



US 20060219407A1

(19) **United States**(12) **Patent Application Publication**
Livingstone(10) **Pub. No.: US 2006/0219407 A1**(43) **Pub. Date: Oct. 5, 2006**(54) **METHOD AND APPARATUS FOR
CEMENTING A WELL USING CONCENTRIC
TUBING OR DRILL PIPE****Publication Classification**(51) **Int. Cl.**
E21B 43/00 (2006.01)(52) **U.S. Cl.** **166/285; 166/177.4**(75) **Inventor: James I. Livingstone, Calgary (CA)**

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CALGARY, AB T2P 4K7 (CA)(57) **ABSTRACT**

An apparatus and method for cementing a well using concentric drill string, e.g., concentric drill pipe, concentric coiled tubing and the like is disclosed. Concentric drill string comprises an inner string and an outer string, forming an annular conduit therebetween. Cementing apparatus comprises an isolation cementing tool and a cementing flow control means. The isolation cementing tool has a center tube and an outer casing forming an annular conduit therebetween, and an expandable packer means surrounding the outer casing. The cementing flow control means has a center tube and an outer casing forming an annular conduit therebetween, and a plurality of check valves positioned in either the center tube, within the annular conduit between the inner tube and the outer casing, or both.

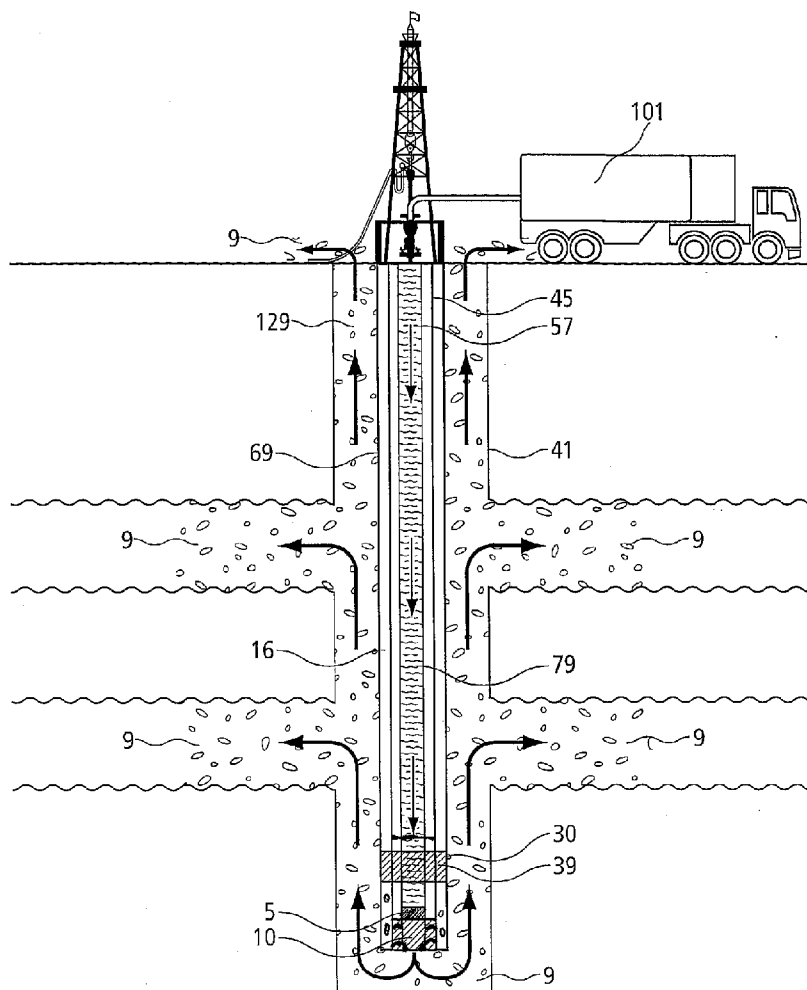
(73) **Assignee: PRESSSOL LTD., Calgary (CA)**(21) **Appl. No.: 11/308,263**(22) **Filed: Mar. 14, 2006****Related U.S. Application Data**(60) **Provisional application No. 60/594,130, filed on Mar. 14, 2005.**

