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(54) **CASING DEGASSER TOOL**

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(57) **ABSTRACT**

A casing degasser tool (CDT) is provided which is adapted to be inserted into production piping such as casing, slotted liners, or production tubing for use during well completion. The CDT comprises a body having a top end, a bottom end and an outer surface, at least one sealing element surrounding a portion of the outer surface of the body and a connection means located at or near the top end of the body for connecting a wire line or other pulling device to the CDT to assist in positioning the CDT within the production piping and for pulling the CDT through the length of the production piping. The CDT can be used when adding joints of production piping to prevent hydrocarbons from flowing to the surface of the well.

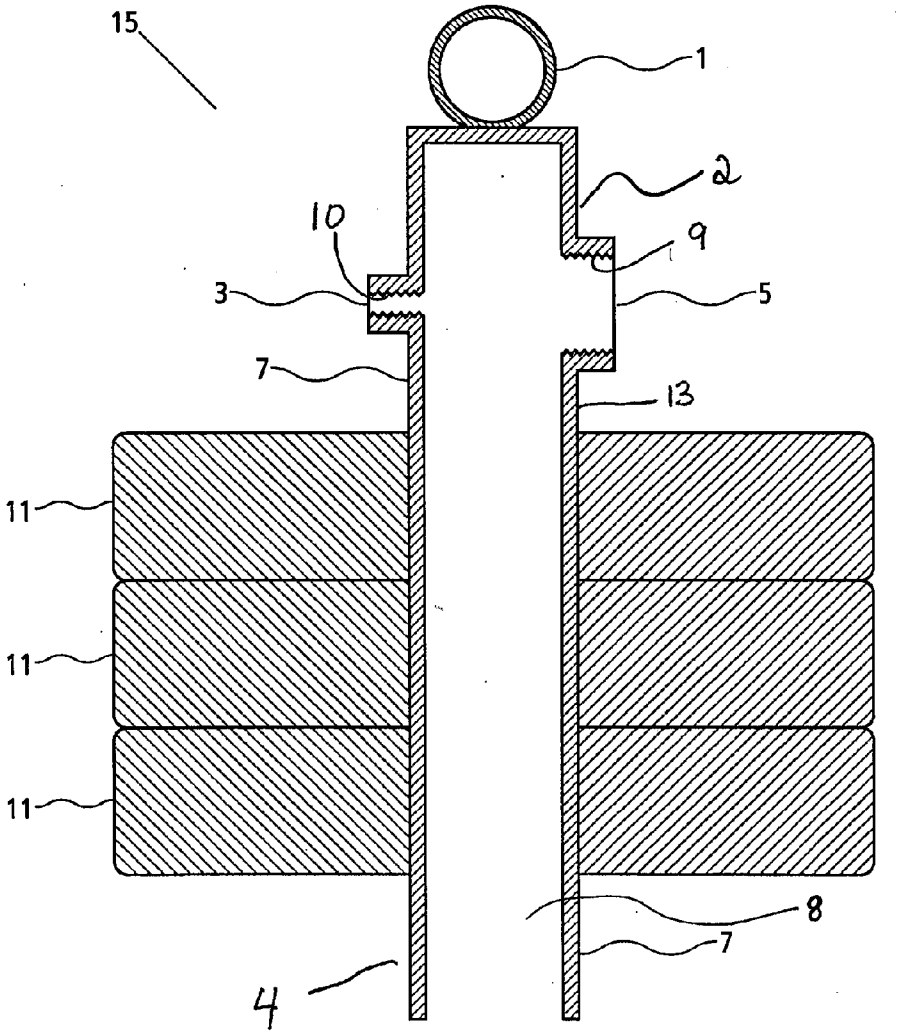


Fig. 1

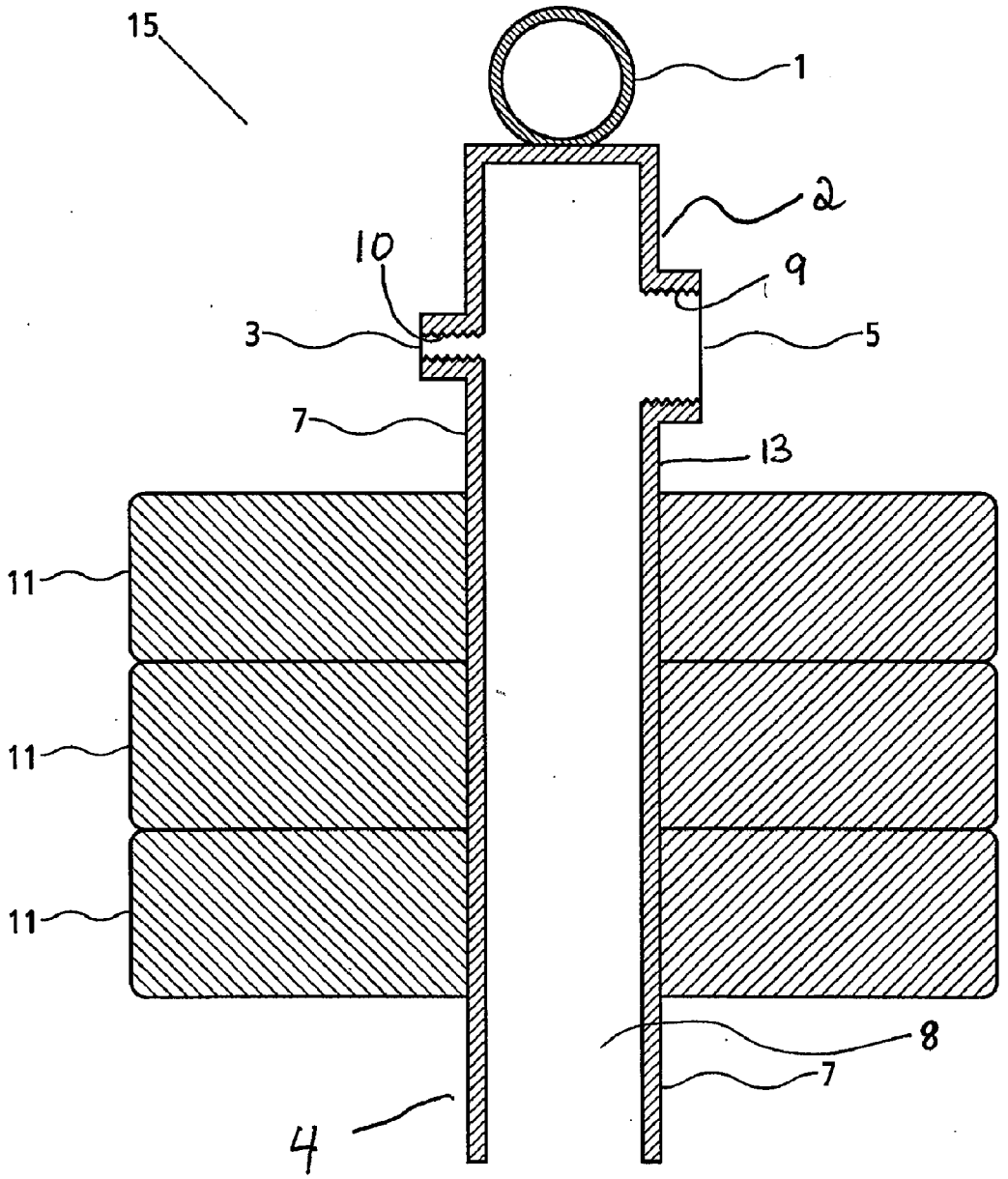
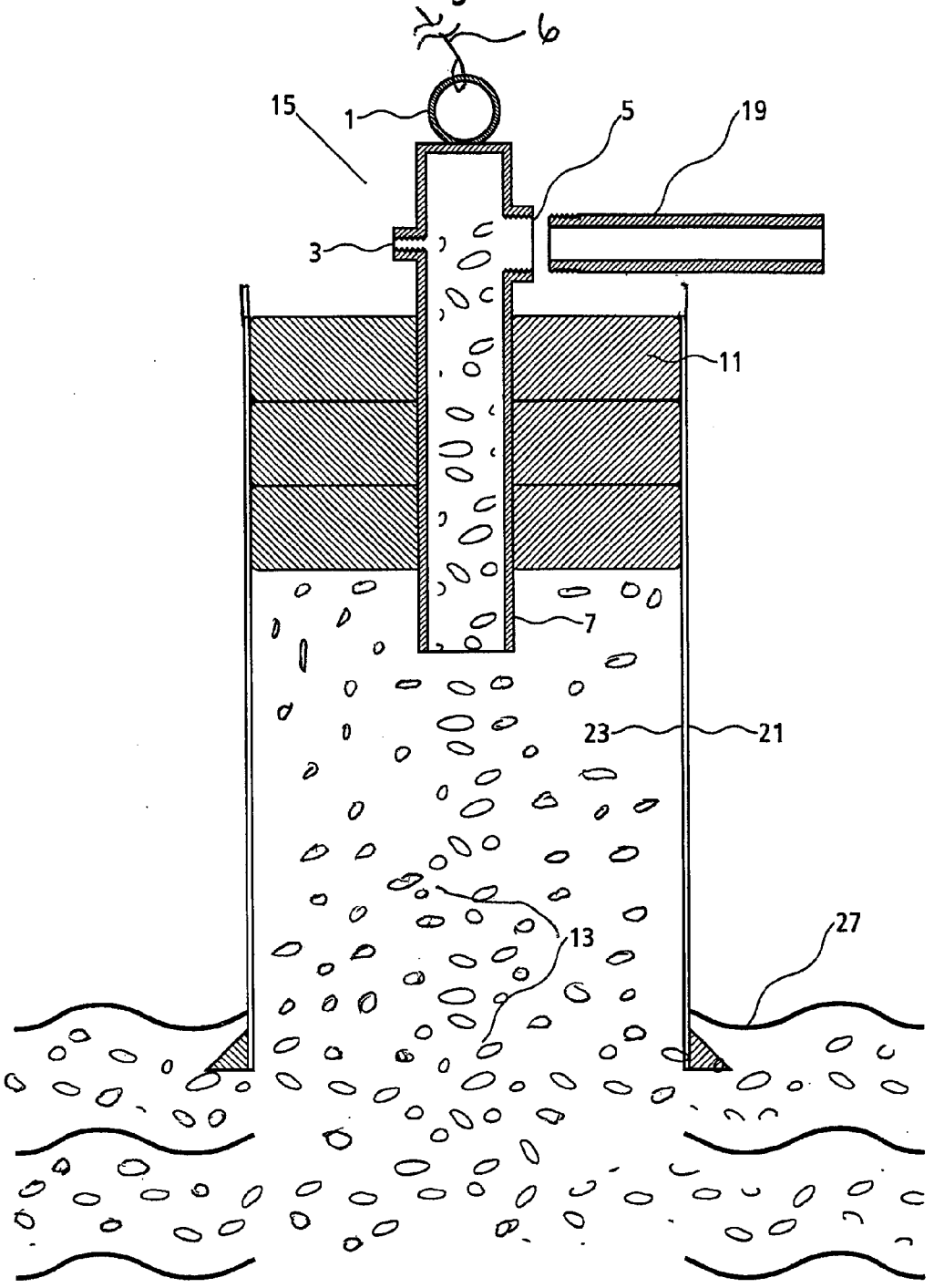


