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(54) Title: WELLBORE ACTIVATION SYSTEM

(57) Abstract: A wellbore activation device and method of use in downhole operations are provided. The device comprises a deployment member packaged in a first configuration and arranged to be deployed from said first configuration upon deployment of the activation device within a wellbore, and an activation mechanism for activating the operation of a tool, the activation mechanism being operable upon the deployment or unwinding of a predetermined length of the deployment member. The wellbore activation device and method may initiate the operation of one or more downhole tools.

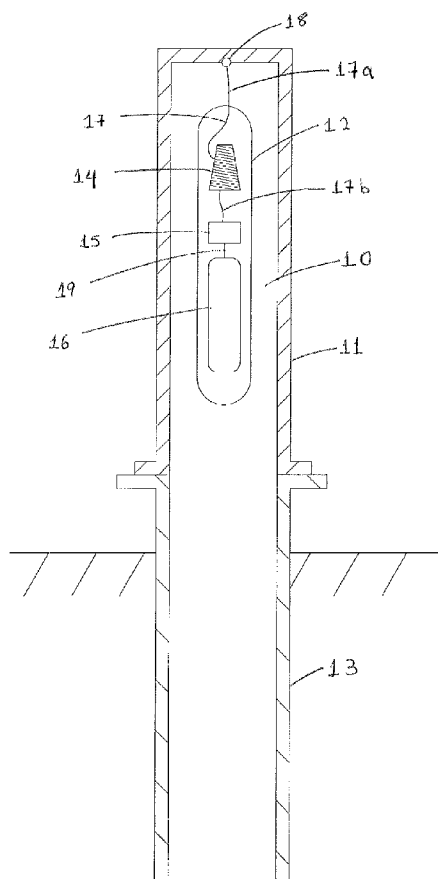


Figure 1





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Wellbore Activation System

FIELD OF INVENTION

5 The present invention relates to a wellbore activation device, and a method of using the same in oil and gas operations.

BACKGROUND OF THE INVENTION

10 Oil and gas operations employ a plurality of downhole tools. Such tools may be deployed within the borehole temporarily to support temporary operations such as perforating, or may be run as part of a well pipe in wellbore completions to allow long-term repetitive operations.

15 In some instances, as for example in the case of a tool which is temporarily deployed within a wellbore to perform a certain operation, activation of the tool should occur at a precise location within the wellbore.

20 In other situations, as in a multi-zone well operation, the well pipe may comprise a plurality of permanently deployed tools that may need to be selectively activated at different times to allow treatment of, or fluid production, from different well zones as desired.

25 Various tools and mechanisms are heretofore used for the activation of downhole tools, however, sequential activation of a series of downhole tools, or activation of a downhole tool at a precise location may not always be an easy operation employing existing wellbore activation devices.

SUMMARY OF THE INVENTION

 An aspect of the present invention is directed to a wellbore activation device comprising:

30 a deployment member packaged in a first configuration and arranged to be deployed from said first configuration upon deployment of the activation device within a wellbore; and

 an activation mechanism for activating the operation of a tool, the activation mechanism being operable upon the deployment of a predetermined length of the deployment member.

In use the activation device may be deployed within a wellbore with the first end of the deployment member anchored at a location at or near the surface. As the activation device is deployed into the well bore the deployment member is deployed from said initial configuration.

5 The activation mechanism may be initiated upon the deployment of a predetermined length of the deployment member. According to an embodiment, the activation mechanism may be initiated upon full deployment of the deployment member. In this manner, the wellbore activation device may be deployed and/or activated to a precise location within the wellbore as determined by the length of the deployment member that is packaged or loaded in said first configuration without the need of measuring the length of the deployment member that has been deployed .

10 The activation mechanism may initiate the operation of one or more downhole tools. Thus, the wellbore activation device may allow activation of a downhole tool at a precise wellbore location which is determined by the length of the deployment member that has been deployed.

15 The activation device may also initiate the operation of a first tool which in turn may activate another downhole tool. For example, the first tool may be a variable size dart such as an expandable dart which may be activated to vary its size for example by expanding or contracting before reaching a corresponding mating seat or mechanism of a downhole tool such as the landing seat of a dart or drop ball operated sliding sleeve tool. In this manner, the activation device may be used to selectively activate a specific tool within a series of identical tools positioned at different locations within a wellbore completion. For example, the present activation device may eliminate the need to provide downhole tools such as drop ball operated sliding sleeves with varying size ball seats, as the same sliding sleeves with identically sized seats may be selectively activated by use of the present invention activation device.

20 Thus, the activation device may be initiated at a precise desired downhole position as indicated by the length of the deployment member that has been deployed. The activation device may be initiated once a predetermined length of the deployment member has been deployed or may be initiated once the whole length of the deployment member has been deployed.

25 Other conditions may be included as prerequisites for the activation or initiation of the activation. For example the activation device may comprise a safety device that prevents initiation of the activation device unless a certain condition is met in order to prevent accidental activation.

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The activation device may be initiated provided the ambient pressure on the activation device is above a safe pressure threshold to prevent accidental initiation of the activation device at the surface. For example, the activation mechanism may comprise a shear pin that may shear only when the ambient pressure on the activation device exceeds a predefined pressure threshold.

The activation device may be initiated provided the ambient temperature on the activation device is above a certain temperature threshold. For example, the activation mechanism may comprise a temperature sensitive device such as a shear pin made from a material that softens or melts above a predefined temperature so that when the ambient temperature on the activation device exceeds the predefined temperature the shear pin may sufficiently soften or melt, thus allowing the activation mechanism to be initiated.

The activation device may comprise a first tool.

The first tool may be deployed or deployable within the wellbore with the activation device. The first tool may be an integral part of the activation device. The first tool may be mounted to the activation device.

The first tool may in turn initiate the operation of a second tool. The second tool may also be a tool deployed with the activation device. The second tool may be part of a wellbore completion.

The activation device may be used to initiate the operation of any number of suitable tools. The tool may be any suitable downhole tool. Examples of suitable tools may include but are not limited to a perforation gun or a set of perforating guns, an explosive charge, a cutting tool, a tubing cutter, a casing cutter, a dart, a dart that changes dimensions such as an expandable or contractable dart also referred to as a variable size dart, a drop ball, a drop ball that changes dimensions such as an expandable or contractable drop ball also referred to as a variable size drop ball, a flow control device such as a sliding sleeve, a down hole choke, a ball valve, a fluid loss device, a seal forming device such as a packer, a plug, a pump down plug, a plug that changes dimensions such as an expandable or contractable plug also referred to as a variable size plug, a shifting tool, a device that uses slips to anchor itself into a tubing or casing, a tubing patch, a casing patch, a straddle tool and the like.

The tool may be any tool that may be deployed into a well and may require to be activated at a particular location or at a particular time during a well operation.

The activation device may comprise a variable size tool. An example of a variable size tool may be an expandable tool such as an expandable dart which may

expand upon initiation of the activation device to obtain a larger effective diameter. Upon expansion, the expanded tool or dart may engage a corresponding operating mechanism such as a seat of a wellbore tool to cause the initiation of the operation of the wellbore tool. For example, the wellbore tool may be a sliding sleeve which upon engagement of the expanded dart with the seat of the sliding sleeve, the sliding sleeve may slide to an open position uncovering one or more ports to allow injection of a fluid into the wellbore as it is often desirable in fracing, chemical injection, well stimulation or wellbore fluid production operations. The tool may comprise a profile for allowing retrieval of the tool once the operation is completed using a fishing tool having a corresponding mating profile.

The activation device may comprise a frame or housing for supporting the various components of the activation device.

The frame may comprise any suitable shape provided it may readily be deployed within the wellbore.

The frame may be made of, or comprise, any suitable material including, but not limited to metal, metal alloys, plastic, rubber, degradable materials, and the like. Examples of suitable materials may include steel, stainless steel, other steel alloys, non-corrosive steel alloys, high impact rubber, high impact thermoplastic materials, water soluble plastics and rubbers, oil soluble plastics and rubbers, other degradable or dissolvable materials and the like. According to an embodiment of the invention the frame may be made of steel. According to another embodiment of the invention the frame may comprise a degradable plastic.

The activation device may further comprise a spool for winding the deployment member thereon in a first configuration prior to deployment. The spool may be mounted to the frame. The spool may be mounted to the frame using a releasable fastener that releases the spool after initiation of the activation mechanism. The spool may be mounted to the frame securely using conventional fasteners so that it may remain connected to the frame upon initiation of the activation mechanism.

The spool may be an integral part of the frame.

The spool may be an insert that may readily be inserted within a corresponding pocket of the frame.

The spool may be loaded with the desired length of the deployment member before or after the spool is mounted or inserted on the activation device frame.

The spool may be made of any suitable material including but not limited to metal, metal alloys, plastics, rubbers, water soluble plastics and rubbers, oil soluble

plastics and rubbers, other degradable or dissolvable materials and the like. The spool may have any suitable shape and size. The spool may comprise a barrel or cylinder around which the deployment member may be wound. The spool may comprise a flanged cylinder or barrel.

5 The spool may be a single piece.

 The spool may comprise a split arrangement comprising two or more cooperating parts. The two or more parts of the split arrangement spool may be held together in a first position via a holding mechanism whereas upon release of the holding mechanism the split arrangement may shift in a second position. Shifting of the split arrangement from the first to the second position may be a requirement for the initiation of the activation mechanism. Upon shifting of the split arrangement from the first to the second position the activation mechanism may be activated or initiated.

10 According to one embodiment, the spool may be a split arrangement comprising two parts that are held together in a first position via a holding mechanism whereas upon release of the holding mechanism the two parts may shift to a second position. According to this embodiment, shifting of the two parts of the spool from the first position to the second position may be a requirement for the initiation of the activation mechanism.

15 The holding mechanism may be or comprise any suitable mechanism. The holding mechanism may comprise the deployment member being wound around the spool split arrangement, whereas upon unwinding of the deployment member the split arrangement may shift to the second position.

 The deployment member may be any suitable deployment member.

20 According to one embodiment the deployment member may be sufficiently thin to allow a sufficient length of the deployment member to be wound on the spool. The deployment member may at the same time be sufficiently strong to hold the weight of the activation device including the weight of the deployment member itself and of any associated tool or tools as the case may be.

25 The deployment member may be a spoolable member. The deployment member may be a spoolable member wound on a spool.

30 The deployment member may be or comprise a line made from Vectran and/or Kevlar fibres, monofilament polymer, steel, copper, glass fibre or any other material that can be formed into a wire, thread, line or braid. According to an embodiment of the invention deployment member may be or comprise a line made from Vectran and/or Kevlar fibres.