Fig. 1

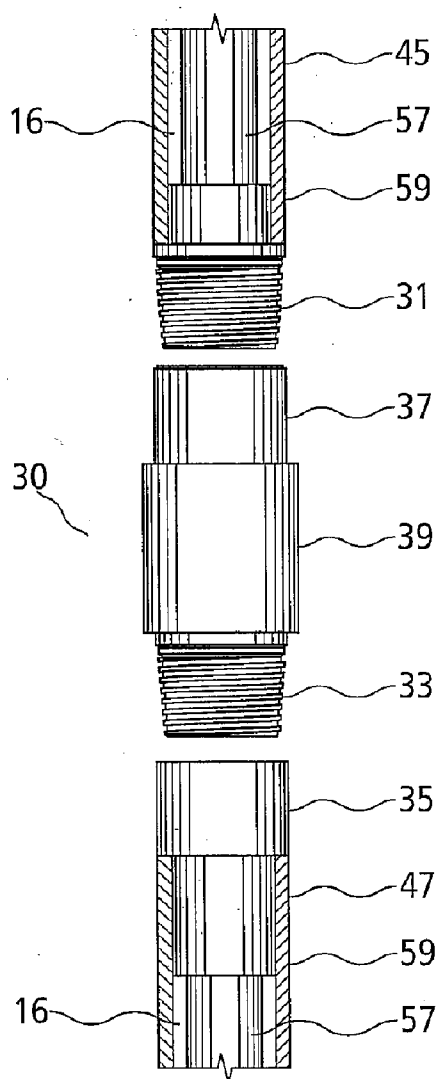


Fig. 2

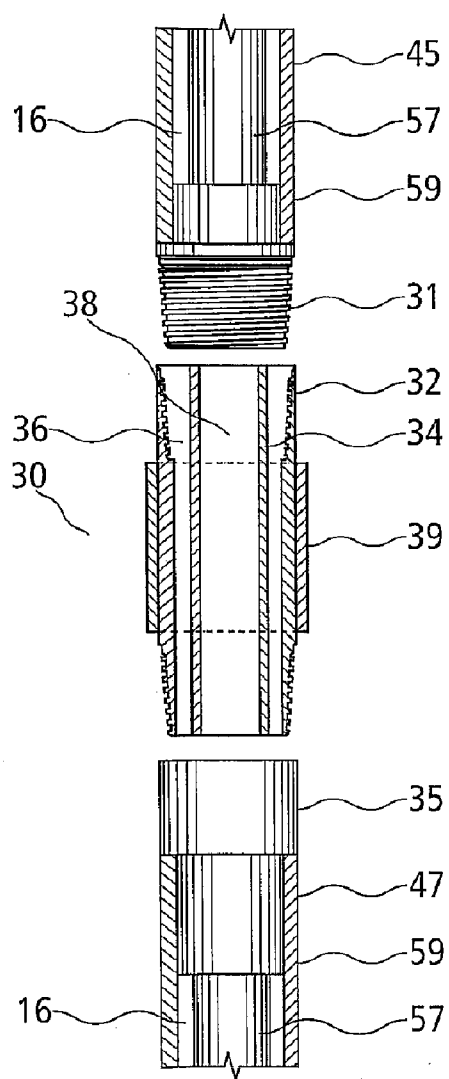


Fig. 3a

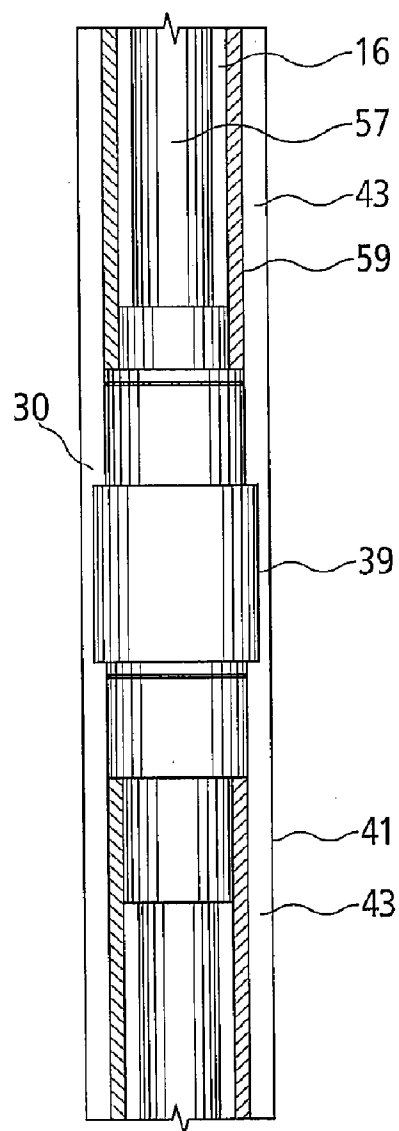


Fig. 3b

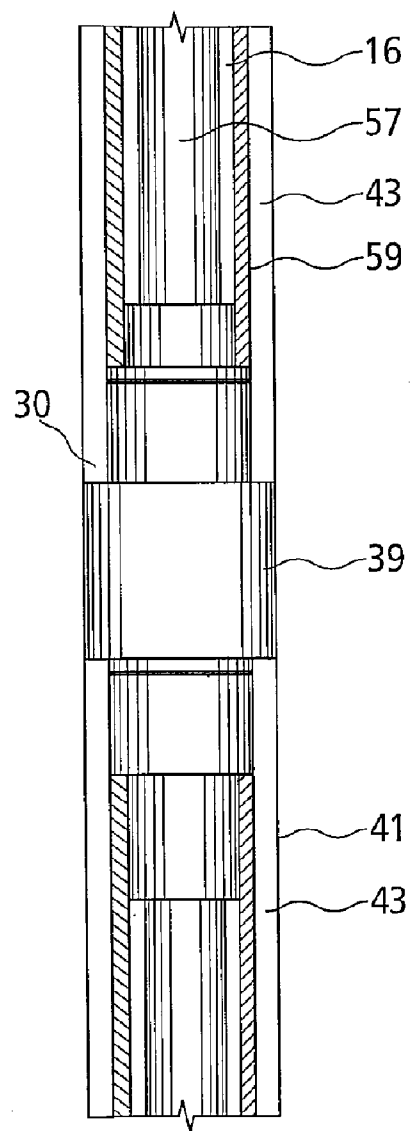


Fig. 4

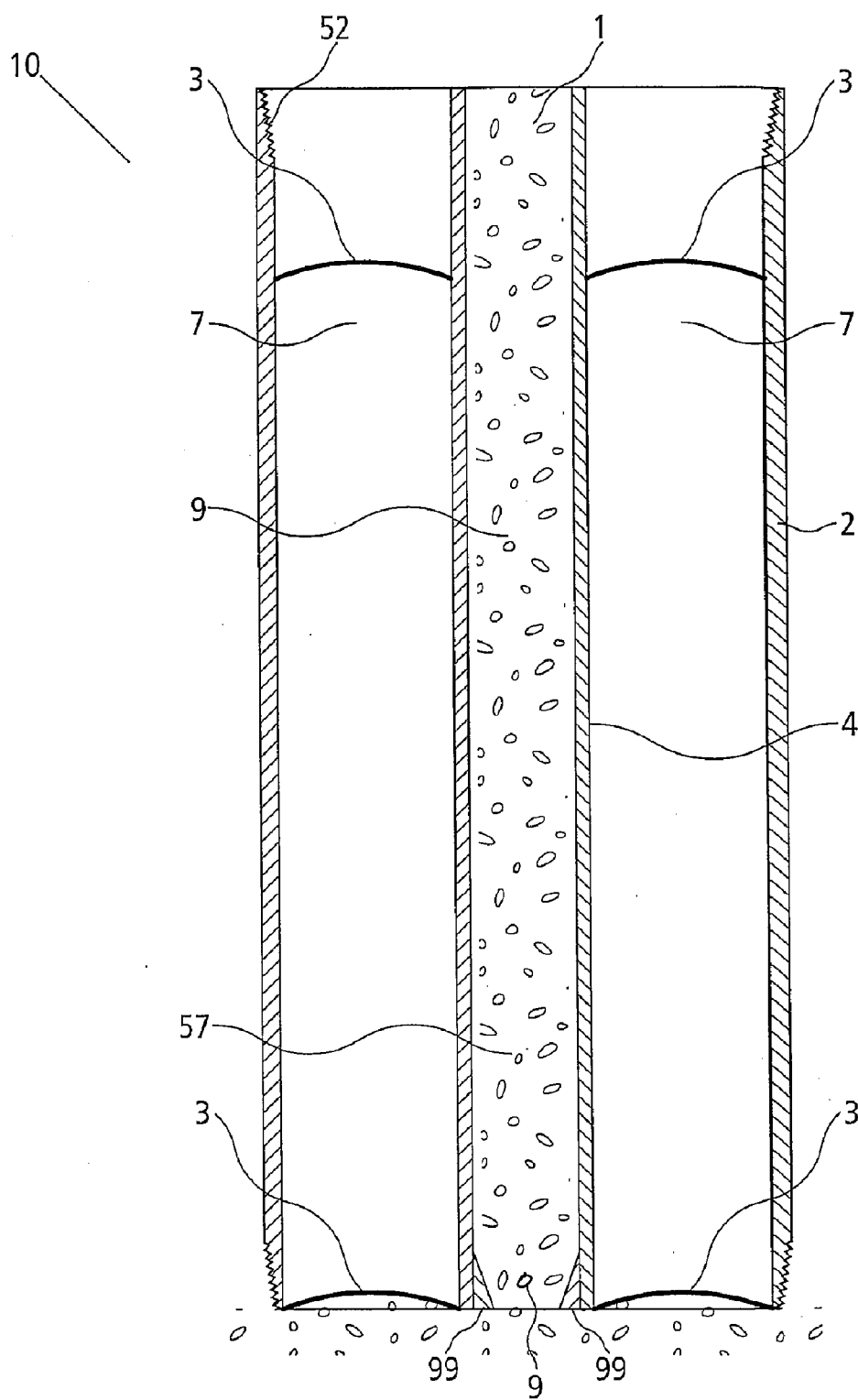


Fig. 5

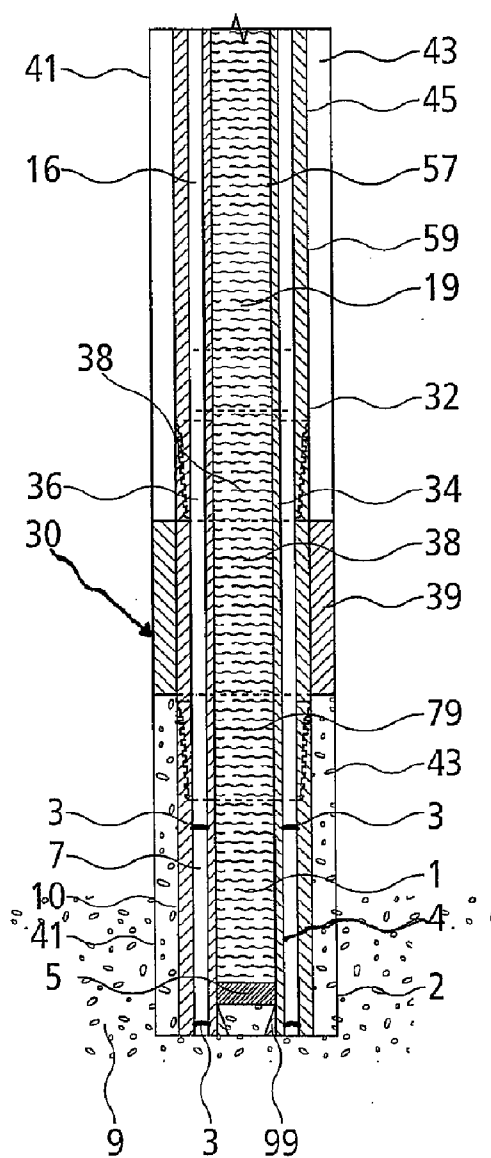


Fig. 6

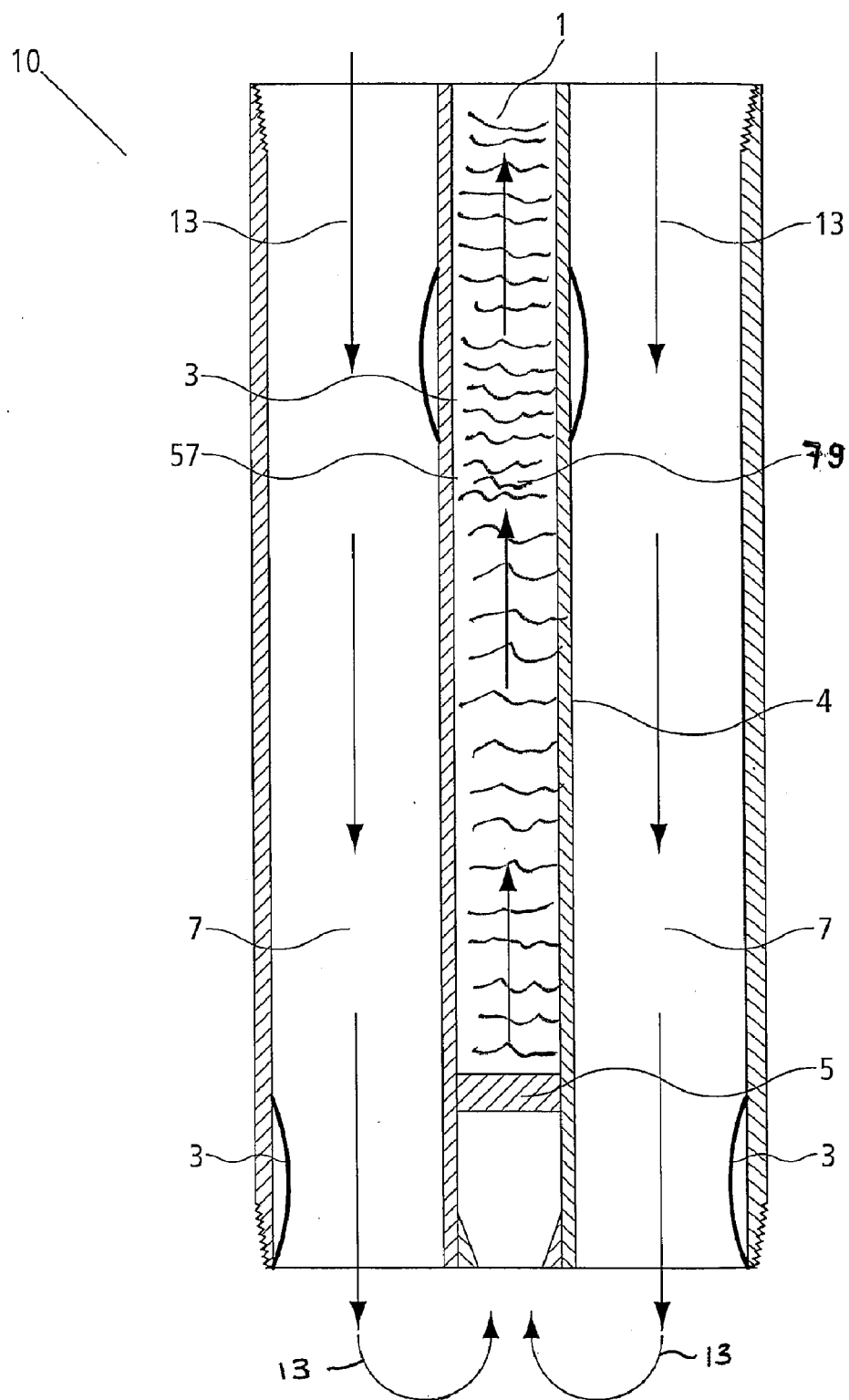


Fig. 7

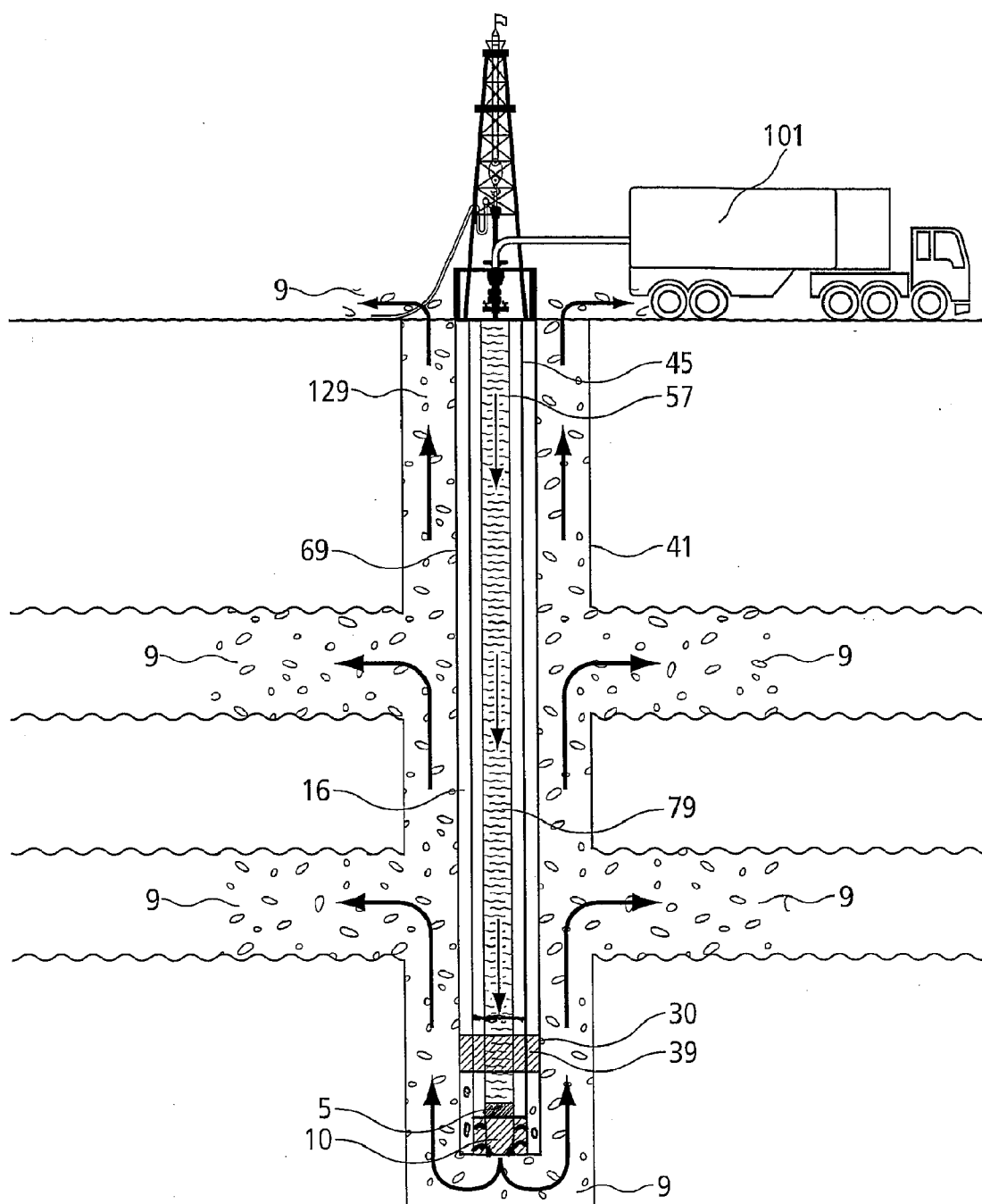


Fig. 8

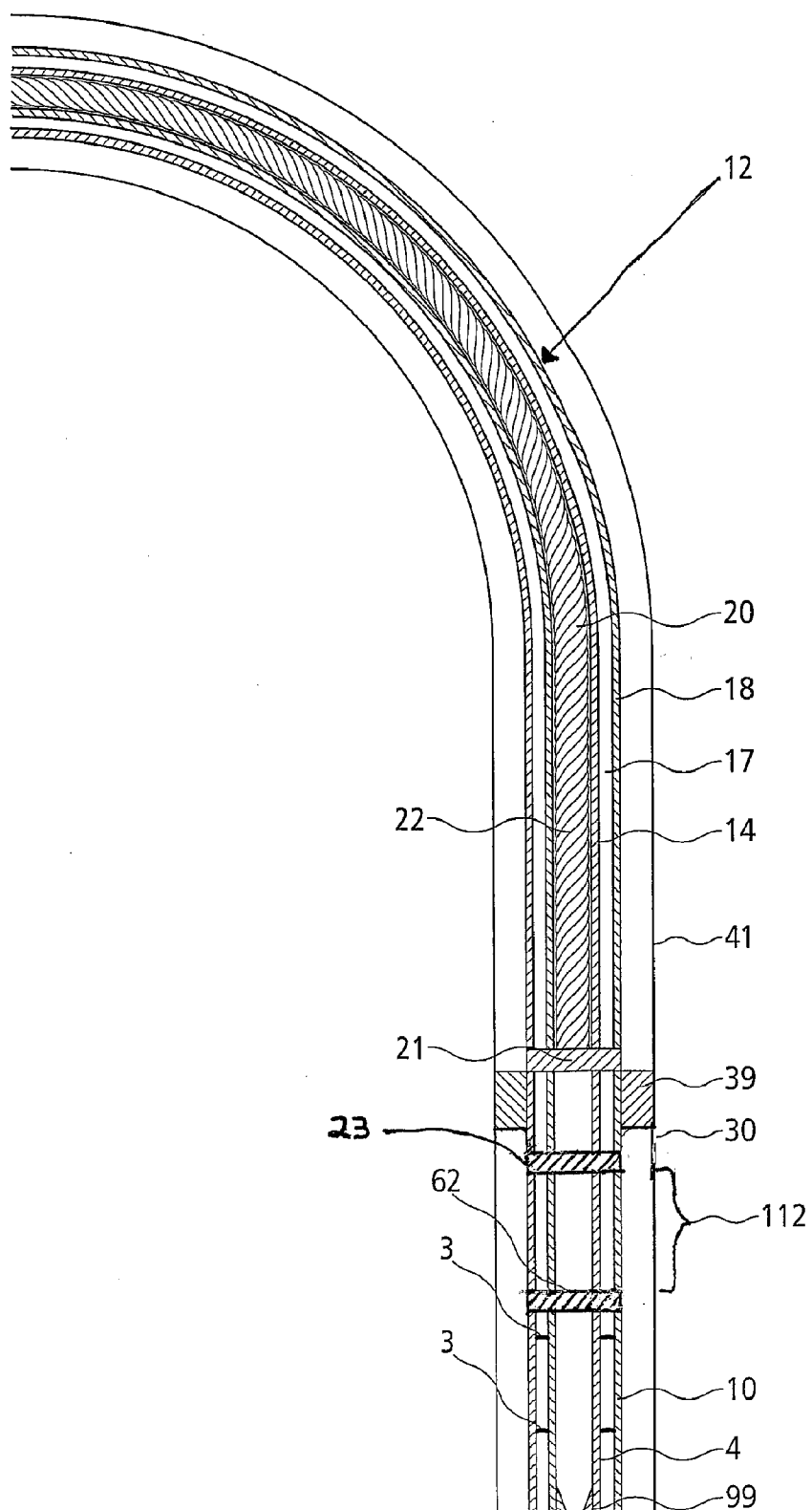


Fig. 9

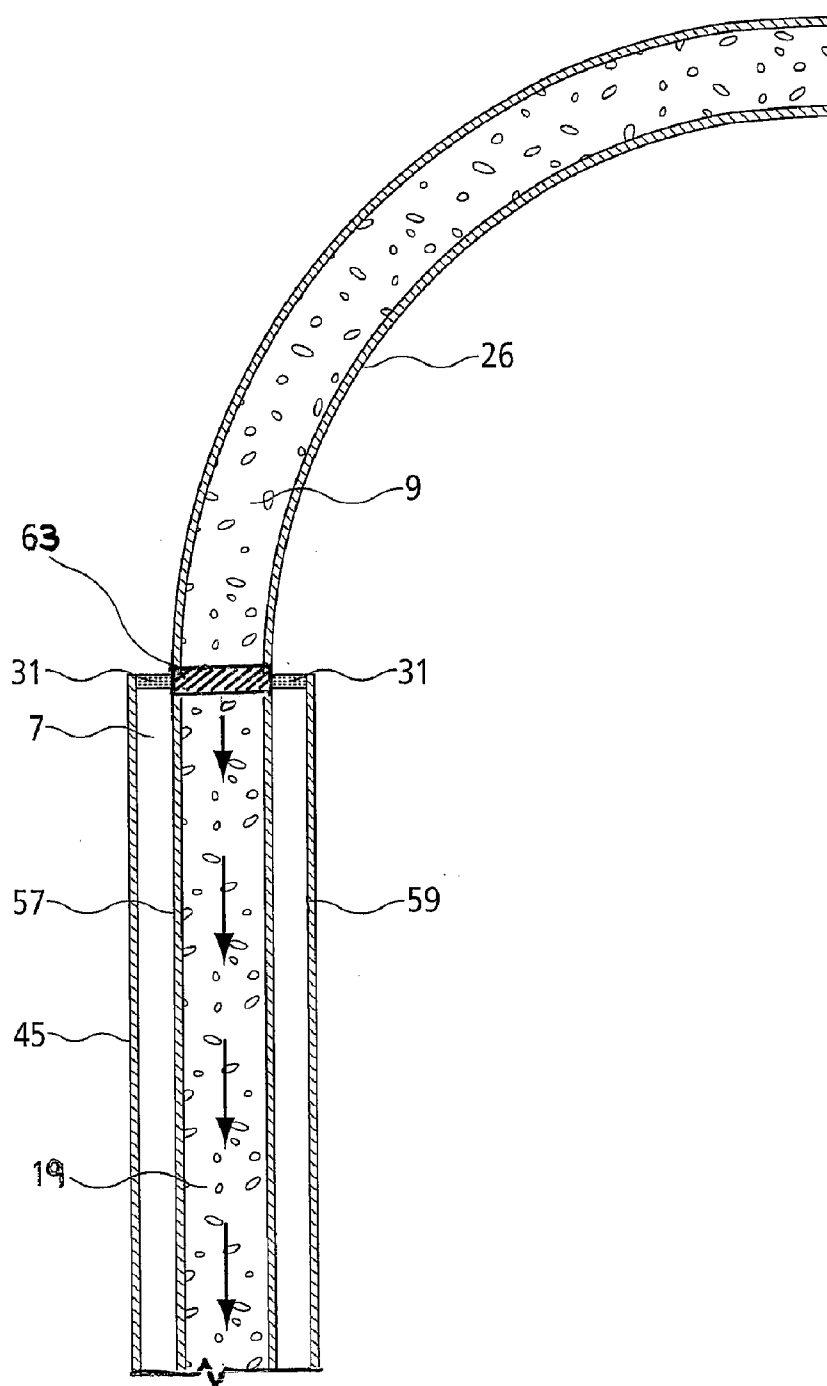


Fig. 10

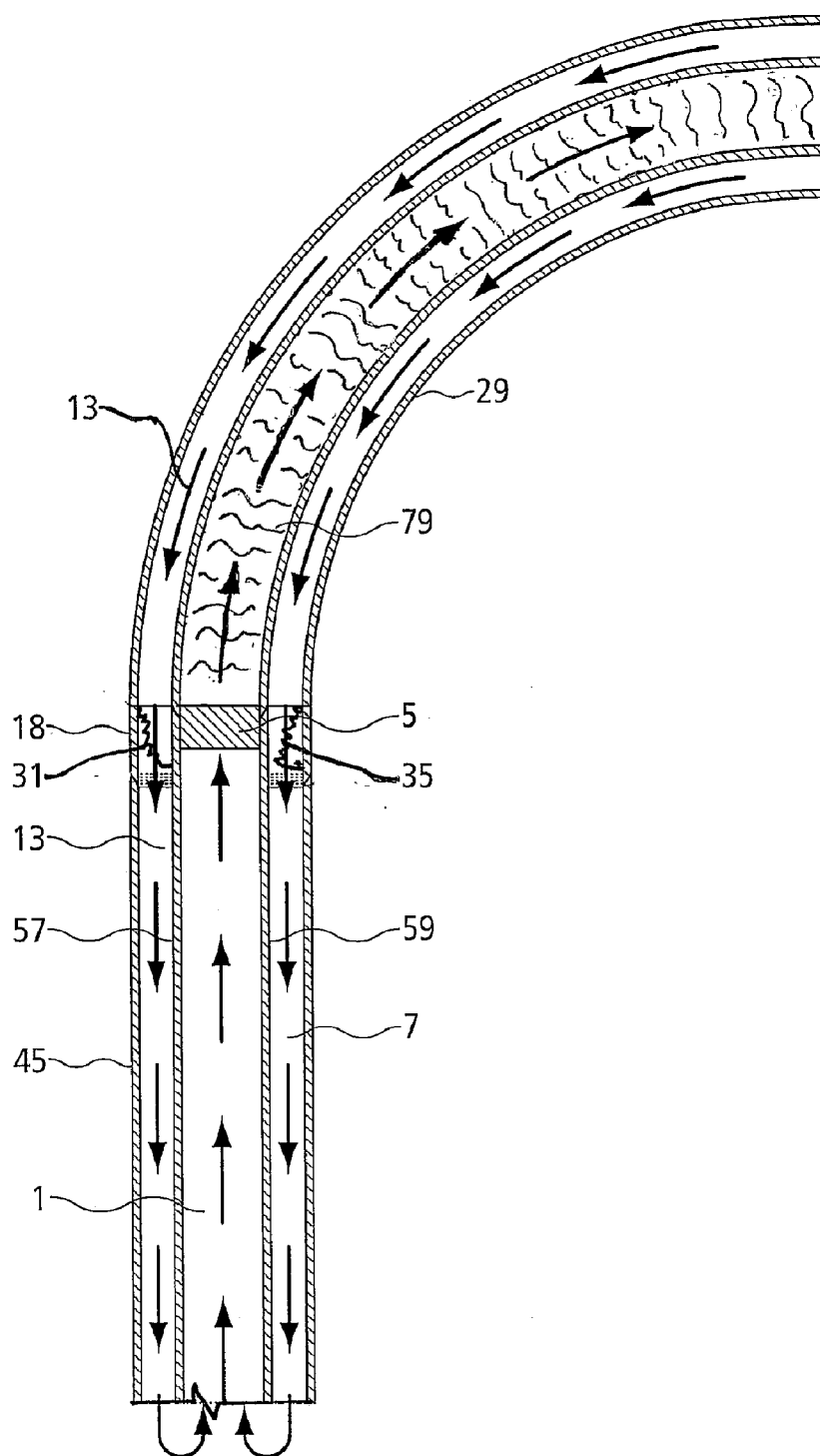
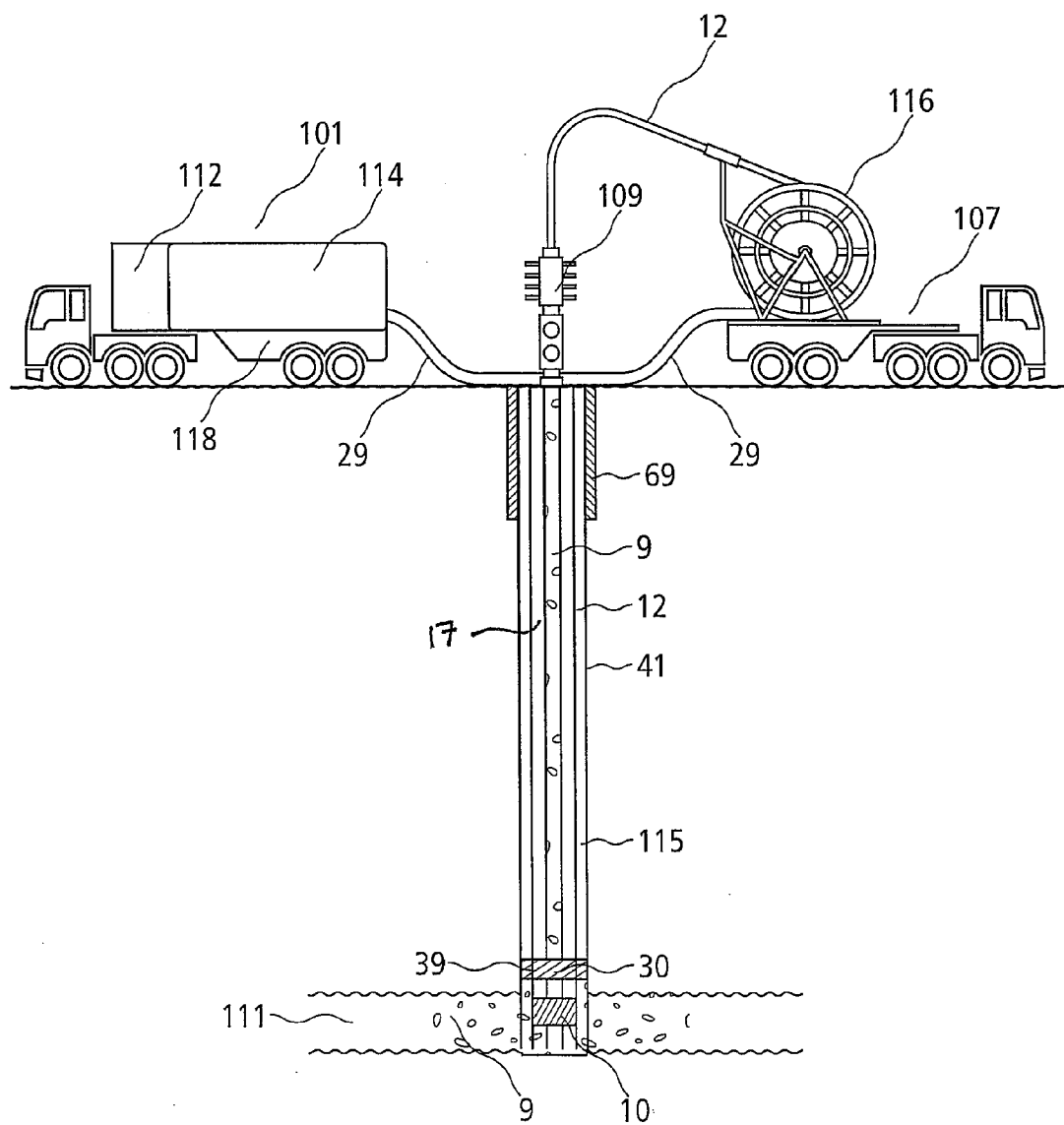


Fig. 11



METHOD AND APPARATUS FOR CEMENTING A WELL USING CONCENTRIC TUBING OR DRILL PIPE

[0001] This application claims the benefit of U.S. Provisional Application No. 60/594,130, filed Mar. 14, 2005.

FIELD OF THE INVENTION

[0002] The present invention relates to a method and apparatus for cementing individual and multi-zones in a vertical, directional or horizontal wellbore, using concentric tubing or drill pipe.

BACKGROUND OF INVENTION

[0003] Cementing is used in the oil and gas industry to seal off fluids and unconsolidated materials from entering the well bore, for packing off unwanted zones, as a loss circulation material and to abandon wells.