Fig. 2



CASING DEGASSER TOOL

[0001] This application claims the benefit of U.S. Provisional Application No. 60/521,523, filed May 13, 2004.

FIELD OF THE INVENTION

[0002] The present invention relates to an apparatus and method useful for well completion of a wellbore containing hydrocarbons. In particular, the present invention relates to an apparatus adapted to be inserted into production piping, such as casing, slotted liners, or tubing, to control the flow of fluids from the reservoir through the production piping during well completion operations and further relates to a process using said apparatus for running joints of production piping into a wellbore to form a completed well.

BACKGROUND OF INVENTION

[0003] Current technology uses kill fluids to stop the flow of reservoir fluids (e.g. hydrocarbons) so that well completion operations such as running production piping in the wellbore or installing a wellhead assembly at surface can be accomplished without the presence of hydrocarbons. Conventional kill fluids known in the art are typically aqueous liquids such as water or weighted fluids such as drilling mud. The kill fluid applies a hydrostatic pressure against the reservoir fluid, which typically is greater than the pressure exerted by the reservoir fluid attempting to intrude into the wellbore.

[0004] This overbalanced hydrostatic pressure, however, can cause damage to reservoirs, in particular, to reservoirs containing swelling clays or reservoirs having a pressure well below the hydrostatic pressure of the kill fluid being used. Hydrocarbon reservoirs with high permeability and porosity can also be damaged with the use of kill fluids.

[0005] The present invention provides an apparatus and method for carrying out completion activities without the need to kill the flow of hydrocarbons by means of kill fluids.

SUMMARY OF THE INVENTION

[0006] A casing degasser tool (CDT) is provided which is adapted to be inserted into production piping such as casing, slotted liners, or production tubing. One CDT embodiment comprises a body having a top end, a bottom end and an outer surface, and at least one expandable sealing element surrounding a portion of the outer surface of said body. The expandable sealing element can be formed from a material such as expandable rubber, rubber and steel, fiberglass or other composite material, and can be expanded such that it provides a fluid tight seal with the inside wall of the production piping. For example, the sealing element can be an inflatable ring wherein the inflatable ring expands or contracts by pumping fluids into or out of the inflatable ring.

[0007] In another embodiment, the CDT comprises at least one sealing element surrounding a portion of the outer surface of said body, wherein each sealing element has a fixed dimension, which dimension depends upon the inner diameter of the completion piping for which it is designed. Thus, in this embodiment, the sealing element dimension can vary for each type of production tubing but will still provide a fluid tight seal when the CDT is inserted therein. Hence, it is understood that the sealing element of the CDT can come in different sizes to ensure that the CDT always fits snuggly inside the production piping having a range of different inside diameters.

[0008] The body further comprises a connection means located at or near the top end of the body for connecting a wire line or other pulling device to the CDT to assist in positioning the CDT within the production piping and for pulling the CDT through the length of the production piping.

[0009] In one embodiment, the body further comprises an inner cavity extending through the bottom end of the body so that the bottom end of the body is in fluid communication with the inside of the production piping when the CDT is inserted therein. In this embodiment, the body may further comprise a pressure relief fitting and/or a pressure gauge fitting.

[0010] The pressure relief fitting has one end in fluid communication with said inner cavity and an opposite end for connecting a pipe or hose thereto to bleed off hydrocarbons to the surface when necessary during a well completion operation. A flow prover can also be connected to the pressure relief fitting instead of a pipe or hose to test for well production capability at the completion of running the production piping. The pressure relief fitting further comprises a sealing means for keeping the pressure relief fitting sealed until the pipe, hose or flow prover is connected thereto.

[0011] Similarly, the pressure gauge fitting has one end in fluid communication with said inner cavity and an opposite end for connecting a pressure gauge or other instrumentation package thereto for measuring downhole pressure. The pressure gauge fitting further comprises a sealing means for keeping the pressure gauge fitting sealed until the pressure gauge or other instrumentation package is connected thereto.

[0012] A process of running joints of production piping into a wellbore that contains flowing hydrocarbons, which uses the CDT of the present invention, is also provided. The process comprises placing the CDT inside a first joint of production piping, said production piping having a top end and a bottom end, and lowing the production piping into the wellbore bottom end first. The CDT is preferably positioned near the top end of the first joint of production piping and at least one sealing element is in frictional engagement with the inside wall surface of the production piping to provide a fluid tight seal.

