United States Patent [19]

Land

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[54] **MEANS FOR STABILIZING WELLBORES**

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[52] **U.S. Cl.** **166/207**

[51] **Int. Cl.** **E21b 43/10**

[58] **Field of Search** 166/207

[56] **References Cited**

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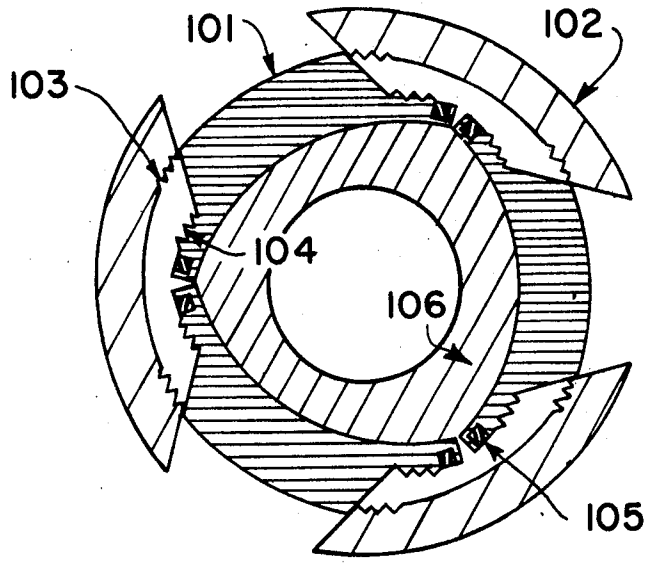
[57] **ABSTRACT**

Disclosed herein is an expandable casing comprised of inside and outside axial sections of casings which fasten to form a sealed casing joint capable of withstanding pressure and formation loads as the casing is expanded and locked into position. The expandable casing stabilizes wellbores, preventing deformation, fracturing or fluid communication between fluids conducted within the wellbore and formations isolated through use of the casing. The casing sections are attached to an inflatable bladder element which affords placement through smaller diameter wellbores and orderly expansion of the sections in the wellbore adjacent to the formation to be stabilized or protected.

7 Claims, 3 Drawing Figures



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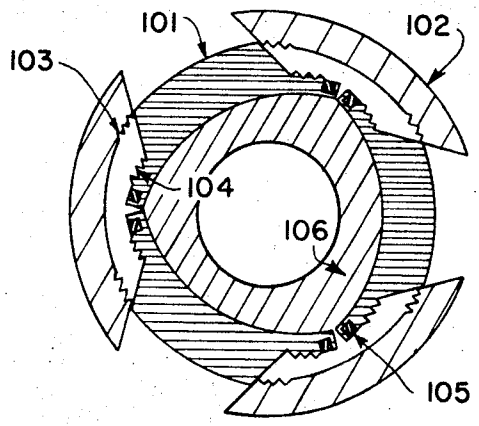

