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COMPLETION METHOD AND SYSTEM FOR WELLS

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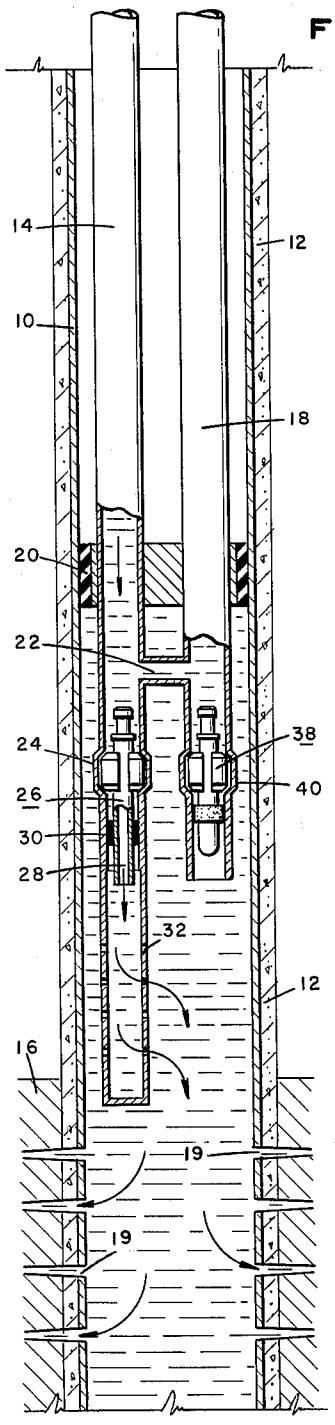


FIG. 1.

FIG. 2.

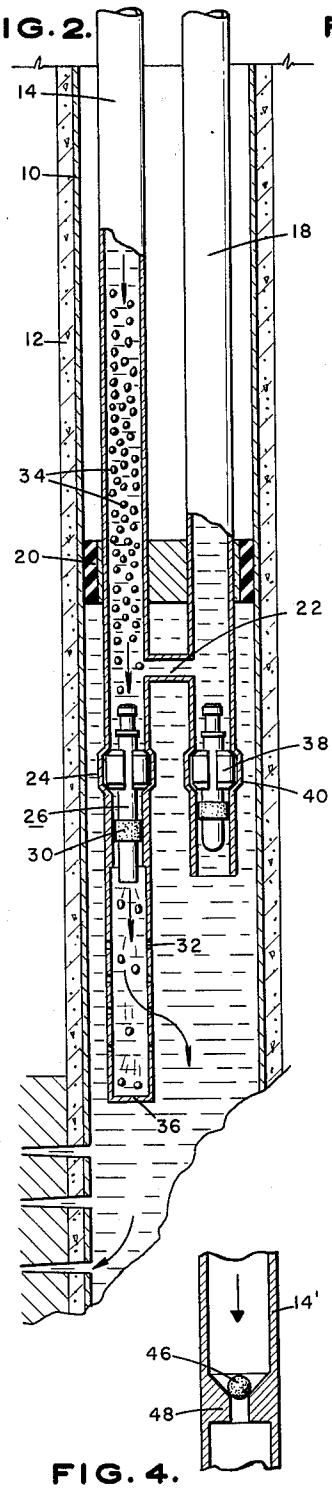
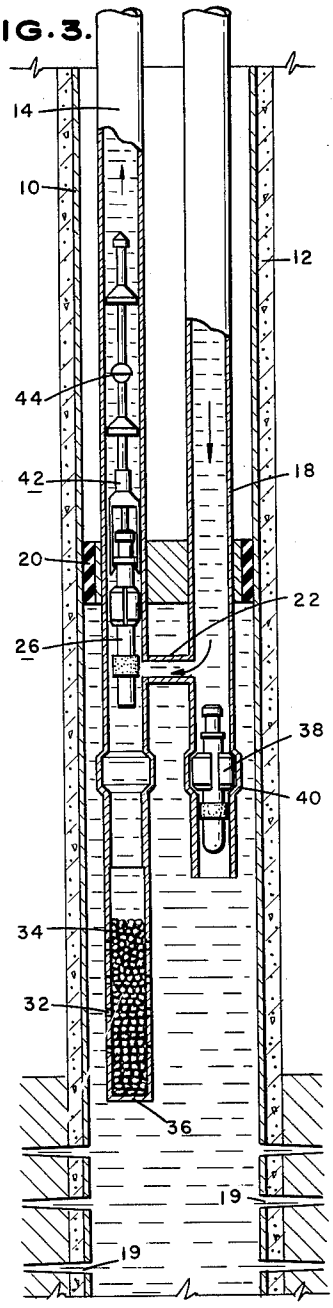