[0013] The process further comprises adding a second joint of production piping, said second joint of production piping also having a top end and a bottom end, to the first joint of production piping by coupling the bottom end of said second production piping to the top end of the first production piping with coupling means known in the art. A wire line or other pulling device is then attached to the CDT by first passing it through the second joint of production piping and then attaching it to the connection means located at or near the top of the body of the CDT.

[0014] Finally, the CDT is pulled through the top end of the first joint of production piping, through the bottom end of said second joint of production piping and into the second joint of production piping. The wire line or other pulling device that is connected to the top end of the body of the CDT is then removed and the process is repeated until all joints of production piping have been coupled together.

[0015] To aid in the pulling of the CDT through the production piping, a lubricant such as pipe thread dope may be added to the inside surface of the production piping.

[0016] In another embodiment of the process, the CDT can simply remain positioned in the first joint of production piping at all times during the addition of each new joint of production piping and the CDT pulled through all production piping at once when the well is completed.

[0017] In one embodiment, when the running of the production piping is complete (i.e., all of the joints of production piping have been connected together), well production capability can be tested by connecting a flow prover to the pressure relief fitting of the CDT. The CDT can then be removed by means of the wire line or other pulling device that is connected to the CDT.

[0018] In another embodiment, the process of running production casing into wellbore further comprises periodically checking the downhole pressure by means of a pressure gauge attached to the pressure gauge fitting of the CDT. In another embodiment, the process further comprises bleeding built up pressure from the wellbore, should the downhole well pressure starts to become a concern, by attaching a hose or pipe to the pressure release fitting of the CDT. The pressure then can be bled down by attaching the opposite end of the hose or pipe to a blewie line and allowing the built up hydrocarbons in the well to flow into a flare stack, a tank or a pit.

[0019] This invention may have one or more of the following advantages over the use of kill fluids to stop the flow of hydrocarbons during completion operations:

[0020] (1) time and money can be saved because there is no need to use kill fluids;

[0021] (2) in low and under pressure reservoirs there is less formation damage as compared to the damage caused as a result of the hydrostatic weight of the kill fluid;

[0022] (3) in dehydrated and clay swelling reservoirs there are no fluids to cause damage;

[0023] (4) it provides an alternative method to using a snubbing unit;

[0024] (5) it allows reverse circulated center discharge drilled wells to be completed without having to kill the well;

[0025] (6) wellbores can be safely bled down prior to the installation of the wellhead without using kill fluids;

[0026] (7) well production capability can be tested by connecting a flow prover to the pressure relief fitting at the completion of running the production piping; and

[0027] (8) slotted casing and liners can be run into the wellbore without the need to kill the well.

BRIEF DESCRIPTION OF DRAWINGS

[0028] **FIG. 1** is a schematic of the casing degasser tool of the present invention.

[0029] **FIG. 2** is a schematic of the casing degasser tool inside a joint of production piping.

DETAILED DESCRIPTION

[0030] **FIG. 1** schematically illustrates an embodiment of the present invention. Casing degasser tool **15** comprises a body **7** having a closed top end **2**, an open bottom end **4** and an inner cavity **8**. Disposed around the outside surface **13** of body **7**, at or near bottom end **4**, are a plurality of sealing elements **11**, formed from a material such as rubber or the like. When casing degasser tool **15** is placed inside a joint of production piping, sealing elements **111** provide a fluid tight seal with the inside wall of the production piping.

[0031] Sealing elements **11** may also be made of expandable rubber and the like so that sealing element **11** can be expanded by means of pumping fluid or air therein or by means of an electric current. This assists in the frictional engagement of the sealing element with the inside wall of the production piping to ensure a fluid tight seal. Further, the sealing element can then be contracted slightly to facilitate the pulling of the casing degasser tool **15** through the production piping.

[0032] At or near top end **2** is connection means **1** to which a wire line or other pulling devices known in the art can be attached for positioning the casing degasser tool **15** within the joint of production piping and for pulling the casing degasser tool **15** through the joint of production piping.