[0004] Current cementing technology requires a casing or liner to be placed in the well bore and a cement slurry is then pumped downhole and back up into the space or annulus between the casing or liner and the wall of the well bore. However, each succeeding casing or liner placed in the wellbore has an outside diameter significantly reduced in size when compared to the casing or liner previously installed. Thus, each time casing is run in a wellbore the diameter of the wellbore is reduced by the size of that casing.

[0005] Further, where operations require the cementing of casing such as the setting of surface or production casing, there is the need to use the following equipment: a casing shoe, float equipment and cement plug. This equipment can only be removed by drilling them out. This takes up valuable drilling time and can prove difficult when using an air hammer drilling system.

[0006] The present invention allows the cementing operation to be completed without the need to run casing or have cement returned to surface thereby allowing larger diameter wellbores to be drilled into zones of interest. Further, time and money are saved on not having to run intermediate casing strings, and cement does not have to be pumped to surface. Finally, the present invention allows cementing to be completed without having to drill out equipment such as cement plugs, float equipment and casing shoes.

SUMMARY OF THE INVENTION

[0007] An apparatus for cementing a well for use with concentric drill string, e.g., concentric drill pipe, concentric coiled tubing and the like, comprising an isolation cementing tool and a cementing flow control means and a method of using such cementing apparatus is disclosed. Concentric drill string comprises an inner string and an outer string, forming an annular conduit therebetween.

[0008] The isolation cementing tool has a center tube and an outer casing forming an annular conduit therebetween, said isolation cementing tool further having an expandable packer means surrounding at least partially the outer casing. The tool is adapted to connect to a bottom of a piece of concentric drill string in such a fashion as to be in fluid communication with the concentric drill string.

[0009] The cementing flow control means also has a center tube and an outer casing forming an annular conduit there-

between and is either directly connected to the bottom of the isolation cementing tool or separated from the isolation cementing tool by additional shorter pieces of concentric drill string such that the cementing flow control means is also in fluid communication with both the isolation tool and the concentric drill string.

[0010] The cementing flow control means further has a plurality of check valves, either positioned in the center tube or within the annular conduit between the inner tube and the outer casing or both to prevent cement from flowing upwardly therethrough when cement is being pumped through either the inner conduits or annular conduits. In one embodiment where the cementing flow control means comprises check valves in the annular conduit thereof, which is used when cement is pumped through the inner conduits, the inner diameter of the center tube of the cementing flow control means is reduced at or near the bottom end thereof to prevent a cement plug from exiting therefrom as will be explained in more detail below.

[0011] In operation, when the packer means of the isolation cementing tool is in the expanded position, the isolation cementing tool is in the "closed position" and when the packer means is in the contracted position the isolation cementing tool is in the "open position". When in the contracted or open position, fluids are free to flow from the outer annulus between the concentric drill string and the formation walls. In a preferred embodiment, the expansion of the packer means is controlled by an electric current for quicker opening and closing of the isolation cementing tool.