FIG. 1

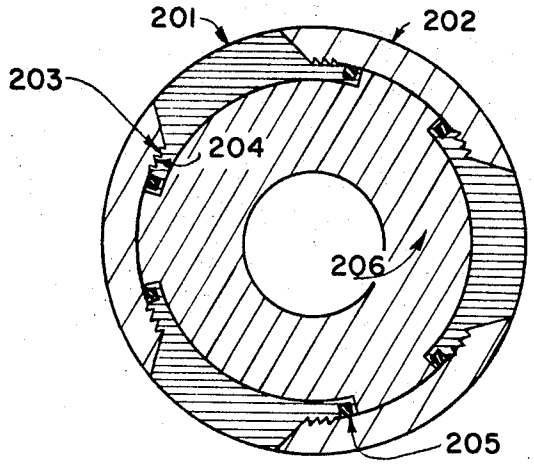

FIG. 2

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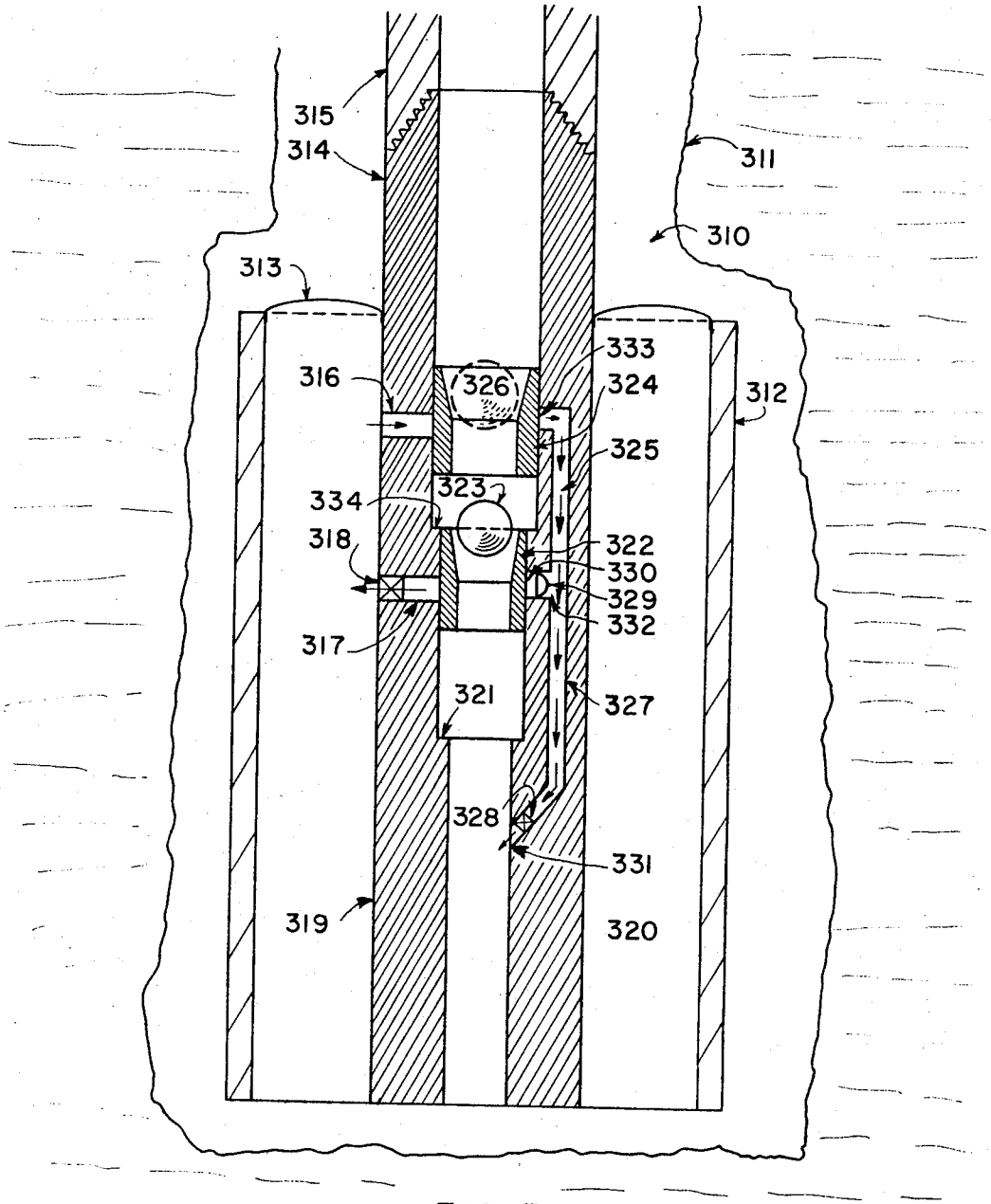

FIG. 3

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MEANS FOR STABILIZING WELLBORES

BACKGROUND OF THE INVENTION

This invention relates to means for stabilizing a wellbore. More particularly, the present invention represents apparatus comprising expandable casing, the use of which prevents deformation, fracturing and fluid communication between fluids transported within a wellbore and formation fluids.

Wellbore deformation and instability, for example that caused by salt flow, sloughing of shale deposits, low mud circulation, etc., resulting within fractured or highly porous formations are frequent problems associated with drilling and completion of hydrocarbon and mineral bearing formations. In the completion or production of hydrocarbons and minerals from subterranean reservoirs, often formations are encountered having lower constituency than desirable for the completion of production tubing and wellbore liners therein. Therefore, during the production interval of the hydrocarbon or mineral containing reservoir, one may encounter a failure of the wellbore completion through deformation of the wellbore liner or production equipment associated therewith, fracturing through the wellbore liner and formation, thereby causing losses of wellbore fluids or fluid communication between wellbore formations through the annulus formed between the formation and the wellbore liner giving undesirable consequences to the production operation.