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The deployment member may be made from a material that degrades or dissolves in the presence of well bore fluids. The deployment member may exhibit a sufficiently high strength, thermal stability and low stretch or deformation for supporting the weight of the activation device under the wellbore ambient temperature conditions.

5 The deployment member may exhibit a sufficiently high strength, thermal stability and low stretch or deformation for supporting the self- weight of the deployment member when it is fully unspoiled and suspended in a well under the wellbore ambient temperature conditions. The deployment member may exhibit a sufficiently high strength, thermal stability and low stretch or deformation for supporting
10 the flow induced forces caused by the fluid flow around and along the deployment member suspended in the well as injection and/or fracturing fluids are pumped into the well.

 The deployment member may include an electrical and/or a fibre optic component, for example to support signal control, power and/or data communications
15 as may be needed.

 The deployment member may be of any suitable diameter provided that the deployment member is sufficiently thin to permit storing a sufficient length of the deployment member on the available volume provided by the spool.

 Various materials may be used to control unintentional deployment or
20 unwinding of the deployment member. For example, a wax, varnish, lacquer, grease or any other material with semi sticky properties may be applied on the loaded deployment member to keep the deployment member from deploying unintentionally.

 The wellbore activation device may be introduced within the well using conventional methods and devices such as conventional lubricator devices, dart and/or
25 ball launching devices, or by manually removing or breaking into a section of surface pipework. Such devices, methods and operations are well known to those skilled in this art and therefore will not be described in any detail.

 Once inside the well, the wellbore activation device may have the first end of the deployment member anchored to a suitable location. The anchoring device may
30 employ a hook, a knot, a clamp, a magnet or magnets or any other suitable method to secure the first end of the deployment member.

 The wellbore activation device may be deployed immediately once it is introduced into the well or it may be held within a surface launcher until such time as deployment is required. A method by which the wellbore activation device may be held
35 may be or comprise, for example, a valve in a closed position which when moved to an

open position allows the wellbore activation device to deploy into the well. Multiple wellbore activation devices may be held awaiting sequential deployment. Various holding and launching devices may be used without departing from the scope of the present invention. Once the wellbore activation device has been released from the holding device it is said to be deployed or launched. Gravity may then cause the wellbore activation device to fall down the well causing the deployment member to be deployed.

The wellbore activation device may also be deployed within a wellbore by the injection of a fluid. Such a method may be employed, for example, if the well is to be fractured or stimulated by chemical injection. Deploying the wellbore activation device by pumping fluid into the well allows the wellbore activation device to access deviated or horizontal wells where gravity may not be sufficient to transport the wellbore activation device to a specified location.

The wellbore activation device may be deployed within a wellbore by the combined action of gravity and a pumped fluid.

The activation mechanism may be any suitable activation mechanism.

The activation mechanism may be operable upon the deployment of a predetermined length of the deployment member. The activation mechanism may be an integral part of the frame of the activation device. The activation mechanism may be a separate device operably connected to the spool. The activation mechanism may be a separate device that may be mounted to the frame of the activation device. The activation device may comprise one or more parts which may be mounted to the frame of the activation device or form an integral part of the activation device.

The activation mechanism may be or comprise an energy storage mechanism which may release the stored energy to activate a tool once a predetermined length of the deployment member or the entire length of the deployment member is deployed. For example the activation may be or comprise a mechanical energy storage mechanism such as one or more compressed coils, springs, snap rings and the like which are held in a compressed state during deployment and are allowed to expand and release the stored energy in order to activate a tool. For example the spring or springs may displace a first member which in turn may displace a second member that causes the activation of a downhole tool. For instance the second member may cause the extension of the extendable members of an expandable dart, or the sliding of a sleeve to open one or more ports of a sliding sleeve tool, or the setting of a mechanical packer, a plug and the like. Alternatively, the activation mechanism may be or comprise

a chemical energy storage mechanism. For example the activation mechanism may comprise an explosive or propellant material that may be initiated once a predetermined or the entire length of the deployment member is deployed. According to one embodiment the activation mechanism may comprise a first member also referred to as a hammer or firing bolt, and a second member also referred to as a percussion initiator whereas upon deployment of the activation device at the specified downhole location the hammer strikes the percussion member. The percussion initiator may contain a small amount of a suitable explosive material which may be initiated upon impact. The explosion may initiate the operation of a first tool. The explosion of the percussion initiator may be transmitted via a detonation cord to one or more explosive charges which may be ignited. The hammer may be held in a first position during deployment by virtue of a number of holding devices or mechanisms to prevent accidental striking of the hammer on the percussion initiator. Once, the activation device is deployed at the specified position then the hammer is released and it is allowed to strike the percussion initiator thus creating an explosion which in turn initiates the operation of a first tool. The holding device may comprise a pull out pin holding a safety pin or wedge at a first position preventing the hammer from striking the percussion initiator. The pull out pin may be tied to the deployment member so that upon unwinding of the full length of deployment member, the deployment member pulls the pull out pin thus freeing the wedge to move to a second position thus allowing the hammer to strike the percussion initiator. The hammer may be designed to strike the percussion initiator by virtue of the action of a compression coil or spring or any other suitable device.

According to one aspect of the present invention there is provided an activation device comprising a deployment member, an activation mechanism comprising a hammer and a percussion initiator, a detonation cord and a perforation gun having multiple charges. The deployment member may be preloaded with a sufficient length for deploying the perforation gun to a desired wellbore location. Once at the desired location, the hammer is released to strike the percussion initiator causing it to explode. The explosion is then transmitted via the detonation cord to a plurality of charges carried by the perforation gun to fire the gun and perforate the casing/tubing and/or wellbore. The deployment member may be preloaded or wound on a spool or alternatively may be packaged in a first configuration without the need of a spool. According to another aspect of the present invention there is provided a wellbore activation device comprising a deployment member, and an activation mechanism. The

activation mechanism may comprise a first member and an expandable second member or members. The activation device may comprise a housing or frame. The housing may comprise a main body and other components as may be needed to house and secure the various components of the wellbore activation device, such as the deployment member, and the activation mechanism. The deployment member may be preloaded with a sufficient length to allow deployment of the wellbore activation device and cause actuation at a specified location within the wellbore. Once at the specified location the first member of the activation mechanism may be released allowing the first member to operably interact with the second member or members. The second member or members may thereby be moved from a first position to a second position, wherein the first position may be a collapsed or retracted position and the second position may be an extended or expanded position. In the second position, the second member or members adopt a configuration with an effective diameter greater than the effective diameter of the second member or members in the first position and greater than the effective diameter of the activation device overall. In this expanded configuration the activation device may be used as a first tool to operate a second downhole tool such as a tool comprising a sliding sleeve. The deployable member may be preloaded on a spool or alternatively may be packaged or wound in first configuration without the need of a spool. Thus, according to this embodiment, the wellbore activation device may obtain, upon activation, an expanded configuration that allows engagement with a mating seat or other device or mechanism of a downhole tool. It should be understood, however, that according to a variation of this embodiment the activation device may further comprise a first tool which may be mounted to the housing or frame of the activation device the first tool being operable to obtain an extended or expanded configuration upon initiation of the activation mechanism.

The sliding sleeve may comprise a seat and drop ball operating mechanism for controlling the operation of the sliding sleeve. Typically, the sliding sleeve may be held in a closed position, covering one or more ports in a wellbore tubular, by a device or mechanism or shearable member. The seat may be connectively associated with the sliding sleeve such that a force applied to the seat may be transmitted to the shearable member. The passage way through the seat may have an effective internal diameter greater than that of the activation device when the second member or members are in the first retracted position but less than that of the activation device when the second member or members is in the second extended position. With the second member or

members in the first retracted position the activation device may be capable of passing through the internal diameter of the downhole tool. With the second member or members in the expanded second position the activation device of the first tool may engage with the seat of the downhole tool to operate the downhole tool. For example, 5 when the downhole tool is a sliding sleeve, the activation device may, upon engagement with the seat of the sliding sleeve, apply a force to the seat causing the shearable device to shear and the sliding sleeve to move to the open position.

A wellbore may contain a plurality of downhole tools. The plurality of downhole tools may be placed in a sequence in the well. The plurality of downhole tools may all 10 have substantially the same effective internal seat diameter. Selective actuation of any one of the second tools may be achieved by deploying an activation device comprising a variable size tool such as an expandable member or an expandable tool with a deployment member configured to actuate the expandable member or expandable tool at a specified location. The specified location may be any location 15 between two adjacent downhole tools in a sequence of downhole tools whereby adjacent downhole tools may comprise an upper downhole tool which may not to be selectively actuated and a lower downhole tool which may be selectively actuated. Thus using a variable size tool the present invention wellbore activation device may facilitate the activation of a plurality of downhole tools that form part of a completion 20 without the need to vary the size of the downhole tools in the completion.

Yet another aspect of the present invention is directed to a method for the activation of a wellbore tool, the method comprising:

introducing the inventive wellbore activation device inside a well;

25 anchoring a first end of a deployment member to a well structure at or near the surface;

launching the well bore activation device into the well bore under the action of gravity and/or fluid flow;

deploying or unwinding the deployment member and;

30 initiating the activation device once a predetermined length of the deployment member has been deployed or unwound.

The initiating step may occur once the entire length of the deployment member has been deployed or unwound. Initiation of the activation device may activate the

operation of one or more wellbore tools. According to one embodiment of the present invention method initiation of the activation device activates the operation of a first tool which in turn may activate a second tool. For example the first tool may be a variable size tool which upon activation obtains a different effective configuration and may then engage the seat of a second downhole tool. Examples of variable size tools may include but are not limited to expandable or contractable darts, drop balls, or plugs. For example, the first tool may be an expandable dart which upon activation obtains a larger, expanded effective diameter and may then engage the seat of a second downhole tool such as a sliding sleeve to operate the downhole tool

According to another embodiment of the present invention method initiation of the activation device activates the operation of a perforation gun.

According yet to another embodiment of the present invention method initiation of the activation device activates the operation of a pipe cutter device. The pipe cutter device may be any suitable cutter device for cutting pipe such as casing, conductor pipe, marine risers, or all others tubular components in a wellbore. Examples may include but are not limited to any suitable casing or drillpipe cutters such as hydraulic pipe cutters or mechanical casing cutters. According to one embodiment, the pipe cutter may comprise one or more cutter arms reinforced with a suitable hard material such as tungsten carbide. The cutter arms may be retractable to allow ready deployment within a wellbore in a retracted configuration. Once the pipe cutter is deployed in a desired location within the wellbore the activation device will cause the pipe cutter to be activated and the cutter arms to expand to commence the cutting operation. Deployment and retraction of the cutter arms maybe achieved by hydraulic pressure or mechanical action which may in turn be initiated by the activation device.