[0012] When running the cementing apparatus in the hole, the isolation cementing tool is in the open position, i.e., the packer means is contracted. When the tool is in the open position it does not restrict or reduce the radius of the annulus between the outside wall of the drill string and the wellbore, as the outside diameter of the tool is preferably equal to, less than or slightly larger than the outside diameter of the concentric drill string.

[0013] When cementing is required, the isolation cementing tool, which is now positioned directly above the zone to be cemented, is put in the closed position, i.e., the packer means is expanded to abut the adjacent wellbore walls. Thus, the portion of the well bore below the isolation cementing tool is shut off or isolated from the portion of the well bore above the tool as the expanded packer means will not allow fluids to flow passed it.

[0014] In one embodiment of the method, cement is first pumped down the inner string of the concentric drill string, through the center tube of the isolation cementing tool and ultimately through the center tube of the cementing flow control means and into the formation. A cement plug of a type well known in the art is then inserted into the inner string and "chased" with a fluid such as water, gas, air, etc., which fluid is also pumped through the inner string, etc. The insertion of the plug and the subsequent pumping of fluid force the cement out through the bottom of the cementing flow control means and into the formation. In this embodiment, cementing flow control means has a plurality of check valves of a type well known in the art in the annular conduit thereof. Cement is prevented from flowing up the annular conduit of the concentric drill string as a result of the upward pressure exerted on the check valves in the annular conduit of the cementing flow control means, closing same.

[0015] The cement plug, which preferably has a diameter slightly less than the inner diameter of the center tube of the cementing flow control means, will ultimately hit the portion of the center tube where the inner diameter of the center tube is reduced. The plug becomes wedged at that point such that no further fluid can be pumped therethrough. The fluid contained in the inner conduit of the inner string of the concentric drill string can then be easily removed by reverse circulating compressed fluid such as water, air, gas and the like through the annular conduit of the concentric drill string thereby forcing the plug to be dislodged and travel up the inner conduit of the inner string of the concentric drill string to the surface. Further, any fluid present in the inner string will also be forced up to the surface.

[0016] The invention has one or more of the following advantages over current cementing methods:

[0017] Cementing back to surface isn't required;

[0018] Less damage to producing formations from the lower hydrostatic cement weight;

[0019] Less cement in the formation for fracture treatment to deal with;

[0020] No need to run a string of casing, cementing shoe and float equipment

[0021] Much less cement is needed;

[0022] The main portion of the well can be drilled with the same hole diameter;

[0023] Chemicals to strength and accelerate the curing of the cement can be added through the concentric drill string, preferably through the annular conduit;

[0024] Loss circulation material can be added through the concentric drill string, preferably through the annular conduit;

[0025] Single or multiple zones can be cemented off to prevent fluid invasion or unconsolidated materials from plugging the well bore;

[0026] Significant cost savings on cementing time, actual cement and casing costs;

[0027] When water is used as the "chasing" fluid, water is conserved by collecting it through the concentric drill string, preferably out through the inner string, to the surface prior to removing the concentric drill string;

[0028] Lower productive zones can be completed with larger diameter casing, liners or left open hole;

[0029] Compressed air can be blown down the concentric drill string, either through the annular conduit or through the inner string to greatly reduce the curing time of the cement;

[0030] No casing shoe, float equipment and cement plug to drill out; and

[0031] Well abandonment programs can be done much quicker and cheaper;

BRIEF DESCRIPTION OF DRAWINGS

[0032] FIG. 1 is a schematic of an embodiment of an isolation cementing tool of the present invention.

[0033] FIG. 2 is a cross-sectional view on an enlarged scale of the isolation cementing tool shown in FIG. 1.

[0034] FIGS. 3a and 3b is a schematic of the isolation cementing tool of FIG. 1 in the open position and closed position, respectively.

[0035] FIG. 4 is a cross-sectional view of an embodiment of a cementing flow control means with cement flowing down the center tube and check valves in the closed position.

[0036] FIG. 5 is a cross-sectional view of an embodiment of a cementing apparatus of the invention assembled on concentric drill string.

[0037] FIG. 6 is a cross-sectional view of an embodiment of a cementing flow control means, in the displacement position, showing compressed fluid being delivered down the annular conduit for pushing the cement plug and water up the center tube to the surface.

[0038] FIG. 7 is a schematic of the surface and downhole equipment involved in cementing a wellbore where casing has been run in the wellbore.

[0039] FIG. 8 is a cross-sectional view of an embodiment of a cementing apparatus of the invention when using concentric coiled tubing.

[0040] FIG. 9 is a cross-sectional view showing the connection of a single wall high-pressure cement pumping hose to concentric drill string.

[0041] FIG. 10 is a cross-sectional view showing the connection of a double wall high-pressure cement pumping hose to concentric drill string.

[0042] FIG. 11 is a schematic illustration of a concentric coiled tubing unit pumping cement down a wellbore.

DETAILED DESCRIPTION

[0043] The cementing apparatus and method will be described with reference to the following preferred embodiments.

[0044] FIG. 1 schematically illustrates an embodiment of an isolation cementing tool 30 and means for attaching the tool between two pieces of concentric drill string 45 and 47. Preferably, isolation cementing tool 30 is attached to concentric drill string 45 and 47 such that the isolation cementing tool 30 is positioned the proper distance from the bottom of the wellbore to allow the desired zone to be properly cemented.

[0045] Concentric drill string 45 and 47 both comprise an inner string 57 and an outer string 59, forming an annular conduit 16 therebetween. Concentric drill string 45 and 47 are designed such that at one end of the concentric drill string is a threaded pin end and at the other is a threaded box end. Thus, pieces of the concentric drill string can be connected end to end by screwing the thread pin end of the new piece of concentric drill string to be added into the box end of the drill string below. It is understood that concentric drill string could also be a continuous length of concentric coiled tubing having an inner coiled tube and an outer coiled tube in which case isolation cementing tool would be operably attached to the end thereof by coupling means known in the art for coupling downhole tools to coiled tubing.

[0046] As can be seen in FIG. 1, concentric drill string 45 has threaded pin end 31 at its bottom end and concentric drill string 47 has threaded box end 35 at its top end. Isolation cementing tool 30 is adapted to be inserted between concentric drill string 45 and 47 by means of threaded box end 37 and threaded pin end 33. Thus, threaded pin end 31 of concentric drill string 45 screws into threaded box end 37 and threaded pin end 33 screws into threaded box end 35 of concentric drill string 47. It is anticipated that in some instances concentric drill string 47 may only be a short piece of concentric drill string, e.g., it may not be a complete length of concentric drill pipe as is known in the art. Isolation cementing tool 30 further comprises a packer means 39 surrounding the isolation cementing tool, the operation of which will be described in more detail below.

[0047] With reference to FIG. 2, isolation cementing tool 30 further comprises a center tube 34, an outer casing 32, an annular conduit 36 between the center tube and outer casing, an inner conduit 38, and a packer means 39 surrounding said outer casing 32. When isolation cementing tool 30 is inserted between concentric drill string 45 and 47, the center tube 34 of the isolation cementing tool 30 is in fluid communication, i.e., via inner conduit 38, with the inner string 57 of the concentric drill string 45 and 47 and the annular conduit 36 of the isolation cementing tool 30 is in fluid communication with the annular conduit 16 of the concentric drill string 45 and 47.

[0048] In one embodiment, packer means 39 can be expanded or contracted by means of an electric current flow path. In another embodiment, the packer means comprises an inflatable ring, which can be inflated by pumping various types of fluid into and out of the ring, as is known in the art.

[0049] FIGS. 3a and 3b schematically illustrate the isolation cementing tool attached to the concentric drill string in the open and closed position, respectively, during cementing operations. When packer means 39 is contracted or deflated as shown in FIG. 3a, the tool is in the open position and fluids can flow freely through the wellbore annulus 43 formed between the outer wall of the outer string 59 of the concentric drill string and formation wall 41. When packer means 39 is expanded or inflated as shown in FIG. 3b, the packer means is forced against formation wall 41 thereby closing off annulus 43 to fluid movement above and below packer means 39.

[0050] FIG. 4 is a cross-sectional view of one embodiment of a cementing flow control means 10, which forms part of the cementing apparatus of the invention. Cementing flow control means 10 comprises a center tube 4 and an outer casing 2, forming an annular conduit 7 therebetween. A plurality of check valve means 3 are shown situated within the annular conduit 7 in this particular embodiment. It is understood that in an embodiment where it is desirable that cement is pumped down the annular conduit of the concentric drill string, cementing flow control means would comprise a plurality of check valve means in the inner conduit 57 of the center tube 4. Check valve means useful in downhole tools are well known in the art to allow fluid or gas to flow through tools in only one direction.