Conventional methods and apparatus available for combating wellbore deformation, fracturing or fluid communication comprise complicated wellbore apparatus for the removal of wellbore liners and the replacement thereof or for the recementing and setting of wellbore equipment therein. The inherent problem in all conventional wellbore stabilization equipment for the continued and enhanced production of fluids therefrom subsequent to deformation, fracturing or fluid communication of wellbore fluids with the formations are associated with unreliable solutions which are expensive, time consuming and often have dangers associated therewith. What is required is a reliable technique whereby wellbore deformation and stability may be controlled so as to prevent lost circulation resulting from fractured or highly porous formations being encountered during drilling, completion or production of a wellbore to prevent wellbore deformation and fluid communication from occurring.

It is an object of the present invention to provide apparatus for the stabilization of wellbores.

It is another object of the present invention to provide apparatus for the protection of tubular goods and the cement sheath within a completed wellbore.

It is still a further object of the present invention to provide apparatus whereby the tubular goods contained within a completed well-bore may be stabilized or further reinforced through introduction of the apparatus of the present invention.

With these and other objects in mind, the present invention is hereinafter set forth with particular reference to the following drawings and description:

SUMMARY OF THE INVENTION

The objects of the present invention are accomplished through utilization of apparatus for the stabilization of a wellbore to prevent deformation, fracturing or fluid communication between the wellbore and surroundig formations. The apparatus comprises at lesat two inside axial casing sections circularly aligned with at least two outside axial casing sections circularly aligned about the inside axial casing sections. An inflatable bladder section is provided to connect the inside and outside axial casing sections so that they are normally aligned, with the inside axial casing sections contained within the outside axial casing sections but capable of being positioned so as to form a circular casing joint through inflation of the inflatable bladder section. Means for inflating the inflatable bladder section are provided so that a circular casing joint may be formed from the axial casing sections. It is preferred that the means for inflating the inflatable bladder section be hydraulic.

It is generally preferred that the apparatus of the present invention further comprise the inside axial casing sections having locking serrations on the exterior portion and that the outside axial casing sections further comprise locking serrations on the interior portions which meet with the locking serrations of the inside axial casing sections to lock the axial casing sections into the form of a circular casing joint. In conjunction with the locking serration sections, the apparatus further comprises means for sealing the joints formed between the inside and outside axial casing sections when they are connected to form a circular casing joint.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be more fully understood through referral to the accompanying FIGS. in which:

FIG. 1 represents a set of three inside axial casing sections and three outside axial casing sections in a collapsed position forming one embodiment of the apparatus of the present invention;

FIG. 2 depicts the inside and outside axial sections of FIG. 1 in an expanded and locked position; and

FIG. 3 depicts the apparatus of the present invention further comprising a preferred embodiment utilizing a placement tool in which the inside and outside axial casing sections may be deflated in conjunction with an inflatable bladder in order to prevent deformation, fracturing or fluid communication in the wellbore.

DETAILED DESCRIPTION OF THE INVENTION

The present invention discloses apparatus for the stabilization of wellbores so as to prevent deformation, fracturing, fluid communication and other undesirable physical phenomenas from occuring within the wellbore. The embodiment of the present invention is most easily understood by referral to FIG. 1 in which three inside axial casing sections **101**, being circularly aligned, are depicted in conjunction with three outside axial casing sections **102** circularly aligned about the inside axial casing sections **101**. An inflatable bladder section **106** connects the inside and outside axial casing sections **101** and **102**, respectively, so as to place the inside axial casing sections **101** within the outside axial casing sections **102**, but capable of being positioned so as to form a circular casing joint through inflation of the inflatable bladder section **106**. The apparatus of the present invention is depicted in FIG. **1** and comprises inside axial casing section **101** comprising locking serrations **104** on the exterior portion thereof with the outside axial casing sections including locking serrations **103** on the interior portion thereof to mate with

the locking serrations **104** of the inside axial casing sections **101**. These serrations lock the axial casing sections **101** and **102**, respectively, to form a casing joint. The apparatus further comprises means for sealing the joint formed between the inside and outside axial casing sections **101** and **102**, respectively, for example a rubber sealing element **105** being recessed within the outside portion of the inside axial casing sections **101**.