The pipe cutter may also be an explosive type cutter employing a shaped charge that provides, for example, a 360 degree radial explosive jet to cut a pipe.

The pipe cutter may also be a chemical cutter, for example, the pipe cutter may use a propellant to generate pressure forcing a chemical on the pipe to dissolve and cut the pipe.

The present invention wellbore activation device may be employed with plug-and-perf completions. Specifically, according yet to another embodiment of the present invention there is provided a plug-and-perf method for multistage treatment for cased hole wells, the method comprising:

providing a wellbore completion having a plurality of no-go rings;

providing a wellbore activation device having an obstructing member such as a plug, a drop ball or a dart and a perforation gun;

deploying the wellbore activation device to position the obstructing member to a first no-go ring to isolate a first zone of the well; and

5 activating the perforation gun to perforate a second zone situated above said first zone.

The obstructing member may have any suitable shape and size for blocking the opening of the no-go ring.

10 The plug-and-perf method may comprise pumping a stimulation or treatment fluid into the wellbore and through the perforations into the formation. Upon completion of the stimulation of a first zone, a second obstructing member and perforation gun may be deployed within the wellbore with the wellbore activation device to plug-and-perf another zone of the formation. The process may be repeated as many times as needed. One advantage of using the wellbore activation device of the present invention
15 is that the obstructing member and the perforation gun may be deployed at the same time and arranged so that upon positioning of the obstructing member within or on the no-go ring the perforation gun may then be fired almost instantaneously thus significantly reducing the time needed for such operation.

20 The plug-and-perf method may employ a variable size obstructing member. This is advantageous as it may allow isolation of different zones of the formation using only one type of no-go ring in the completion.

25 According to yet another embodiment of the plug-and-perf method the no-go rings are not pre-installed in the completion but are installed during deployment using the wellbore activation device of the present invention. For example, a wellbore activation device may be equipped with a no-go ring, and a perforation gun which may be deployed simultaneously within the wellbore at a desired location. A no-go ring may be anchored or swaged to the internal wall of the tubular of the completion using any suitable method including, for example, an explosive method. According to one
30 embodiment, an expandable no-go ring may be employed having one or more spikes on its external wall, wherein the spikes are designed to anchor the no-go ring on the internal wall of the completion tubular by expanding the no-go ring when the no-go ring reaches the desired location within the completion. The force to expand the no-go ring may be generated, for example, using a plurality of explosive shaped charges positioned in the internal diameter of the no-go ring, designed to force the no-go ring
35 outwardly upon initiation thus causing the no-go ring to expand and force the spikes to

anchor to the tubular of the completion. The perforating gun is initiated to perforate the wellbore above the no-go ring. An obstructing member such as a plug, a drop ball, or a dart may be pumped to block the opening of the no-go ring so that a treatment fluid is diverted through the perforations into the formation.

5 Another aspect of the present invention is directed to a wellbore activation device comprising a deployment member packaged in a first configuration and arranged to be deployed upon deployment of the wellbore activation device within a wellbore, an activation mechanism for activating the operation of a tool, the activation mechanism being operable upon the deployment of a predetermined length of the
10 deployment member, wherein said tool is a variable size tool. The variable size tool may be selected from the group comprising a dart, a plug, a drop ball and the like.

 The present invention wellbore activation device and method provide deployment and/or activation of a downhole tool at a precise location within a wellbore. The present invention wellbore activation device may also facilitate the sequential
15 activation of a series of wellbore tools. Other advantages of the present invention wellbore activation device will become apparent to a person skilled in this art from the detailed description of the invention in association with the following drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

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 These and other aspects of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

 Figure 1 is a simplified, diagrammatic, longitudinal cross-sectional view of a wellbore activation device, according to one embodiment of the present invention.

25 Figures 2A to 2D are simplified diagrammatic illustrations of the wellbore activation device of Figure 1 as used for perforating a borehole, according to one embodiment of the present invention.

 Figures 3A to 3F are simplified diagrammatic illustrations of a use of an activation device as used for activating a downhole tool, according to one embodiment
30 of the present invention.

 Figures 4A to 4E are simplified diagrammatic illustration of the use of a borehole activation device for activating one or more wellbore tools in a horizontal multi-zone well according to one embodiment of the present invention.

 Figure 5 is an enlarged, longitudinal, cross-sectional view of an activation
35 device, according to one embodiment of the present invention.

Figure 6 is an enlarged, longitudinal, cross-sectional view of an activation device, according to another embodiment of the present invention.

Figure 7 is an enlarged, longitudinal, cross-sectional view of an activation device, according to yet another embodiment of the present invention.

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DETAILED DESCRIPTION OF DRAWINGS

Figure 1 provides a simplified, diagrammatic, longitudinal, cross-sectional view of a wellbore activation device generally identified by reference numeral 10, in accordance with an embodiment of the present invention. The wellbore activation device 10 may be introduced within a well and held in position within the walls of a tubular 11 for use in downhole operations. Tubular 11 is a diagrammatic simplified illustration of a wellhead region and may represent a lubricator section, a ball or dart launcher, a deployment head or any other suitable device for entering the wellbore activation device inside the well head.

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The wellbore activation device 10 comprises a frame or housing 12 within which there are disposed a spool 14, an activation device or mechanism 15 and a tool 16. It should be understood that the specific configurations of the wellbore activation device described herein are provided by way of example only and are not intended to limit the scope of the invention as claimed. For example, although the wellbore activation device 10 is shown having a spool 14, such spool is optional and the activation device may simply comprise a deployment member packaged or wound in a first configuration without a spool and arranged to be deployed or unwound from said first configuration upon deployment of the activation device within a wellbore.

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The spool 14 has a quantity of a deployment member 17 wound thereon for use in spooling out the device 10 inside the wellbore. A first end 17a of the deployment member 17 is attached to the anchor device 18 mounted to a top wall of the tubular 11. A second end 17b of the deployment member 17 is attached to the activation device 15. At an initial position as shown in Figure 1, the deployment member 17, other than its end sections 17a and 17b, is wound around the spool 14.

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The tool 16 may be mounted to the frame and is operatively connected to the activation device 15 via a member 19.

The deployment member 17 may be or comprise a line made from Vectran and/or Kevlar fibres, monofilament polymer, steel, copper, glass fibre or any other material that can be formed into a wire, thread, line or braid.

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The deployment member 17 may be made from a material that degrades or dissolves in the presence of well bore fluids.

5 The deployment member 17 may exhibit a sufficiently high strength, thermal stability and low stretch or deformation for supporting the weight of the activation device under the wellbore ambient temperature conditions.

10 The deployment member 17 may exhibit a sufficiently high strength, thermal stability and low stretch or deformation for supporting the self-weight of the deployment member 17 when it is fully unspooled and suspended in a well under the wellbore ambient temperature conditions. The deployment member 17 may exhibit a sufficiently high strength, thermal stability and low stretch or deformation for supporting the flow induced forces caused by the fluid flow around and along the deployment member suspended in the well as injection and/or fracturing fluids are pumped into the well.

15 The deployment member 17 may include an electrical and/or a fibre optic component to provide support for example for control, power and/or data communication as may be needed.

20 The deployment member 17 may be a wire including but not limited to a slickline, wireline, e-line, or any other similar conveyances employed in oil and gas operations, however, such conveyances may require a rather very long spool member for providing sufficient volume to load a sufficient length of the conveyance and are therefore less preferred. The spool 14 as shown in Figure 1 has a conic frustum shape in order to reduce drag as the deployment member unwinds, however, it should be understood that other shape spools may also be used.

25 The activation device or mechanism 15 may be initiated once the tool 16 has reached the desired location within the wellbore. According to the embodiment shown in Figures 2A-2D, the activation device 15 may be activated once the deployment member 17 has been completely unwound from the spool. However, it should be understood, that according to another embodiment of the present invention the activation 15 may be activated once a predetermined length of the deployment member has been unwound.

30 The tool 16 may be any of many well-known downhole tools such as for example, a perforation gun or a set of perforating guns, an explosive charge, a cutting tool, a tubing cutter, a dart, a dart that changes it's dimensions, a drop ball, a drop ball that changes it's dimensions, a sliding sleeve or other fluid control device, a down hole choke, a ball valve, a fluid loss device, a packer or other seal forming device, a plug, a pump down plug, an expandable plug, a plug that changes it's dimensions, a shifting

35

tool, a device that uses slips to anchor itself into the tubing or casing, a tubing patch, a casing patch, a straddle tool, any tool that is deployed into a well are required to be activated at a particular location or at a particular time during the well operation.

5 The tubular 11 may be connected to another tubular or well pipe 13, such as a completion tubular, deployed within a wellbore. The wellbore may be an open or cased wellbore. The wellbore may be a vertical, deviated or horizontal wellbore.

10 In operation the well bore activation device 10 may be first held within tubular 11 (method of hold not shown) with first end of deployment member 17 attached to anchor device 18. When the hold is released the activation device 10 is moved into wellbore tubular 13 under the influence either of gravity or fluid flow or a combination of both gravity and fluid flow. As the wellbore activation device 10 moves through the wellbore tubular 13 the deployment member 17 unspools.

15 As shown in Figure 2C, once the entire length of the deployment member 17 is unwound, the activation device 10 and the tool 16 are deployed at a precise location within the wellbore 24 which may or may not contain a tubular member. Once the deployment member 17 is unwound, the activation mechanism 15 may be activated to activate the tool 16. Tool 16 as shown in Figures 2A to 2D is a perforation gun that fires once the activation mechanism 15 is activated and the deployment member 17 has unwound in its entirety. As shown in Figure 2D once the perforated gun has been
20 fired a plurality of perforations 23 are formed within the wellbore. The activation device 10 is disintegrated into small pieces 25 which are allowed to fall within the wellbore 24.

25 Deployment member 17 may then be retrieved and operation can be resumed, or deployment member 17 may be released from anchor device 18 and allowed to enter the well bore 24 under the influence either of gravity or fluid flow or a combination of both gravity and fluid flow.

It should be understood however that depending upon the structure and functionality of the tool 16, as well as of the other components of the wellbore activation device 10, that there may be one or more components still pending from the deployment member 17 at the end of the operation which may be readily retrieved to
30 the surface. For example, according to another embodiment of the present invention not shown, the activation device comprising the spool and the activation mechanism may remain tied to the deployment member after the firing of the perforation gun or guns and thus can be retrieved to the surface for further future use.