[0051] It can be seen in FIG. 4 that the inner diameter of the center tube 4 is reduced at the bottom end thereof. Thus, the inner wall diameter at the bottom end is less than the diameter of the rest of the center tube 4. This area of reduced

diameter is often referred to in the art as a stinger and is designated element 99. FIG. 4 shows cement 9 being pumped through the inner conduit 1 of center tube 4. Annular conduit 7 is closed off both at the bottom and the top of the cementing flow control means by two sets of check valves 3, thereby preventing cement 9 from flowing up annular conduit 7. Cementing flow control means 10 further comprises threaded box end 52 so that this end can be attached to either the threaded pin end of a piece of concentric drill string or directly attached to the threaded pin end 33 of isolation cementing tool.

[0052] When the cementing flow control means 10 is properly connected, it is understood that center tube 4 of the cementing flow control means 10 is in fluid communication with the inner string of concentric drill string and the center tube of the isolation cementing tool, and that annular conduit 7 of the cementing flow control means 10 is in fluid communication with the annular conduit of concentric drill string and the annular conduit of the isolation cementing tool.

[0053] FIG. 5 illustrates an embodiment of an assembled cementing apparatus of the present invention. Isolation cementing tool 30 is shown operably attached to concentric drill string 45 by means of threads as described above. It can be seen that annular conduit 16 of concentric drill string 45 is in fluid communication with annular conduit 36 of isolation cementing tool 30 and that inner conduit 19 of concentric drill string 45 is in fluid communication with inner conduit 38 of isolation cementing tool 30. In this embodiment, cementing flow control means 10 is directly attached to the end of isolation cementing tool 30 by thread means. It can be seen that annular conduit 7 of cementing flow control means is in fluid communication with annular conduit 36 of the isolation cementing tool 30 and that inner conduit 1 of cementing flow control means 10 is in fluid communication with inner conduit 38 of isolation cementing tool 30.

[0054] In operation, in one embodiment of the invention, cement 9 is first pumped through inner conduit 19 of inner string 57, then through inner conduit 38 of isolation cementing tool 30, and finally through inner conduit 1 of cementing flow control means 10. Isolation cementing tool is in the closed position. Cement plug 5, which has on outside diameter slightly smaller than the inner diameter of the inner string 57, the inner diameter of center tube 34 and the largest inner diameter of center tube 4, but larger than the diameter of stinger 99, is inserted through inner string 57 and "chased" with a fluid such as air, gas or water 79.

[0055] The pumping pressure of fluid 79 pushes cement plug 5 down to the bottom of the cementing flow control means 10 and thereby forces cement 9 out into the wellbore. The pressure ultimately forces cement 9 past formation wall 41 and into the formation itself causing that part of the formation to become sealed off. Some of the cement 9 will be forced up outer annulus 43 but flow will be stopped when cement 9 reaches the bottom of inflated/expanded packer means 39 (the closed position). Cement 9 is further prevented from returning up annular conduit 7, and subsequently up annular conduit 16 of concentric drill string 45 to the surface, by means of check valves 3 sealing off the annular conduit 7 as a result of the upward pressure which results when pumping down cement 9 and fluid 79 through the various inner conduits.

[0056] Cement plug 5, which follows cement 9, is eventually chased down by fluid 79 to the bottom of cementing flow control means 10. As previously mentioned, the inner diameter of center tube 4 is reduced near its bottom forming stinger 99 so that travel of cement plug 5 is stopped. At this point, essentially all of the cement 9 will have been forced out of the various inner conduits and into the formation, leaving most of fluid 79 still contained in the inner conduit of inner string 57 of the concentric drill string 45.

[0057] At this point, chemicals or other additives to strengthen or speed up the cure time for the cement 9 can be pumped down annular conduit 16 by applying downward pressure to both sets of check valves 3 thereby opening them to allow the chemicals or additives to reach the cement 9. Further, fluid 79, which has essentially been contained in the various inner conduits, can now be removed by reverse circulating air or other fluid down annular conduit 16 of concentric drill string 45, through the annular conduit 36 of isolation cementing tool 30 and through annular conduit 7 of cementing flow control means 10 and up through the center of the center tube 4 of cementing flow control means 10, the center tube 34 of the isolation cementing tool 30 and the inner string 57 of concentric drill string 45, thereby forcing out the fluid 79 which can then be collected at the surface of the well.

[0058] FIG. 6 is a cross-sectional view of cementing flow control means 10 during the displacement/removal of fluid 79 operation. Essentially, both cement plug 5 and fluid 79 are displaced as a result of a fluid such as compressed air 13 being pumped down the various annular conduits and reverse circulated up through the various inner conduits. When the pressure of air 13 is exerted on check valves 3, these check valves are forced in the open position as shown in FIG. 6. Thus, air 13 eventually displaces both cement plug 5 and fluid 79 up through the center of the concentric drill string to the surface. This both eliminates the necessity to drill out the cement plug and conserves fluids such as water.

[0059] Once cementing is completed and the cement plug and excess water removed, isolation cementing tool 30 is placed back in the open position, i.e., packer means is deflated as shown in FIG. 2, and the concentric drill string is tripped out of the well bore. In a preferred embodiment, isolation cementing tool 30 is put in the open position and concentric drill string 47 is pulled up above the cement in the well bore. Isolation cementing tool 30 is then placed in the closed position and compressed air or other gas is pumped down annular conduits 16, 36 and 7 to reduce the amount of time for the cement to cure so drilling or other operations may resume.

[0060] FIG. 7 illustrates another embodiment of the invention wherein casing is first placed in the wellbore. FIG. 7 shows the surface equipment required to pump cement down a well bore. Casing 69 is run in the wellbore between formation walls 41, thereby forming annulus 129 between the casing 69 and formation wall 41. Cement 9 is pumped from surface by cement pump 101 down inner tube 57 of concentric drill string 45, followed by cement plug 5 and fluid 79. Isolation cementing tool 30 is in the closed position, i.e., packer means 39 is in the expanded position and abuts against the inside wall of casing 69. When isolation cementing tool 30 is in the closed position, this allows both the

pumping pressure and the hydrostatic weight of the cement 9 and fluid 79 to push cement 9 up annulus 129 to the surface of the wellbore. As previously explained, cementing flow control means 10 prevents cement 9 from entering annular conduit 16 of the concentric drill string 45.

[0061] Once the cement 9 returns to surface, displacement operations as shown in FIG. 6 and described above commence. Thus, no casing shoe, float equipment and cement plug are left in the well bore that have to be drilled out when drilling operations resume.

[0062] FIG. 8 is a cross-sectional view of another embodiment of a cementing apparatus of the present invention using concentric coil tubing 12. Concentric coiled tubing 12 comprises inner tube 14, which provides inner conduit 20 for pumping cement and water, and outer tube 18, wherein outer tube 14 and inner tube 12 form an annular conduit 17 therebetween for pumping air/fluid during the displacement operations.

[0063] Isolation cementing tool 30 is attached to concentric coiled tubing 12 by coupling or connecting means 21, as known in the art for connecting downhole tools to coiled tubing, to be in fluid communication with concentric coiled tubing 12 as previously described with drill pipe. A length of concentric coiled tubing 112 is routinely attached at the end of isolation cementing tool 30 via another connecting means 23 known in the art. The length of concentric coiled tubing 112 is determined based on the length of the zone to be cemented.

[0064] Cementing flow control means 10 is attached to the free end of concentric coiled tubing 112 by connecting means 62 as known in the art. As previously mentioned, the inner diameter of the center tube 4 of the cementing flow control means 10 is reduced, forming stinger 99. As mentioned, this reduction in the inside diameter of the center tube prevents cement plug 5 from passing through the center tube and into the wellbore.

[0065] Electrical cable 22 provides electric current to operate the isolation cementing tool 30 by expanding and contracting packer means 39. Other means of operating isolation cementing tool 30 could include fiber optic cables, radio frequency, electric magnetic or small diameter capillary tubes which transmit hydraulic or pneumatic pressure.

[0066] FIG. 9 is a cross-sectional view showing the connection of a single wall high-pressure cement pumping hose 26, which can be used to pump cement 9 through the inner conduit 19. Cement pumping hose 26 is connected to inner string 57 of concentric drill string 45 by connecting means 63. Preferably, the annular conduit 7 is sealed off prior to pumping cement 9 down the inner string 57 by means of donut spacer 31. It is understood that donut spacer 31 could be a separate element or could be an integral part of high-pressure cement pumping hose 26. Cement 9 is pumped down the inner string 57 through inner conduit 19 to the desired depth. Cementing flow control means 10 (not shown) prevents cement 9 from flowing back up the annular conduit 7.