FIG. **2** depicts the inside of axial casing sections **201** and outside axial casing sections **202** in expanded and locked position wherein the inflatable bladder section **206** has been expanded so as to force the axial casing sections to connect to form a circular casing joint. The locking serrations **203** and **204**, respectively, contained upon the inside axial casing sections **201** and outside casing sections **202** mate and lock the axial casing sections to form a circular casing joint. Means for sealing the joints formed between the inside and outside axial casings sections **201** and **202**, respectively, may comprise, as shown, the rubber seals **205**, positioned such that no fluid communication may occur between the interior and exterior of the circular casing joint formed.

Therefore, in the normal operation within a wellbore, the expandable casing joints formed by the apparatus of the present invention may be attached to an inflatable bladder element. The apparatus allows for placement of the casing joint through smaller diameter wellbores and orderly expansion of the axial casing sections within enlarged or underreamed portions of a wellbore adjacent to the zone or formation to be stabilized. The expandable casing apparatus of the present invention may be utilized within encased or cemented wellbores for the repair thereof, or may be utilized in an open hole wherein degradation of the formation and hole enlargement is incurred in which oversized casing joint is required in order to give an adequate completion through further cementing.

One embodiment of the apparatus for positioning the expandable casing joints of the present invention is depicted in FIG. **3**. Illustrated is a tool for running the expandable casing apparatus of the present invention. In the Figure, the expanded casing **312** is depicted, connected to a standard joint of drill pipe **319** through connection of threadable section **314** to a drill string **315**. In the Figure, a drilled hole **311** is shown in which overreaming has occurred due to collapse of a formation **310** such that expanded casing is required for an adequate cementing job or completion to be accomplished. The axial casing sections are expanded within the overreamed area, as shown in the Figure, through the utilization of the pipe **319**. The pipe **319** has a deflation port **316** and inflation port **317** containing a check valve **318** therein for the introduction and withdrawal from the annular section **320** formed between the expanding casing **312** and pipe **319**. Deflation port **316** is normally blocked from fluid flow from within the pipe **319** by a first sliding sleeve valve **324** which is activated by the introduction of a valve ball **326**. When activated, the sliding sleeve valve moves vertically downward inside the pipe **319** until it abutts with recess **334**, thereby exposing deflation port **316** to the interior of the pipe **319**. In a similar fashion, a second sliding sleeve valve **322** blocks fluid flow-through inflation port **317**, but may be activated by introduction of sleeve ball **323** which slideably moves the sliding sleeve valve **322** downwardly within the pipe **319** until it abutts with reamed surface **321**, so as to expose the inflation port **317** to fluid flow. The inflation port **317** contains a check valve **318** which prevents fluid egress from the annulus **320** after the expanded casing **312** is positioned. Means are provided for controlling flow of fluids through the inflation or deflation ports through the sliding sleeves. Also, means are provided for preventing the flow of fluid through the pipe while the bladder section is being inflated through the use of the sliding sleeves.

In conjunction with the apparatus depicted in the FIG. **3** are means for preventing flow of fluids through the pipe comprising a first bypass port **327** contained within the pipe wall **319** having an inlet **330** at or below the inflation port **317** and an exit **331** below the second slideable sleeve **322** positioned so that fluid flow through the inlet **330** is normally blocked when the second sliding valve **322** is activated by valve ball **323**. A bypass check valve **328** is located within the first bypass port **327** so as to prevent reverse flow of fluids from the exit **331** to the inlet **332**. Means for normally preventing flow through the first bypass port **327** when it is exposed through the activation of the second sliding sleeve valve **322** are provided which may comprise a pressure burst plate **329** located within the first bypass port **327** which will burst when a predetermined pressure buildup is exhibited within the pipe **319**. The apparatus may further comprise a second bypass port **325** having an inlet **333** at or above the deflation port **316** and exit **332** into the first bypass port **327** below the first sliding sleeve valve **324** positioned so that fluid flow through the inlet **333** is normally opened when the first sliding valve **324** is activated.