35 Referring now to Figures 3A to 3C, another embodiment of the present invention is described. The embodiment of Figures 3A to 3C shares many similar

features with the embodiment of Figures 1 and 2, and for ease of reference similar features are depicted with the same numeral augmented by 100.

The wellbore activation device 110, as shown in the embodiment of Figure 3A, comprises a spool 114, an activation mechanism 115 and a tool 116 all mounted within
5 a frame or housing 112. The frame 112 of the wellbore activation device 110 may be sized to pass through a first seat 126a of a tool 126 disposed within a completions tubular 124 as shown in Figure 3C. Also, tool 116 comprises an expandable element. Initial setting up of the activation device 110 as shown in Figure 3A and its subsequent release as shown in Figure 3B can be performed as described above in relation to the
10 embodiment of Figures 2A and 2B. Once the wellbore activation device 110 is deployed beyond tool 126 and the deployment member 117 is fully unwound, activation mechanism 115 is activated to cause the tool 116 to expand as shown in Figure 3D. Immediately thereafter, as shown in Figure 3E the frame 112 of the activation device 110 is released from the deployment member 117. The activation device 110 by virtue
15 of the expanded dart 116 may then engage a corresponding seat 127a of tool 127.

Seat 127a may have substantially the same or similar effective internal diameter as seat 126a. Seat 127a may have a larger effective internal diameter than that of seat 126a.

Once the tool 116 engages the seat 127a of tool 127, a desired operation may
20 be performed within the wellbore. For instance, tool 127 may be a sliding sleeve tool. Upon engagement by the tool 116 with the seat 127a of the tool 127, the sliding sleeve may slide to an open position uncovering one or more ports to allow injection of a fluid into the wellbore through the ports of the sliding sleeve (not shown) as is for example desirable in fracing or chemical injection operations. Alternatively, once the ports of the
25 sliding sleeve tool are open fluid from the wellbore may be produced through the completion.

The frame 112 may comprise a profile (now shown) for allowing retrieval of the tool 116 once the operation is completed using a fishing tool having a corresponding mating profile.

30 The tool 116 may be designed to be removed or partially removed by means of a milling operation, for example a coil tubing milling operation using standard coil tubing milling tools.

The tool 116 may be designed to degrade or partially degrade, for example tool 116 may be manufactured or partly manufactured from a dissolving and or degradable

material which dissolves and or degrades in the presence of water or hydrocarbons or another fluid introduced into the well, for example an acid solution.

Referring now to Figures 4A to 4E another embodiment of the present invention is described wherein a wellbore activation device 210 is deployed within the tubular 224 of a horizontal completion. The tubular 224 may comprise a plurality of tools 226. The tools 226 as shown are identical having seats 226a that are substantially the same effective internal diameter. However it should be understood that tools with varying size and shape seats may be employed as well.

The wellbore activation device 210 may be deployed within the horizontal well via the help of a fluid flow into the wellbore that guides the activation device 210 through tools 226 as shown diagrammatically in Figure 4B by the arrows F.

Once the wellbore activation device 210 reaches at the proximity of a specified tool 226, the activation mechanism 215 causes the tool 216 to expand to a configuration as shown in Figure 4C that causes the tool 216 to seat within a corresponding seat 226a of tool 226. At about the same time the well bore activation device 210 may be released from the deployment member 217.

The activation mechanism 215 may be activated once the whole length of the deployment member 217 is unwound as shown in Figure 4C. Alternatively the activation mechanism 215 may be activated once a specific predetermined length of the deployment member 217 is unwound. This, for example, may be achieved by employing a smart deployment member comprising an electrical, and/or fibre optic component and a counter (not shown) that measures the length of the deployment member as it is being deployed. Once the desired length has been unwound as measured by the counter, a command will be communicated via the smart deployment member 217 to cause the activation mechanism 215 to activate and expand the tool 216 to the desired expanded configuration.

The operation may be repeated as shown in Figures 4D and 4E to activate more than one downhole tools 226. Once the tools 226 have been activated as may be needed an operation may be performed, such as for instance fracing, chemical injection, or producing of a particular zone of the well.

According to another embodiment of the wellbore activation device 210, (not shown) upon activation of the tool 216, the tool 216 is released from the frame 212 while the activation mechanism 215 and the frame 212 remain attached to the deployment member 217 and can then be retrieved to the surface. Such an

embodiment may be advantageous because the activation device may be used multiple times.

Referring now to Figure 5, an embodiment of the present invention activation device is provided, generally designated with numeral 310. Figure 5 shows a longitudinal, cross-sectional partial view of an embodiment of the present invention activation device 310. The activation device 310, comprises a frame 312 within which there is mounted a split spool arrangement 314 at an upper section of the frame 312. Within frame 312 there is also mounted a wellbore tool 316 at a lower section of the frame 312 and an activation mechanism generally designated with numeral 315 mounted at an intermediate section between the spool 314 and the tool 316. The activation device 310 further comprises a deployment member 317 shown wound around the split spool arrangement 314 with one end 317a of the deployment member extending outside the frame 312 through a port 312a. The split spool arrangement 314 comprises two symmetrical halves 314a and 314b, the two halves forming a flanged cylinder defining a generally cylindrical through bore 314c along a central longitudinal axis Y of the split arrangement 314. The generally cylindrical through bore 314c comprises an annular recess 314d extending along a partial length of the split spool arrangement 314. The activation device 310 further comprises an activation mechanism generally designated with numeral 315 and a tool 316 partially shown. Once the activation device is deployed at a desired location within the wellbore the activation mechanism 315 is initiated which in turn initiates the operation of the tool 316.

The activation mechanism 315 generally comprises a first member 318, a spring 324 and a second member 326. The first member 318 comprises a generally cylindrical elongated body 318a, and a generally T- shape head 319 with a pointed tip 319a and wider diameter shoulder or rim 319b. The first member 318 acts as a hammer that strikes the second member 326 under the biasing force of the spring 326 once the first member is released from the spool split arrangement 314. The operation of the activation mechanism will become apparent to a person skilled in the art upon reading the following description.

Within the through bore 314c there is disposed the elongated body 318a of the first member 318. The elongated body 318a has a generally cylindrical shape and an annular shoulder 318d extending along only a partial length of the elongated body 318. The shoulder 318d cooperates with the annular recess 314d to hold the first member in a first position as shown in Figure 5.

The first member 318 is urged against the split spool arrangement 314 via the spring 324 with the shoulder 318d abutting against the annular recess 314d of the split arrangement. The spring 324 is wound around a partial length of the elongated member 318 within an annulus 329 that is formed between the elongated body 318a and the frame 312. The spring 324 abuts at one end 324a against the spool 314, and at a second end 324b against the shoulder 319b spool frame 312. The spring 324 urges the first member against the split spool arrangement 314.

So long as there is deployment member 317 wound around the spool, the force of the deployment member 317 is sufficient to hold the two halves 314a and 314b of the spool arrangement 314 tight against the first member 318 and thus prevent the first member 318 from striking the second member. Once the deployment member 317 is fully unwound the force of the spring pushes the first member 318 forward to release it from the hold of the split spool arrangement 314 and then the first member strikes the second member. The second member 326 may be a percussion initiator containing an explosive which ignites upon the impact of the first member 318. The explosion of the percussion initiator may be used to initiate a downhole tool 316 such as a perforating gun. The explosion of the percussion initiator may be used to ignite a detonator cord which may transmit the explosion to a plurality of charges in a perforation gun (not shown).

The frame 312 further comprises a transverse through bore 322 within which there is disposed a safety screw 320. The member 318 is biased via a spring 324 against safety screw 320 with the shoulder 319b abutting against the safety screw 320. The safety screw 320 may prevent accidental initiation of the activation mechanism 315 at the surface and may be removed when the activation device is ready for deployment.

The two halves 314a and 314b of the split spool arrangement 314 are held together at a first position as shown in Figure 5 so long as the deployment member 317 is not fully unwound. At this first position the activation mechanism 315 may not be initiated because the elongated member 318 is held securely in place via the shoulder 318d and recess 314d arrangement.

The split spool arrangement 314 may be loaded with any suitable, length of a deployment member as may be desired for deploying the activation mechanism to a specified location within the wellbore. For instance the split arrangement as shown in Figure 5 may be loaded with 20,000 ft. of a deployment member made of Kevlar, for example.

Referring now to Figure 6 another embodiment of an activation device is provided. The embodiment of Figure 6 has many features which are similar to the features of the embodiment of Figure 5 and which for simplicity are designated with the same numerals increased by 100. The activation device 410 of Figure 6 includes a chamber of air gas 428 at atmospheric pressure sealed between two different sized o-rings 430, 432. The chamber 428 forms a hydrostatic pressure switch. Hydrostatic pressure acting on the chamber causes a force which causes the shear pin 433 to shear only if the hydrostatic pressure exceeds a predefined pressure threshold. The pressure threshold may typically be about 10 to 50 Bar thus ensuring that accidental firing of the activation device may not occur at the surface of the well. According to this embodiment, before the activation device is initiated at least the following three conditions should be met: 1) the safety screw 420 is removed, 2) the ambient pressure is greater than the pressure threshold, and 3) all of the deployment member 417 is unwound. It should be understood that depending upon the application other conditions may also be incorporated before the activation device is initiated. For example when the tool 416 is a perforation gun, it may be desirable to include a minimum temperature condition that should be met before the guns are fired. This could be achieved by using a safety pin with a melting point slightly less than the typical well temperature but slightly higher than the typical surface temperature. For example, a safety pin having a melting or softening point of from about 80 to about 100 C may be used.

Referring now to Figure 7, another embodiment of the wellbore activation device 510 is provided. The wellbore activation device 510, comprises a frame 512 within which there is mounted a spool 514, an activation mechanism generally designated with numeral 515 and a tool 516. The frame 512 may generally be divided in an upper section wherein the spool 514 is mounted, a lower section comprising the tool 516 and a middle section comprising the activation mechanism 515. Features of the embodiment of Figure 7 which are similar to features of the embodiment of Figure 5 are designated with the same numerals augmented by 200.

The spool 514 is mounted within a cavity 513 formed within an upper part of the frame 512. The spool 514 is a single piece flanged cylinder providing an area for loading the deployment member 517. One end 517a of the deployment member extends outside the frame 512 through a port 512a while a second end 517b is tied to a pull out pin 536.

The activation mechanism 515 is generally mounted within the frame 512 at a position intermediate the tool 516 and the spool 514. The activation mechanism 515

generally comprises a first member 518, a spring 524, and a second member 526. The first member 318 comprises a generally cylindrical elongated body 518a, and a wider diameter head 519 with a pointed tip 519a and generally slanted sides 519b and 519c. The first member 518 is disposed within a bore 527 formed within the frame 512 below the spool 514. The frame 512 further comprises a first transverse bore 522 within which there is disposed a safety screw 520 and a second transverse bore 535 within which there is disposed a safety wedge 534.