FIG. 4.

FIG. 3.



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COMPLETION METHOD AND SYSTEM FOR WELLS

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This invention relates to oil and gas wells. More particularly, this invention is a method and system for removing tools from a well when the conventional methods and systems cannot be used to remove these tools because of excessive lost returns.

Certain operations are performed in oil and gas wells which require the fluid circulation of pump tools. Pump tools, for example, may be used extensively in completing submarine wells. An example of an operation which may be performed by the use of pump tools is the installation or removal of a storm choke or subsurface safety valve from its position within a tubing string placed in the well.

However, in order to properly utilize pump tools for removing subsurface devices by fluid circulation, it is necessary that excessive loss of the circulating fluid to the subsurface formations be prevented. If there is excessive loss of the circulating fluid to the formations, sufficient pressure and circulating volume cannot be developed to circulate the pump tool and remove the subsurface devices.

The invention to be described herein provides the art with a method and system which can be used to prevent excessive loss of the circulating fluid to the formation during the removal of subsurface tools such as storm chokes.

The invention, as well as its many advantages, will be further understood by reference to the following detailed description and drawings in which:

FIG. 1 is a schematic, elevational view showing a storm choke in position within the well;

FIG. 2 is a schematic, elevational view showing the introduction of a dissolvable granular material for placement in the well to prevent excessive loss of circulation;

FIG. 3 is a schematic, elevational view showing the removal of a storm choke from the well after the dissolvable granular material has been properly located; and

FIG. 4 is a schematic, elevational view illustrating the use of an acid dissolvable ball for preventing excessive loss of returns instead of the acid dissolvable granular material.

Referring to the drawings and more particularly to FIG. 1, a casing **10** is shown cemented to the sides of a borehole by the usual cement **12**. A tubing string **14** extends from the earth's surface (not shown) to a point adjacent the subsurface producing formation **16**. The usual perforations **19** have been made through casing **10**, cement **12**, and into producing formation **16** for the production of oils and gases from producing formation **16**.

A tubing string **18** is also provided in the well. The tubing string **18** extends to a point within the well adjacent the subsurface producing formation **16** and is used primarily to form a circulating path from the surface to the well bottom. Tubing string **18**, serving as an alternate to tubing string **14**, may also be used to conduct oils and gases produced from subsurface formation **16** to the earth's surface. The usual packing **20** is provided about the tubing string **14** and tubing string **18**.

The tubing strings **14** and **18** are fluidly interconnected by a crossover or interconnecting line **22** located below the packing **20**. The tubing string **14**, interconnecting line **22**, and tubing string **18** provide a fluid circulating

path into and from the well. A retrievable plug **38** is placed in landing nipple **40** in tubing string **18** at a point below interconnecting line **22**.

A landing nipple **24** is provided within the tubing string **14**. A storm choke **26** is provided with a bore **28** is shown positioned within the landing nipple **24**. The usual seal **30** is provided about the storm choke **26**.

A plurality of perforations **32** is formed adjacent the bottom of tubing string **14**. If it is desired to remove the storm choke **26** with a pump tool circulated into the tubing string **14** from the earth's surface, it is necessary that sufficient circulating pressure be developed. Therefore, a surface pressure test is conducted, as shown in FIG. 1, to estimate whether or not sufficient fluid pressure can be placed against the subsurface formation **16**. If excessive fluid is lost to the subsurface formation **16** at low pressure, sufficient pressure cannot be maintained against the pump tool to remove the storm choke **26**.