[0067] FIG. 10 is a cross-sectional view of another embodiment of the invention showing the connection of a double-walled high-pressure cement pumping hose 126 to concentric drill string 45 which can be used for both delivering cement and chasing fluid and also during the

displacement of chasing fluid operation. Pin end **31** of double-walled high-pressure cement pumping hose **29** connects to box end **35** of concentric drill string **45** by means of threads as previously described. During displacement operations, fluid such as air **13** is reverse circulated through annular conduit **7** of concentric drill string **45** and up through inner conduit **1**, which pushes cement plug **5** and chasing fluid **79** back to surface.

[0068] In an embodiment as shown in **FIG. 11**, truck **101** comprises a cement tank **114** for holding cement, a fluid tank **112** for holding fluid such as water, which is used to chase the cement and cement plug to the bottom of the cementing apparatus, and an air compressor **118** for delivering compressed air for displacing the chasing fluid. Truck **101** further comprises a pumping mechanism (not shown) and a valve manifold system (not shown) both of which are connected to cement tank, water tank and air compressor by double-wall cement pumping hose **29**. Valve manifold system operates to switch between pumping cement, pumping fluid such as water and pumping air.

[0069] Double-wall cement pumping hose **29** connects to concentric coiled tubing **12**, which is wrapped around reel **116** on coiled tubing truck **107**. In operation, cement **9** is pumped via pumping mechanism through hose **29** and ultimately through either the annular conduit or inner conduit of the concentric drill string **12**. Cement **9** is pushed to the bottom of wellbore **115** by adding cement plug (not shown) and pumping fluid such as water from fluid tank **112**. This forces cement **9** to be squeezed through formation wall **41** into a fluid zone of the formation required to be sealed off with cement. Once cement **9** has cured or set, it then prevents formation fluid **111** from entering wellbore **115**.

[0070] Surface blowout preventor (BOP) **109** provides a surface seal for concentric coiled tubing **12** so that pumping pressure can deliver cement **9**, water or air down to the wellbore **115** to prevent formation fluid **111** from entering wellbore **115**. It can be seen from **FIG. 11** that surface casing **69** has previously been cemented in place and the rest of wellbore **115** has been drilled open hole.

[0071] Once cementing has been completed, isolation cementing tool **30** is placed in the open position by contracting packer means **39** and concentric coiled tubing **12** and cementing apparatus are pulled up several feet from the top of the cement deposited in the wellbore **115**. Then, isolation cementing tool **30** is put back in the closed position by expanding packers means **39** at which point displacement operations are commenced.

[0072] Compressed air **13** is now pumped through annular conduit **17** to first assist in drying cement **9** and then to push cement plug and chasing fluid back to the surface where it is returned to fluid tank **112**. It is understood that, in addition to compressed air, other chemicals, loss circulation materials and other fluids can also be pumped through annular conduit **17**.

[0073] In an embodiment of the invention (not shown) where cement and chasing fluid is delivered through the annular conduit of concentric drill string, it is the radius of the annular conduit of the cementing fluid control means which is reduced, thereby forming an annular conduit stinger. In this embodiment, a donut shaped cement plug, which has a radius small enough to freely slide through the

various annular conduits but large enough that it can not get passed the annular conduit stinger of this embodiment of the cementing fluid control means is used. Fluid such as water is then pumped through the annular conduits to chase down the donut shaped cement plug until it gets lodged in the stinger. Compressed fluid such as compressed air is then pumped through the various inner conduits to force the donut shaped cement plug and chasing fluid back to the surface. In this embodiment, the cementing fluid control means comprises a plurality of check valves situated in the inner tube rather than the outer conduit.

[0074] In an embodiment where reverse circulating cementing operations are taking place within zones containing hydrocarbons, a surface and downhole well control system is added for safety reasons to prevent the flow of hydrocarbons to the surface. Examples of cementing operations where well control may be needed are during abandonment of a wellbore, when trying to stop a loss circulation problem, and when squeezing a wet zone or a depleted zone in a multi-zone well. During these reverse circulation cementing operations, the well could "kick" and without the well control downhole and at surface a blow out situation could arise. Examples of surface flow control means and downhole flow control means that can be used with concentric drill string are given in U.S. Pat. No. 6,854,534 and U.S. Pat. No. 6,892,829, both of which are incorporated herein by reference.

What is claimed is:

1. An apparatus for cementing a zone in a wellbore formation with cement, comprising:

(a) a first concentric drill string comprising an inner string having an inner conduit and situated within an outer string to form an annular conduit therebetween;

(b) an isolation cementing tool having an expandable and contractible packer means therearound, and adapted to be operably connected to said concentric drill string such that the isolation cementing tool is in fluid communication with both said conduits; and

(c) a cementing flow control means having a plurality of valve means for controlling the flow through the annular conduit or the inner conduit, or both, and adapted to be operably connected to said concentric drill string such that the cementing flow control means is in fluid communication with both said conduits.

2. The apparatus of claim 1 wherein said first concentric drill string comprises joints of concentric drill pipe.

3. The apparatus of claim 1 wherein said first concentric drill string comprises concentric coiled tubing.

4. The apparatus of claim 1 wherein said cementing flow control means is operably connected to said first concentric drill string by being operably connected to the cementing isolation tool.

5. The apparatus of claim 1 further comprising a second concentric drilling string wherein said second concentric drilling string is operably connected to both said isolation cementing tool and said cementing flow control means.

6. The apparatus of claim 1 wherein said inner string is made of a rubber material, a mixture of rubber and steel, fiberglass or other composite material and comprises electrical wires, and said packer means of said isolation cement-

ing tool expands or contracts by means of an electric current delivered to the isolation cementing tool by the electrical wires of the inner string.

7. The apparatus of claim 1 wherein said packer means comprises an inflatable ring.

8. The apparatus of claim 7 wherein said inflatable ring expands or contracts by pumping fluids into or out of the inflatable ring.

9. The apparatus of claim 1 wherein said cementing flow control means comprises a center tube and an outer casing, and wherein the inner diameter of said center tube is reduced at some point.

10. The apparatus of claim 1 further comprising a surface flow control means positioned at or near the surface of the wellbore for preventing the flow of hydrocarbons from the wellbore.

11. The apparatus of claim 1 further comprising a downhole flow control means positioned at or near the bottom of the concentric drill string for preventing the flow of hydrocarbons from the inner conduit, the annular conduit or both to the surface of the wellbore.

12. A method for cementing a zone in a wellbore formation with cement, comprising:

- (a) providing a concentric drill string comprising an inner string having an inner conduit and situated within an outer string to form an annular conduit therebetween;
- (b) pumping cement down one of the inner or annular conduits of the concentric drill string to the zone to be cemented;
- (c) sealing off an outside annulus formed between a wall of said wellbore and an outer surface of said concentric drill string at a position above the zone desired to be cemented to prevent the flow of cement therethrough from the zone; and
- (d) sealing off the other of the inner or annular conduits of the concentric drill string to prevent the flow of cement therethrough from the zone.

13. The method of claim 12 further comprising adding a cementing plug to the unsealed conduit after all the cement has been pumped therein.

14. The method of claim 13 further comprising pumping a first fluid through the unsealed conduit after the addition of the cementing plug to assist in pushing the cement through the unsealed conduit and into the zone in the wellbore formation.

15. The method of claim 14 further comprising preventing the cementing plug from exiting into the wellbore.

16. The method of claim 15 further comprising opening the sealed conduit and pumping a second fluid therethrough such that the second fluid is reverse circulated back up the unsealed conduit thereby removing the cementing plug and first fluid from the unsealed conduit to the surface of the wellbore.

17. The method of claim 12 wherein the outside annulus is sealed off by means of an isolation cementing tool comprising an expandable and contractible packer means.

18. The method of claim 17 wherein said packer means is expanded and contracted by means of an electrical current.

19. The method of claim 18 wherein said packer means is expanded and contracted by the addition of fluid into or the removal of fluid out of the packer means.

20. The method of claim 12 wherein the other of the inner or annular conduits of the concentric drill string are sealed off by means of a cementing flow control means comprising a plurality of valve means.

21. The method of claim 12 wherein said concentric drill string comprises joints of concentric drill pipe.

22. The method of claim 12 wherein said concentric drill string comprises concentric coiled tubing.

23. The method of claim 12 further comprising providing a downhole flow control means positioned at or near the bottom of the concentric drill string for preventing flow of hydrocarbons from the inner conduit, the annular conduit or both to the surface of the wellbore.

24. The method of claim 12 further comprising providing a surface flow control means positioned at or near the surface of the wellbore for preventing flow of hydrocarbons from the outside annulus.

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