Spring 524 is wound around the elongated body 518a of the first member. A first end of the spring 524a is placed against the spool 514 while a second end of the spring 524b is placed against a shoulder 519d of the head 519 of the first member. The first member 518 is urged by spring 524 against a safety wedge 534 and a safety screw with sides 519b and 519c abutting corresponding slanted sides of the safety wedge 534 and safety screw 520 respectively. The pull out pin 536 is inserted within a bore 529 of the wedge 534 to hold the wedge securely in place during deployment of the wellbore activation device 510.

In operation, the safety screw 520 is removed at the surface and then the wellbore activation device is deployed within the wellbore. Once the full length of the deployment member is unwound then the pull out pin 536 is pulled out of the wedge bore 529 thus releasing the wedge 534. Then the first member 518 under the biasing force of the spring 524 displaces sideways the wedge 534 and strikes the second member 526. The second member may be a percussion initiator containing an explosive which ignites upon the impact of the first member. The explosion of the percussion initiator may be used to initiate a downhole tool 516 such as a perforating gun. The explosion of the percussion initiator may be used to ignite a detonator cord which may transmit the explosion to a plurality of charges in a perforation gun (not shown).

Figures 5, 6 and 7 show embodiments where the first member may be a hammer device and the second member may be percussion device. It is understood that those skilled in the art would be aware that other embodiments are possible as for example where the first and the second members act to make or break an electrical contact or switch. This could be by the direct making or breaking of an electrical contact or by indirect means, for example a magnet and a reed switch. Those skilled in the art will also recognize the many means of initiating a downhole tool using the release and subsequent movement of a first member with respect to a second member. For example, shearing a retaining pin, failing a rupture disc, opening a valve,

off seating a o-ring seal, off seating a poppet from its seat, removing a support mechanism, releasing an anti pre-set mechanism, flooding a chamber, releasing a pressure, starting a chemical reaction, inducing a voltage, moving a magnetic field with respect to a coil, causing an electrical capacitance change, causing a change in electrical resistance, causing a spark, casing one of many different signaling means, for example magnetic, chemical, acoustic and the like.

While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the invention. Indeed the novel methods and systems described herein may be embodied in a variety of other forms. Furthermore, various omissions, substitutions and changes in the form of the methods and systems described herein may be made without departing from the spirit of the invention. The accompanying claims and their equivalents are intended to cover such forms and modifications as would fall within the scope of the invention.

Claims

1. A wellbore activation device comprising:
 - a deployment member packaged in a first configuration and arranged to
5 be deployed from said first configuration upon deployment of the activation device within a wellbore; and
 - an activation mechanism for activating the operation of a tool, the activation mechanism being operable upon the deployment or unwinding of a predetermined length of the deployment member.
- 10 2. The wellbore activation device according to claim 1, wherein the activation mechanism is initiated upon full deployment of the deployment member.
3. The wellbore activation device according to any preceding claim, wherein the
15 activation mechanism initiates the operation of one or more downhole tools.
4. The wellbore activation device according to any preceding claim, wherein the activation device initiates the operation of a first tool, said first tool then activating a downhole tool.
- 20 5. The wellbore activation device according to any preceding claim, wherein the activation device initiates the operation of a variable size dart causing the variable size dart to obtain a different configuration before reaching a corresponding mating seat of a downhole tool to thereby engage the seat, and activate the downhole tool.
- 25 6. The wellbore activation device according to any preceding claim, further comprising a safety device or mechanism that prevents accidental initiation of the activation device.
- 30 7. The wellbore activation device according to any preceding claim, wherein the activation device is activated only if the ambient pressure on the activation device is above a pressure threshold.
- 35 8. The wellbore activation device according to any preceding claim, wherein the activation device is activated only if the ambient temperature on the activation

device is above a temperature threshold to prevent accidental initiation of the activation device.

5 9. The wellbore activation device according to any preceding claim, further comprising a first tool.

10 10. The wellbore activation device according to any preceding claim, further comprising a first tool selected from the group comprising a perforation gun or a set of perforating guns, an explosive charge, a cutting tool, a tubing cutter, a casing cutter, a dart, a dart that changes dimensions, a drop ball, a drop ball that changes dimensions, a flow control device, a down hole choke, a ball valve, a fluid loss device, a seal forming device, a plug, a pump down plug, a plug that changes dimensions, a shifting tool, a device that uses slips to anchor itself into a tubing or casing, a tubing patch, a casing patch, a straddle tool, and the like.

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11. The wellbore activation device according to any preceding claim, further comprising a frame for supporting the deployment member, and the activation mechanism.

20 12. The wellbore activation device according to any preceding claim, further comprising a spool for winding the deployment member prior to deployment.

13. The wellbore activation device according to claim 11 and 12, wherein the spool is mounted to the frame.

25 14. The wellbore activation device according to claim 13, wherein the spool is an integral part of the frame.

30 15. The wellbore activation device according to claim 13, wherein the spool is an insert adapted to be inserted within a corresponding pocket of the frame.

16. The wellbore activation device according to any of the claims 12 to 15, wherein the spool comprises a core around which a deployment member is wound.

35 17. The wellbore activation device according to any of the claims 12 to 16, wherein the spool comprises a flanged cylinder around which a deployment member is wound.

18. The wellbore activation device according to any of the claims 12 to 17, wherein the spool is a single piece.

5 19. The wellbore activation device according to any of the claims 12 to 18, wherein the spool comprises a split arrangement.

10 20. The wellbore activation device according to any of the claims 12 to 19, wherein the spool comprises an at least partially split arrangement comprising two or more parts that are held together in a first position via a holding mechanism whereas upon release of the holding mechanism the split arrangement may shift in a second position.

15 21. The wellbore activation device according to claim 20, wherein shifting of the at least partially split arrangement from the first to the second position is a requirement for the initiation of the activation mechanism.

20 22. The wellbore activation device according to claim 21, wherein the holding mechanism comprises the deployment member being wound around the at least partially spool split arrangement, and whereas upon unwinding of the deployment member the at least partially split arrangement shifts to the second position.

25 23. The wellbore activation device according to any preceding claim, wherein the deployment member is or comprise a line made from Vectran and/or Kevlar fibres, monofilament polymer, steel, copper, glass fibre or the like.

30 24. The wellbore activation device according to any preceding claim, wherein the deployment member is or comprises a material that degrades or dissolves in the presence of wellbore fluids.

25. The wellbore activation device according to any preceding claim, wherein the deployment member includes an electrical and/or a fibre optic component.

26. The wellbore activation device according to any preceding claim, further comprising a material applied on the deployment member to control unintentional unwinding of the deployment member.
- 5 27. The activation device according to any preceding claim, wherein the activation mechanism is an integral part of the activation device.
28. The wellbore activation device according to any preceding claim, wherein the activation mechanism is a separate device operably connected to the deployment member.
- 10 29. The wellbore activation device according to any preceding claim, wherein the activation mechanism is or comprises an energy storage mechanism adapted to release the stored energy to activate a tool once a predetermined length of the deployment member or the entire length of the deployment member is unwound.
- 15 30. The activation device according to any preceding claim, wherein the activation mechanism is or comprises a mechanical energy storage mechanism adapted to release the stored energy to activate a tool once a predetermined length of the deployment member or the entire length of the deployment member is deployed or unwound.
- 20 31. The activation device according to any preceding claim, wherein the activation mechanism is or comprises a chemical energy storage mechanism adapted to release the stored energy to activate a tool once a predetermined length of the deployment member or the entire length of the deployment member is deployed or unwound.
- 25 32. The activation device according to claim 31, wherein the activation mechanism comprises a percussion initiator containing an explosive material that ignites upon the striking by a hammer once a predetermined length of the deployment member or the entire length of the deployment member is deployed.
- 30

33. The activation device according to claim 32, wherein the hammer is held in a first position during deployment by virtue of a holding device or mechanism that prevents accidental striking of the hammer on the percussion initiator.

5 34. The activation device according to claim 33, wherein the holding device comprises a pull out pin holding a safety pin or wedge at a first position preventing the hammer from striking the percussion initiator.

10 35. The activation device according to claim 34, wherein the pull out pin may be tied to the deployment member so that upon deployment or unwinding of the full length of the deployment member, the deployment member pulls the pull out pin thus allowing the hammer to strike the percussion initiator.

15 36. The activation device according to claim 35, wherein the pull out pin is urged to strike the percussion initiator by virtue of the action of a compression coil or spring or the like.

20 37. The wellbore activation device according to any preceding claim, further comprising one or more perforation guns and wherein the activation mechanism comprises a hammer, a percussion initiator, and a detonation cord, whereas the deployment member is packaged or wound with a predetermined length for deploying the perforation gun to a specified wellbore location whereupon the hammer is released to strike the percussion initiator creating an explosion, and the explosion transmitted via the detonation cord to a plurality of charges carried by the
25 perforation gun to fire the gun and perforate the casing and/or wellbore.

30 38. The wellbore activation device according to any preceding claim, wherein the activation mechanism comprises a first member and a variable size second member or members.

39. The activation device according to claim 37, further comprising a housing for mounting the deployment member, and the activation mechanism.

40. The wellbore activation device according to claim 37, wherein the deployment member is preloaded with a precise length to cause actuation of the first member at a specified location within the wellbore, said first member in turn causing the second member or members to move from a first retracted position to a second expanded position.

41. A method for the activation of a wellbore tool, the method comprising: introducing a wellbore activation device inside a wellbore;
anchoring a first end of a deployment member to a wellbore structure at or near the surface;
launching the well bore activation device into the wellbore under the action of gravity and/or fluid flow;
deploying or unwinding the deployment member; and
initiating the activation device once a predetermined length of the deployment member has been deployed.

42. The method according to claim 41, wherein said initiating step occurs once the entire length of the deployment member has been deployed.

43. The method according to any of the claims 41 to 42 further comprising activating the operation of one or more wellbore tools.

44. The method according to any of the claims 41 to 43, wherein initiation of the activation device activates the operation of a first tool which in turn activates a second tool.

45. The method according to claim 44, wherein the first tool is a variable size dart which upon activation obtains a different effective diameter and may then engage the seat of a second downhole tool.

46. The method according to claim 44, wherein the first tool is an expandable dart which upon activation obtains a larger, expanded effective diameter and may then engage the seat of a second downhole tool.

47. The method according to any of the claims 41 to 46, further comprising activating the operation of a perforation gun.

