**. The mud rises in the well to the ground level and is returned to the mud pit. During this circulation, the casing string is reciprocated vertically in the well bore and the abrading elements on the exterior of the pipe remove adhering mud cake from the well wall and exterior of the casing, or, the casing may be rotated by means of swivel connection on the head at **10***a* or by a swivel connection in the hose, which would have to be held above the head, thus allowing the head to turn with the pipe. When the well bore has been cleaned in this fashion and the amount of cement needed has been determined by logging the well or making a caliper survey, the mud circulation is interrupted. Immediately thereafter, the fluid cement mix is charged into the nozzle **27** from the source of cement supply, such as a cement truck, not shown. The cement mix enters the lower compartment **10***d* of the head through the nozzle and passes downwardly through the casing as a column forcing the mud before it. Once again, the by-pass rods **30** permit equalization of the pressure within the cementing head on all sides of the plug **29**. When the quantity of cement figured for the particular cement job has been introduced, the cement mixing is stopped. The rod **15** is withdrawn from recess **16** below the plug **29** by rotating wheel or sheave **25** by endless chain **26** and the cement pump is started to pump cement, water, oil or mud or the mud pump is started to charge mud into the top of the head through the nozzle. Simultaneously, force is exerted on the cable **48** through a winch or other means (not shown) whereby to move plug **29** downwardly in the cementing head under impetus of the rod **41**. As the pressure is equalized on all sides of the plug by the by-passing of fluids around rod **30**, no great excess of force is required to move the plug. Sufficient force may be applied, however, to break any ice, mud or cement bridges between the plug and body **10**. When either the bottom edge of plug **29** has passed below the bottom edge of nozzle **27**, the pressure will travel up on top of the plug by by-pass rods **30** or when the upper edge of plug **29** has passed below the upper edge of the nozzle **27**, the pressure of the input mud is exerted only on the top surface of the plug and from this point, the plug is driven downwardly by the action of the fluid alone. The dotted lines in Fig. 1 illustrate the rod **41** at its lowest extension with bumper **47** abutting the top of packing nut **36**. Rod **41** is preferably of such length that at full extension the top of plug **29** is pushed just below the upper edge of input nozzle **27** whereby the fluid input will flow in behind the plug to continue its motion into the casing. The pressure of the fluid also tends to return the piston rod **41** to its extended position in the hollow shaft **39** after the plug passes nozzle **27**. The mud fluid charged behind the plug forces the plug from the lower compartment **10***d* of the head into the casing and, acting as a plunger, forces the column of cement downwardly through the casing and into the well bore surrounding the casing. By the time the plug has reached the float valve, not shown, located a short distance above the cement shoe, the fluid cement has been properly placed in the well bore, and mud replaced or forced out of the well by the cement is returned to the mud pond.

During the initial mud circulation and while the cement is being placed, the casing string is vertically reciprocated to maintain the string centrally in the well bore, to prevent accumulation of mud on the well wall and outside of the casing, bridging of the mud or cement between the well wall and the casing, and channeling of the cement while it is being placed.

Thus it will be seen that there has been provided a cementing head adapted to be mounted on the top of the casing string for use during the period when the well is being prepared for cementing and during the time that the cement is being placed. The construction of the head is such that the consecutive operations of mud circulation, introduction of cement, insertion of the cement plug and charging of the mud behind the cement column are performed without the necessity of removing the head. By dispensing with the removal of the head before each operation and by eliminating valve switching at the head and thereby eliminating stopped casing time, considerable time is saved and difficulties attending the interruption of casing reciprocation are avoided. As previously noted, continuous vertical or rotational movement of the casing string in the well bore, combined with the scraping and agitating action of the abrading elements, serve not only to centralize the pipe but also to keep the solids in the mud fluid and the cement mix from setting up prematurely and the cement mix from channeling.

From the foregoing it will be seen that this invention is one well adapted to attain all the ends and objects hereinabove set forth, together with other advantages which are obvious and are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all material hereinbefore set forth or shown in the drawings is to be interpreted as illustrative and not in a limiting sense.

Having described my invention, I claim:

1. A cementing head comprising a hollow body portion, the upper part of said body portion adapted to receive a cement plug, the lower portion adapted to be connected to the casing so as to substantially align the axes of the casing and body portion, removable means for retaining the plug in the upper body portion positioned adjacent the bottom of the upper body portion, the lower portion of said body portion having an input opening for well fluids and open at its lower end for egress of said fluids therefrom, means cooperating between the upper and lower body parts to permit bypass of a portion of the well fluids entering the body portion through the input opening past the plug into the upper body portion to equalize the pressure on each side of the plug, a piston rod mounted at the upper end of said body portion and extending therethrough, the lower end of said piston rod abutting the top of said cement plug, means for applying force axially of said piston rod mounted on said body portion whereby to move said

plug from the upper body portion at least past the upper edge of the fluid input opening in the lower body portion, said rod of sufficient length to continually contact said plug until it passes the upper edge of said fluid input opening, the means cooperating between the upper and lower body portions to permit bypass of well fluids past the plug into the upper body portion comprising at least one rod fixedly attached to the inner wall of said body portion and extending between said upper and lower body portions, said rod of greater length than said plug.

2. A cementing head comprising a hollow body portion, the upper part of said body portion adapted to receive a cement plug, the lower portion adapted to be connected to a casing so as to substantially align the axes of the casing and body portion, removable means for retaining said plug in said upper body portion positioned adjacent the bottom of the upper body portion, the lower portion of said body portion having an input opening for well fluids and open at its lower end for egress of said fluids therefrom, means cooperating between the upper and lower body portions to permit bypass of a portion of the well fluids entering the body portion through the input opening past the plug into the upper body portion to equalize the pressure on each side of the plug, a piston rod mounted at the upper end of said body portion and extending therethrough, the lower end of said piston rod abutting the top of said cement plug, means for applying force axially of said piston rod mounted on said body portion whereby to move said plug from the upper body portion at least past the upper

edge of the fluid input opening in the lower body portion, said rod of sufficient length to continually contact said plug until it passes the upper edge of said fluid input opening, the means for applying force axially of the piston rod comprising a pulley rotatably mounted on said rod adjacent to the upper end thereof and a cable fixed at one end thereof to the body portion which passes over the pulley and has a free end thereof to attach to means to exert force on the cable.

3. Apparatus as in claim 2 including a cable guide mounted on the body portion through which said cable passes, said guide mounted at least substantially on the opposite side of the body portion from the cable attachment thereto.

4. Apparatus as in claim 2 wherein a doubly slotted cable guide surrounds the extension of the rod from the upper body portion, the cable passing through the slots therein.

5. Apparatus as in claim 4 wherein the upper ends of the slots in the guide are closed whereby to retain the cable within said guide.

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