[0033] The top end **2** of body **7** further comprises pressure relief fitting **5** having threaded end **9**, which is in fluid communication with the inner cavity **8**. Pressure relief fitting **5** comprises a sealing means (not shown), which seals the pressure relief fitting **5** until a pipe, or hose (shown as pipe **19** in **FIG. 2**) is connected to pressure relief fitting **5** by thread means. The pressure relief fitting **5** and pipe or hose connected thereto are used to bleed off hydrocarbons from the wellbore to the surface of the well, when necessary during a well completion operation. It is understood that a flow prover (not shown) or other instrumentation can also be connected to the pressure relief fitting **5** by thread means for testing well production capability after well completion.

[0034] Casing degasser tool **15** further comprises pressure gauge fitting **3** having threaded end **10**, which is in fluid communication with the inner cavity **8**. Pressure gauge fitting **3** comprises a sealing means (not shown), which seals the pressure gauge fitting **3** until a pressure gauge or other instrumentation package is attached thereto by thread means for measuring downhole pressure.

[0035] **FIG. 2** schematically illustrates casing degasser tool **15** when it is situated inside production piping **21** and said production piping **21** is situated within a wellbore. Sealing elements **111** of casing degasser tool **15** are shown in frictional engagement with the inside wall **23** of production piping **21** to create a tight fluid seal. Reservoir hydrocarbons **13** are thus prevented from flowing out of production casing **21** by sealing element **11**. Further, top end **2** of casing degasser tool **15** is closed so as to prevent the flow of hydrocarbons through the inner cavity **8** of casing degasser tool **15**. Finally, pressure gauge fitting **3** and pressure relief fitting **5** are also in the sealed position, unless pipe, tubing, pressure gauges and other instrumentation are connected thereto, and thus hydrocarbons cannot escape therethrough.

[0036] A surface control system comprising a surface blowout preventor (not shown) can also be used in combination with the present invention. A surface blow out preventor will prevent the flow of any hydrocarbons that may escape on the outside of the production piping through the annulus formed between the outer wall of the production piping and the wellbore wall during well completion.

[0037] Once a new joint of production piping is added to existing production piping **21**, wire line **6** is fed through the new joint of production piping and through production piping **21** and attached to connection means **1**. Casing degasser tool **15** is then pulled first through the top of production piping **21** and then through the bottom of the newjoint of production casing so as to position casing degasser tool **15** preferably in the upper portion of the new piece of production casing. It is understood that during the addition of each joint of production casing, wire line **6** is first removed and then reattached to pull the casing degasser tool **15** into the newly added joint of production piping.

[0038] In the alternative, casing degasser tool **15** can remain situated in the first joint of production piping until all subsequent joints of production piping have been added. Wire line **6** is then threaded through all interconnected joints of production piping and attached to connection means **1**. Casing degasser tool **15** is then pulled through all joints of production piping upon well completion.

[0039] To facilitate the movement of the casing degasser tool **15** through production piping, sealing element **11**, if expandable, may be slightly contracted to allow casing degassing tool **15** to move more freely through the production piping. In the alternative, if sealing element **11** is not expandable, a lubricant such as pipe thread dope may be added to the inside surface of each joint of production piping to facilitate the movement of the degasser tool **15** through the production piping.

[0040] Pressure of formation **27** is monitored by connecting a proper pressure gauge (not shown) to pressure gauge fitting **3**. When necessary to bleed off pressure from formation **27**, hose or pipe **19** is connected to pressure relief fitting **5** and hydrocarbons **13** are flared through a blewie line (not shown) attached to the opposite end of pipe **19** or put into tank or pit (not shown). In the alternative, a flow prover (not shown) can be connected to pressure relief fitting **5** at the completion of running the production piping to test for well production capability.

[0041] While the foregoing is directed to one embodiment of the present invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of the invention.