5 48. The use of the wellbore activation device according to claims 1 to 40 with a plug-and-perf completion.

49. A plug-and-perf method for multistage treatment for cased hole wells, the method comprising:

10 providing a wellbore completion having one or more no-go rings;
 providing a wellbore activation device having a plug and a perforation gun;
 deploying the wellbore activation device to position the plug to a first no-go ring to isolate a first zone of the well; and
 activating the perforation gun to perforate a second zone above said first zone.

15 50. The plug-and-perf method according to claim 49, further comprising pumping a stimulation or treatment fluid into the wellbore and through the perforations into the first zone of the formation.

20 51. The plug-and-perf method according to claim 50, wherein the plug is a variable size plug.

52. The plug-and-perf method according to any of the claims 49 to 51, wherein the one or more no-go rings are pre-installed in the completion.

25 53. The plug-and-perf method according to any of the claims 49 to 51, wherein at least one of the one or more no-go rings are installed during deployment using the wellbore activation device of the present invention.

30 54. The plug-and-perf method according to claim 49, wherein the wellbore activation device comprises a no-go ring, and a perforation gun which are simultaneously deployed within the wellbore at a desired location using the wellbore activation device.

55. The plug-and-perf method according to claim 54, further comprising perforating the well; and deploying an obstructing member selected from the group comprising a plug,

a drop ball or a dart to block the opening of the no-go ring and divert a treatment fluid through the perforations into the formation.

56. The plug-and-perf method of claim 55, wherein said deploying the obstructing member comprises pumping said obstructing member into the wellbore.

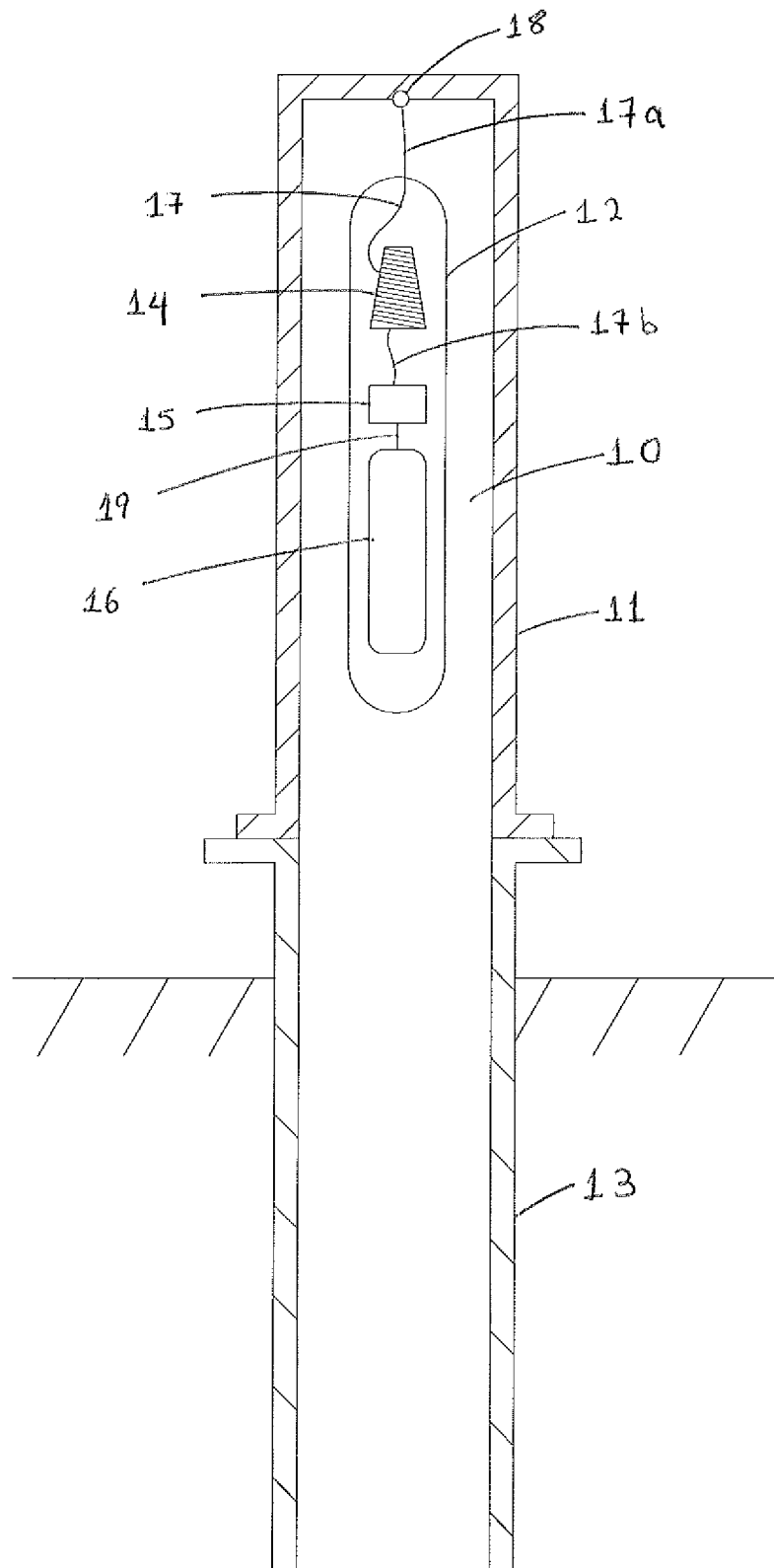
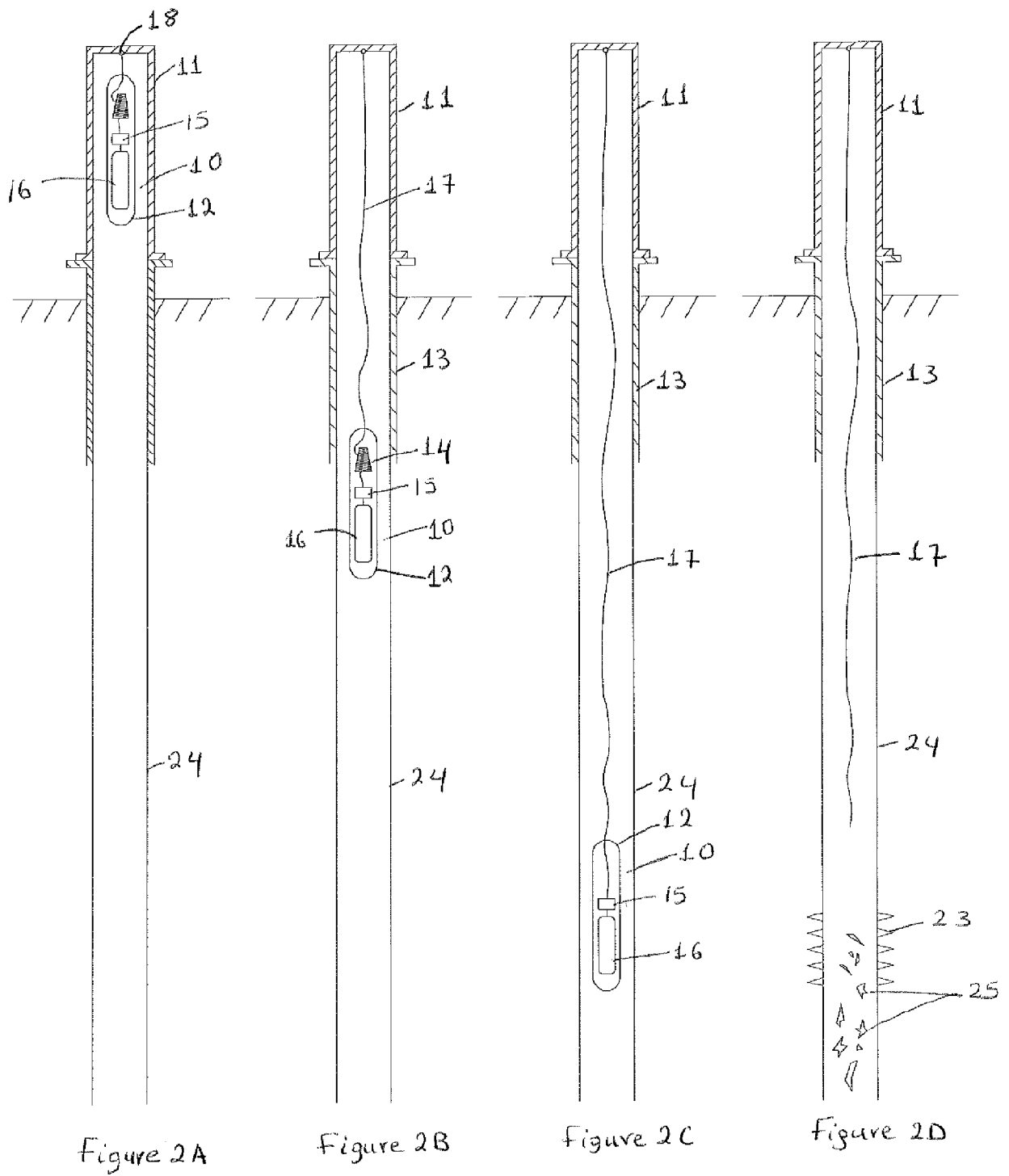