My new method and system can be used to remove the storm choke **26** or other similar tools from the tubing string **14** when conventional methods and systems for removing these devices cannot be utilized because of excessive loss of circulating fluid to the subsurface formation. The perforations **32** are provided in tubing string **14** so that acid dissolvable granular material **34** (FIG. 2) may be pumped down the tubing string **14** through the bore **28** of storm choke **26** and into the bottom portion of tubing string **14** to pack off the perforations **32**. The tubing string **14** is closed at the bottom by plate **36** for this purpose.

Examples of acid dissolvable materials are calcium carbonate and aluminum. These materials may be dissolved by acids such as hydrochloric acid or acetic acid. The granular material may be placed into the well by mixing it with viscous fluids, such as oil-water emulsions or conventional drilling muds, in order that the granular material can be pumped as a slug to the proper position. The bridging of the granular material **34** against perforations **32** will sufficiently restrict loss of returns to permit application of adequate pressure against circulated pump tools to allow the storm choke **26** to be removed from the well.

FIG. 3 illustrates the removal of the storm choke **26** from the tubing string **14** by means of reverse circulation after the pump tool **42** has been pumped into the tubing string **14** by direct circulation to engage the storm choke **26**. The pump tool **42** is provided with knuckle joints **44** to permit pumping through curved tubular members and flow lines (not shown) located at the surface. As shown in FIG. 3, the pump tool has engaged the storm choke and is being removed upwardly through tubing string **14** by reverse circulation of fluid through tubing string **18**, interconnecting line **22**, and tubing string **14**.

FIG. 4 shows an alternate to the use of granulated material with a perforated tubing. An acid dissolvable ball **46** is placed on the tapered seat **48** positioned within the tubing string **14'**. The tapered seat **48** is located in a position similar to the location of the perforations **32** of FIGS. 1 through 3. The ball **46** can be made of aluminum or calcium carbonate and can be either porous or fluted to permit acid to be circulated to the bottom when it is desired that the ball be dissolved for restoration of the well to production.

In operation, if the storm choke **26** cannot be removed by conventional means because of loss of returns, the acid dissolvable granular material **34** is pumped down tubing string **14** to bridge the perforations **32**. In the alternative, the acid dissolvable ball **46** can be dropped to the bottom of the well through tubing string **14**. Thereafter, the pump tool **42** is directly circulated down tubing string **14** to engage storm choke **26**. The pump tool **42** along with the storm choke **26** is then removed from the

well by reverse circulation. The well can be returned to production by circulating acid, such as hydrochloric acid or acetic acid, to dissolve the granular material **34** or if the ball **46** is used, to dissolve the ball **46**.

The method and system described herein has applicability to the use of tools other than storm chokes in the well. Also, the method and system may be used to remove material, such as paraffin, by pumping a plug into and from the well.

I claim:

1. A method of removing from a borehole a member having a bore therethrough positioned in the first of side by side first and second tubing strings fluidly interconnected intermediate their ends and included as a part of a system for obtaining hydrocarbons from a subsurface producing formation wherein at least one perforation is provided in said first tubing string adjacent the bottom thereof and wherein the normally open bottom of the second tubing string is closed, said perforation being below said positioned member and below the point of fluid interconnection, comprising the steps of:

introducing acid dissolvable material down the first tubing string and through said member to a position below the point at which the tubing strings are interconnected to pack off the perforation and thereby develop circulating pressure in said tubing strings on pumping fluid therein;

pumping a pump tool down the first tubing string and attaching said pump tool to said member;

pumping the pump tool with the attached member to the surface by circulation of fluid down the second tubing string and up the first tubing string; and

dissolving said acid dissolvable material by circulating acid into contact with said acid dissolvable material to open said perforation.

2. A method in accordance with claim **1** wherein the dissolvable material is a granular material.

3. A method in accordance with claim **1** wherein the dissolvable material is in the shape of a sphere.

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