What is claimed is:

1. A casing degasser tool adapted to be inserted into a joint of production piping, the production piping having an inner wall, for preventing the flow of hydrocarbons through the production tubing during well completion, comprising:

(a) a body having a top end, a bottom end and an outer surface;

(b) at least one sealing element surrounding the outer surface of the body; and

(c) a connection means located at or near the top end of the body for connecting a wire line or other pulling device to the casing degasser tool;

whereby when the casing degasser tool is inserted into the production piping, the sealing element is in frictional engagement with the inner wall of the production piping.

2. The casing degasser tool as claimed in claim 1 wherein the sealing element is expandable.

3. The casing degasser tool as claimed in claim 1 wherein the sealing element comprises an inflatable ring.

4. The casing degasser tool as claimed in claim 3 wherein the inflatable ring expands or contracts by pumping fluids into or out of the inflatable ring.

5. The casing degasser tool as claimed in claim 1 wherein the body further comprises an inner cavity extending through the bottom end of the body so that the inner cavity is in fluid communication with the production piping.

6. The casing degasser tool as claimed in claim 5 wherein the body further comprises a pressure relief fitting having one end in fluid communication with the inner cavity and an opposite end adapted to be fitted to a pipe or hose for bleeding off the hydrocarbons.

7. The casing degasser tool as claimed in claim 5 wherein the body further comprises a pressure gauge fitting having one end in fluid communication with the inner cavity and an opposite end adapted to be fitted to a pressure gauge for measuring downhole pressure or a flow prover for testing well production capability.

8. A process for running joints of production piping into a wellbore containing flowing hydrocarbons, comprising:

(a) positioning a casing degasser tool as claimed in any of claims 1 to 7 inside a first joint of production piping, the first joint of production piping having a top end, a bottom end and an inner wall, such that the sealing element of the casing degasser tool is in frictional engagement with the inner wall of the first production piping;

(b) lowering the first joint of production piping into the wellbore bottom end first;

(c) adding a second joint of production piping, the second joint of production piping having a top end, a bottom end and an inner wall, to the first joint of production casing by coupling the bottom end of the second joint of production piping to the top end of the first joint of production piping with coupling means;

(d) attaching a pulling device to the connection means of the casing degasser tool; and

(e) pulling the casing degasser tool through the top end of the first joint of production piping, through the bottom end of the second joint of production tubing and into the second joint of production piping, so that the sealing element is in frictional engagement with the inner wall of the second joint of production piping.

9. The process as claimed in claim 8 further comprising checking the downhole pressure by means of a pressure gauge attached to the pressure gauge fitting of the casing degasser tool.

10. The process as claimed in claim 8 further comprising bleeding built up pressure from the wellbore by attaching a

hose or pipe to the pressure release fitting of the casing degasser tool and allowing the hydrocarbons to flow into a flare stack, a tank or a pit.

11. The process as claimed in claim 8 further comprising testing well production capability by means of a flow prover attached to the pressure gauge fitting of the casing degasser tool.

12. A process for running joints of production piping into a wellbore containing flowing hydrocarbons, comprising:

(a) positioning a casing degasser tool as claimed in any of claims 1 to 7 inside a first joint of production piping to be lowered into the well bore, the first joint of production piping having an inner wall, such that the sealing element of the casing degasser tool is in frictional engagement with the inner wall of the first production piping;

(b) lowering the first joint of production casing into the wellbore;

(c) adding additional joints of production piping to the first joint of production piping until all the joints of production piping have been added;

(d) attaching a pulling device to the connection means of the casing degasser tool; and

(e) pulling the casing degasser tool through the joints of production piping to the surface of the well.

13. The process as claimed in claim 12 further comprising checking the downhole pressure by means of a pressure gauge attached to the pressure gauge fitting of the casing degasser tool.

14. The process as claimed in claim 12 further comprising bleeding built up pressure from the wellbore by attaching a hose or pipe to the pressure release fitting of the casing degasser tool and allowing the hydrocarbons to flow into a flare stack, a tank or a pit.

15. The process as claimed in claim 12 further comprising testing well production capability by means of a flow prover attached to the pressure gauge fitting of the casing degasser tool.

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