Figure 1



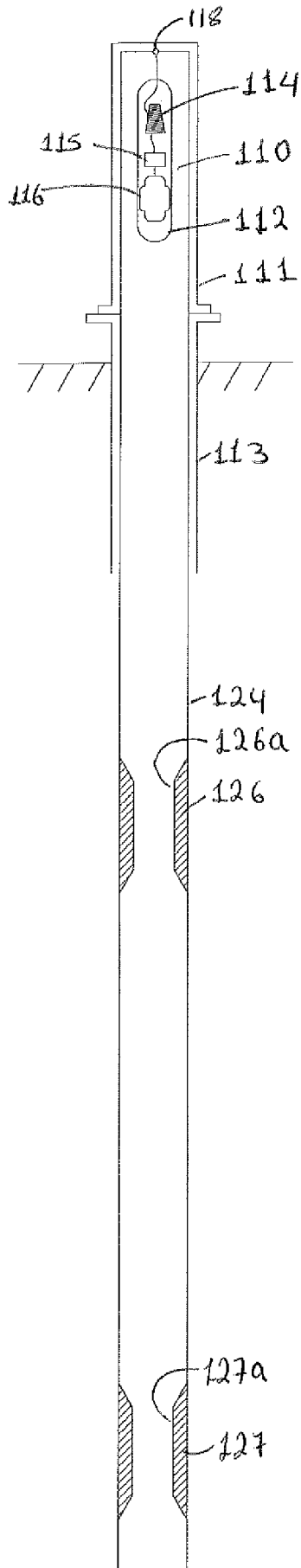


Figure 3A

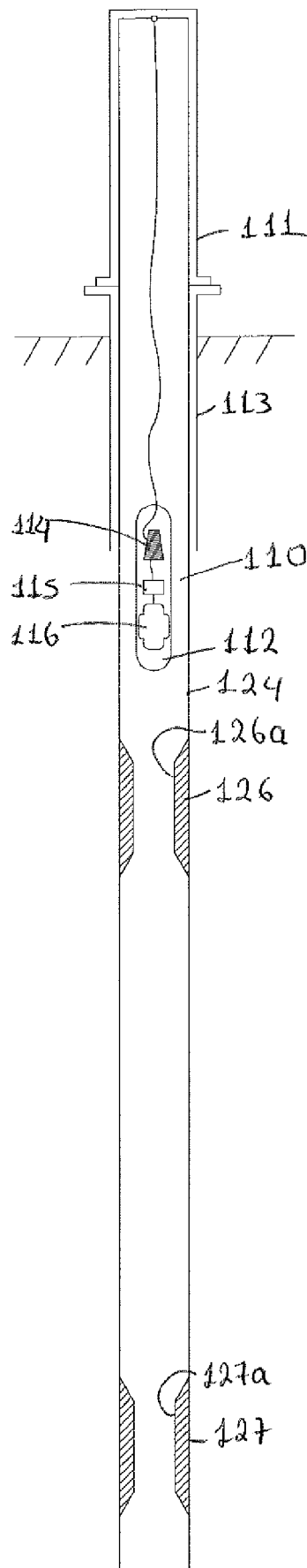


Figure 3B

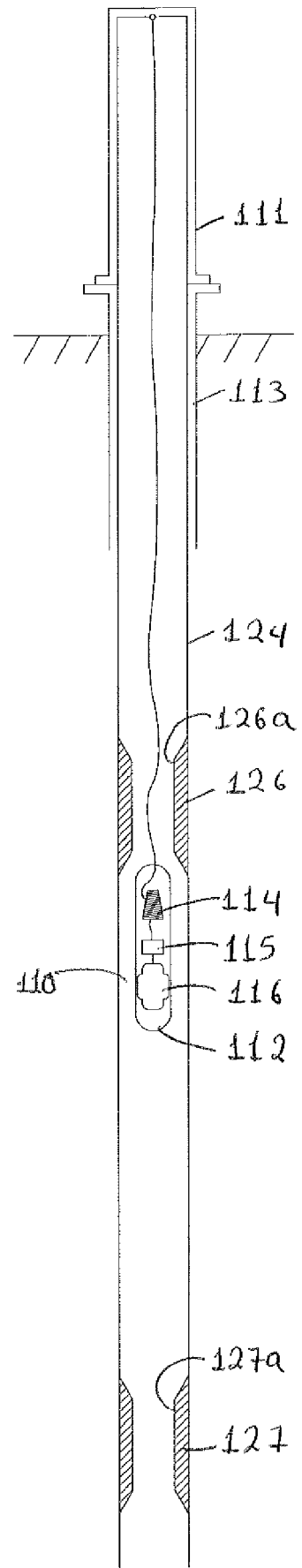


Figure 3C

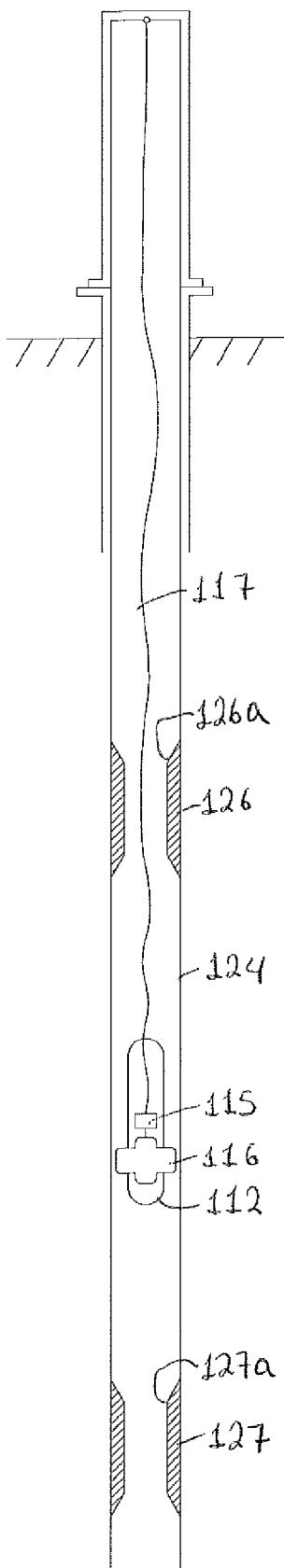


Figure 3D

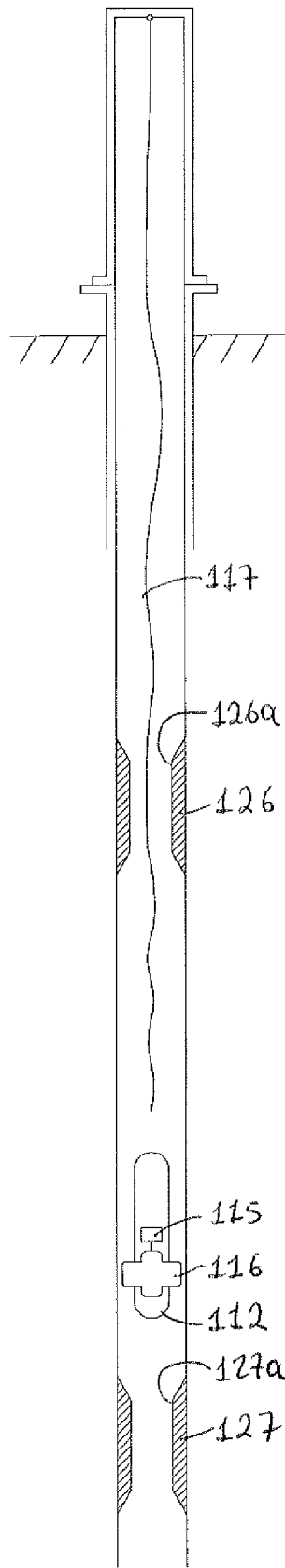