In the utilization of the apparatus of the present invention, the following procedure may be utilized for running a length of expandable casing in an uncompleted hole:

1. Underreaming the zone where casing is to be set;
2. Running expandable casing on a bladder with the drill pipe open for circulation;
3. When the expandable casing is at the proper depth, a small diameter sleeve valve plug (ball) is dropped, causing a sliding sleeve valve to be actuated opening inflation ports into the bladder and closing circulation into the annulus, the bladder is thus expanded using drill pipe or tubing pressure;
4. After expansion, the pump pressure is increased slightly to rupture the burst plates and allow annulus circulation;
5. Cement is then circulated behind the expanded casing and overflushed to clear the running tool;
6. A second valve plug is dropped to actuate a sliding sleeve valve and open deflation ports and annulus ports; and
7. The running tool is retrieved to surface after deflation.

Therefore, through utilization of the apparatus of the present invention, one is afforded the means and method for stabilizing the wellbore for the prevention of deformation, fracturing or fluid communication so that loss of circulation due to salt flow, sloughing of shales, loss of hole or collapse of pipe, etc., may be circumvented through the optimal production and completion of a wellbore.

While the invention has been described herein with respect to certain embodiments thereof, it will be understood by those skilled in the art that various changes

and modifications may be made without departing from the spirit or scope of the invention as set forth.

Therefore, I claim:

1. An apparatus for the stabilization of a wellbore for the prevention of deformation, fracturing, fluid communication, etc., which comprises:
   a. at least two inside axial casing sections circularly aligned and including locking serrations on the exterior portion thereof;
   b. at least two outside axial casing sections circularly aligned about the inside axial casing sections and including locking serrations on the interior portion thereof which mesh with the locking serrations of the inside axial casing sections to lock the axial casing sections into the form of a circular casing joint;
   c. an inflatable bladder section connecting the inside and outside axial casing sections so that the inside axial casing sections are contained within the outside axial casing sections but capable of being positioned so as to form said circular casing joint through inflation of the inflatable bladder section:
   d. hydraulic means for inflating the inflatable bladder section;
   e. means for locking the axial casing sections when expanded; and
   f. means for sealing the joints formed between the inside and outside axial casing sections when they are connected to form said circular casing joint.

2. The apparatus of claim 1 wherein the hydraulic means for inflating the inflatable bladder section comprise:
   a. a section of pipe passing therethrough the circularly aligned axial casing sections and attached thereto the inflatable bladder section so as to form an annulus therebetween the exterior of the pipe and the interior of the circularly aligned axial casing sections, and having one or more deflation and inflation ports located therein the pipe; and
   b. means for controlling the flow of fluids through the inflation or deflation ports.

3. The apparatus of claim 2 wherein the means for controlling the flow of fluids through the inflation or deflation ports comprise:
   a. an inflation check valve positioned within each of the inflation ports so as to prevent the egress of fluids from within the annulus to within the pipe;
   b. a first sliding sleeve valve positioned to normally block the flow through the one or more deflation ports; and
   c. means for activating the first sliding sleeve valve.

4. The apparatus of claim 3 further comprising:
   a. a second sliding sleeve valve positioned to normally block the flow through the one or more inflation ports; and
   b. means for activating the second sliding sleeve valve.

5. The apparatus of claim 4 further comprising:
   a. the first and second sliding sleeve valve being ball activated with the means for preventing the flow of fluid through the pipe comprising a first bypass port contained within the pipe wall having an inlet at or above the inflation port and an exit below the second sliding sleeve valve positioned so that fluid flow through the inlet is normally blocked but allowed when the second sliding valve is activated;
   b. a bypass check valve located within the first bypass port so as to prevent reverse flow of fluids from the exit to the inlet; and
   c. means for normally preventing flow through the first bypass port when it is exposed through activation of the second sliding sleeve valve.

6. The apparatus of claim 5 in which the means for normally preventing flow through the first bypass port comprise a pressure burst plate located within the first bypass port which will burst when a predetermined pressure buildup is exhibited within the pipe.

7. The apparatus of claim 6 further comprising a second bypass port having an inlet at or above the deflation port and an exit into the first bypass port below the first sliding sleeve valve positioned so that fluid flow through the inlet is normally blocked, but allowed when the first sliding valve is activated.

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