Figure 3E

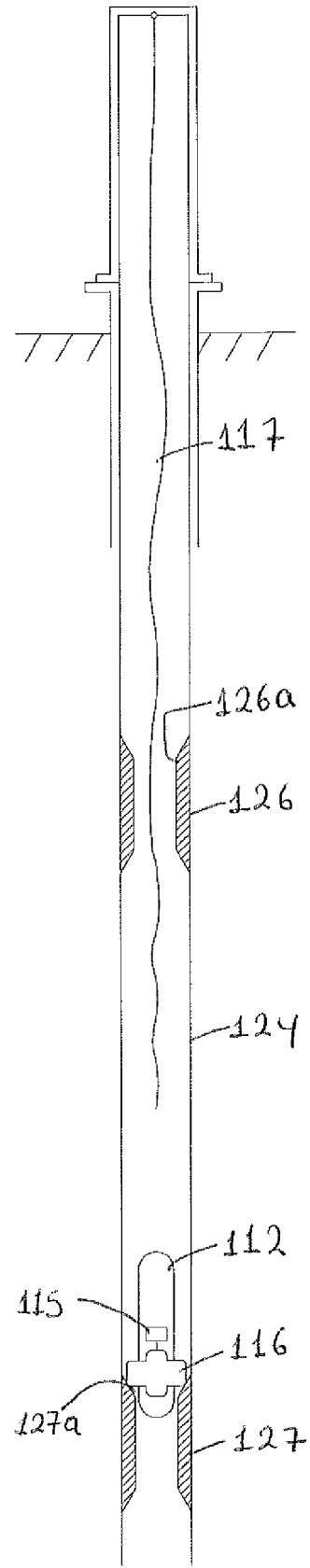


Figure 3F

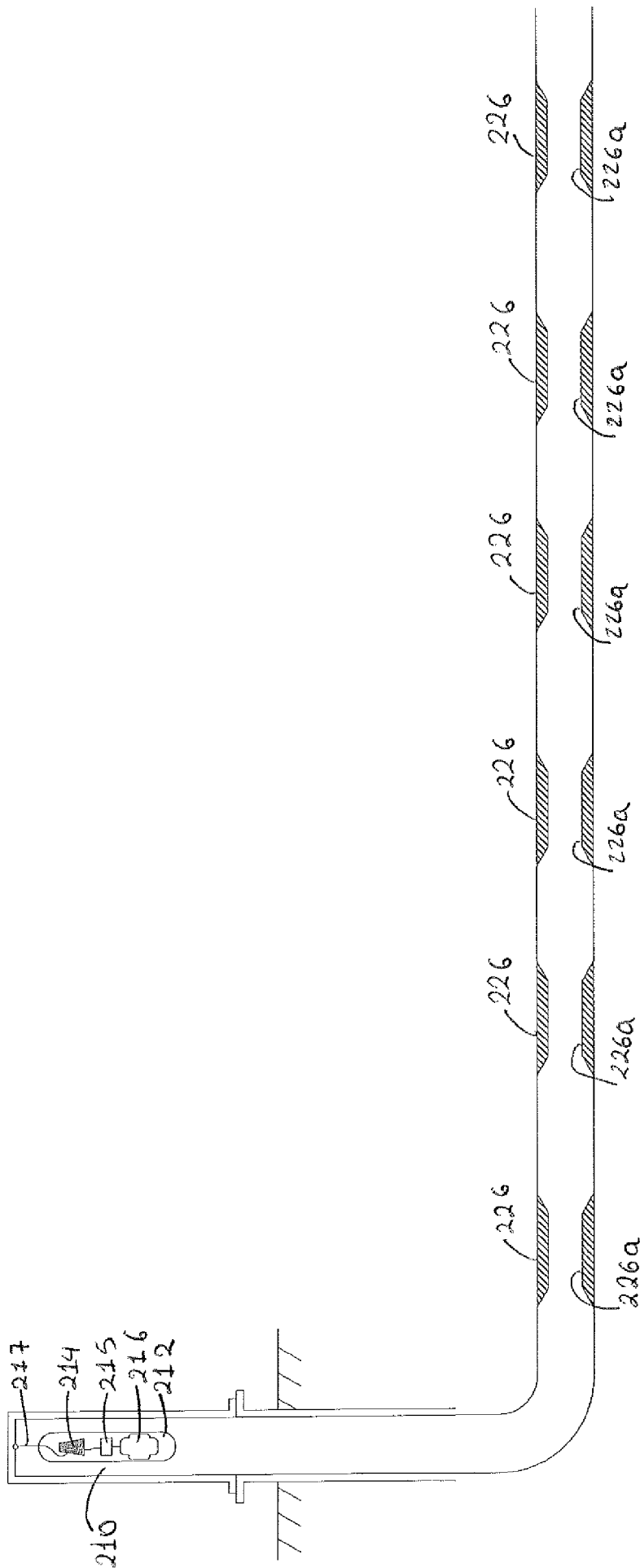


Figure 4A

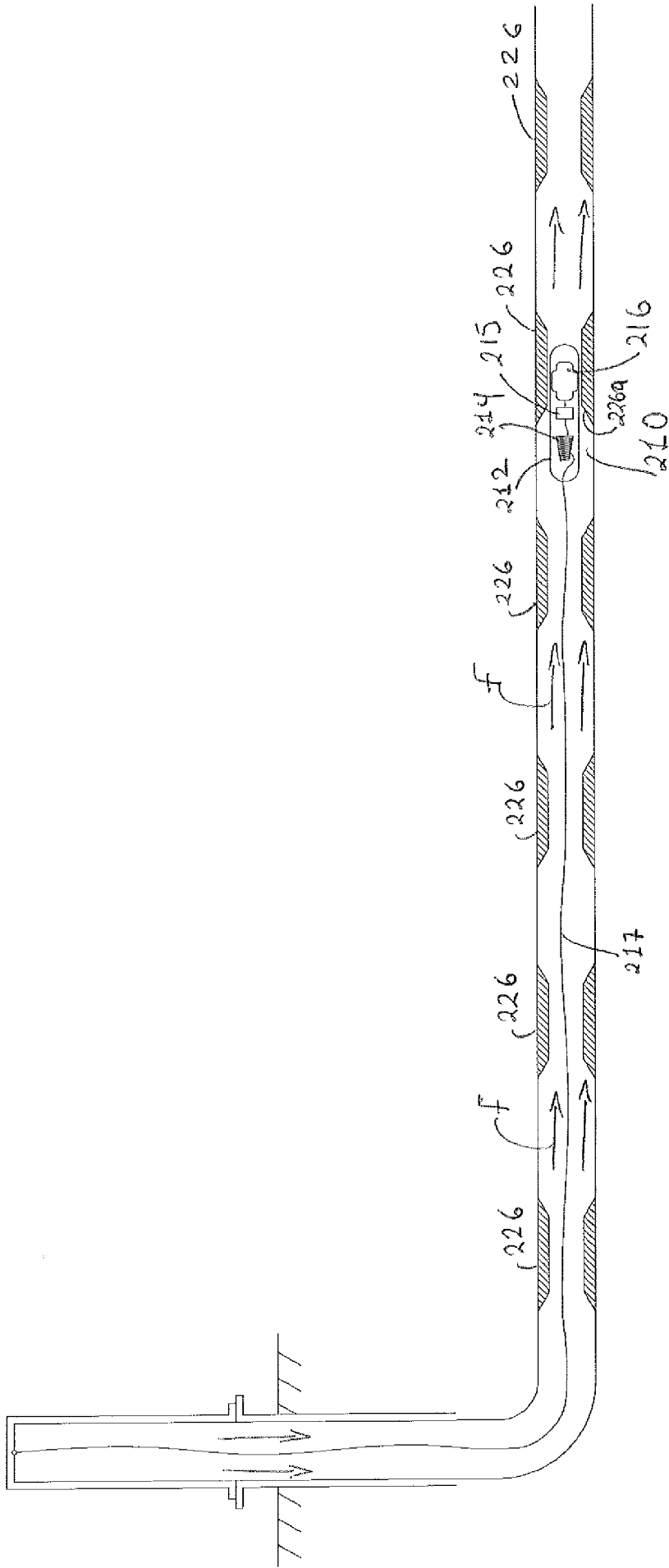


Figure 4B

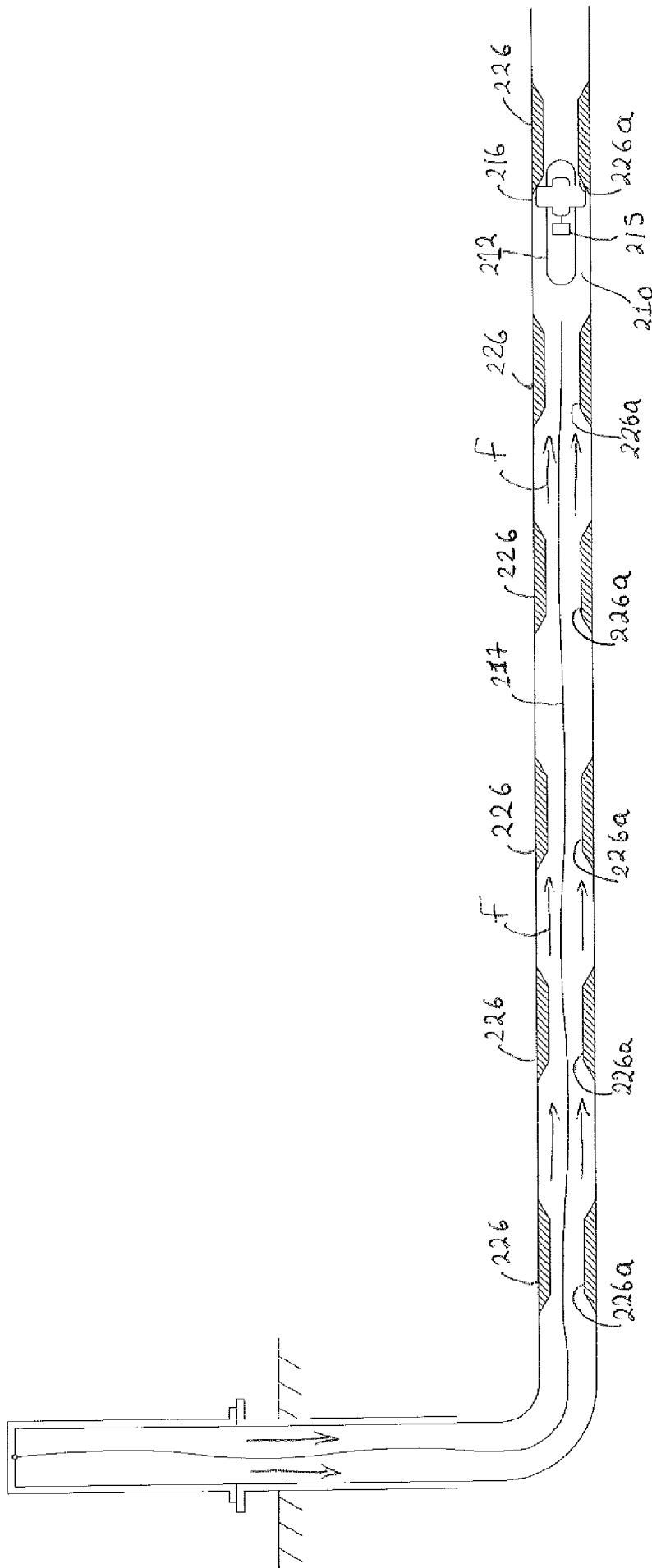


Figure 4c

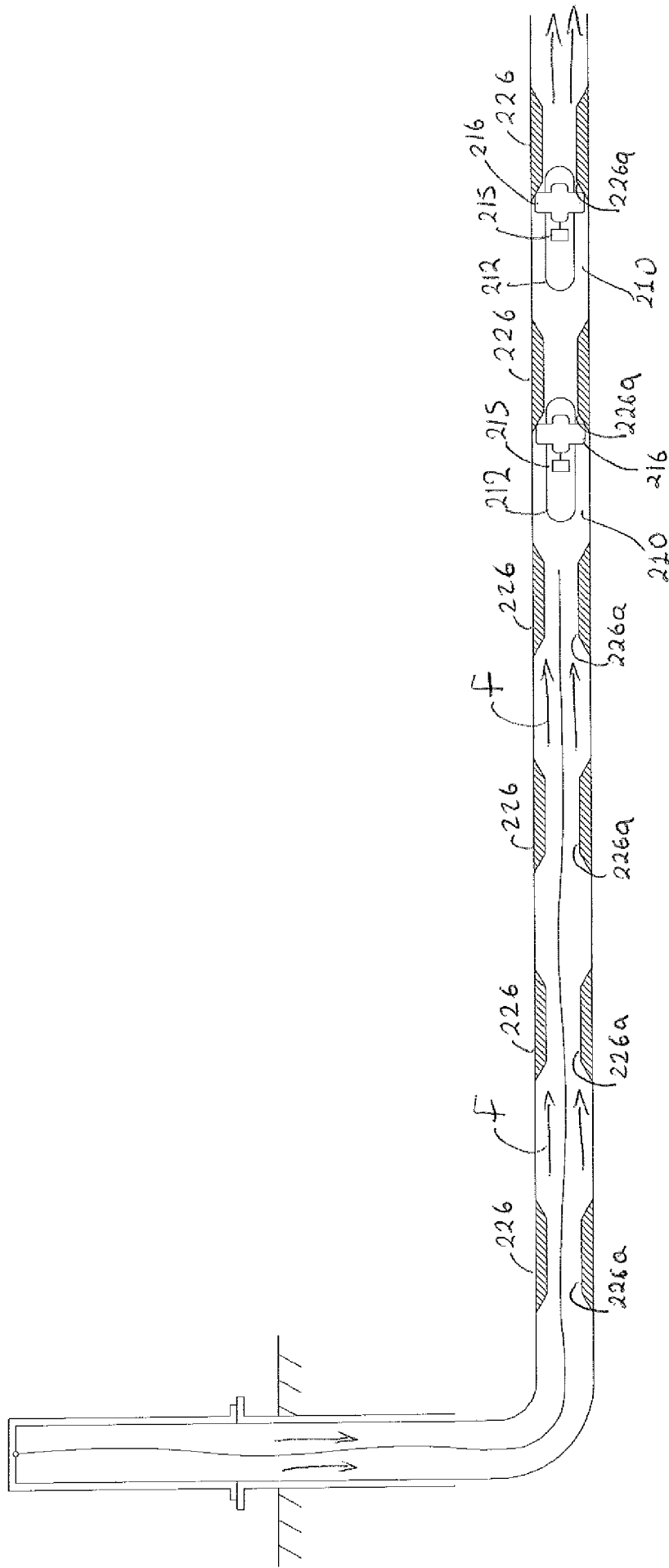


Figure 4D

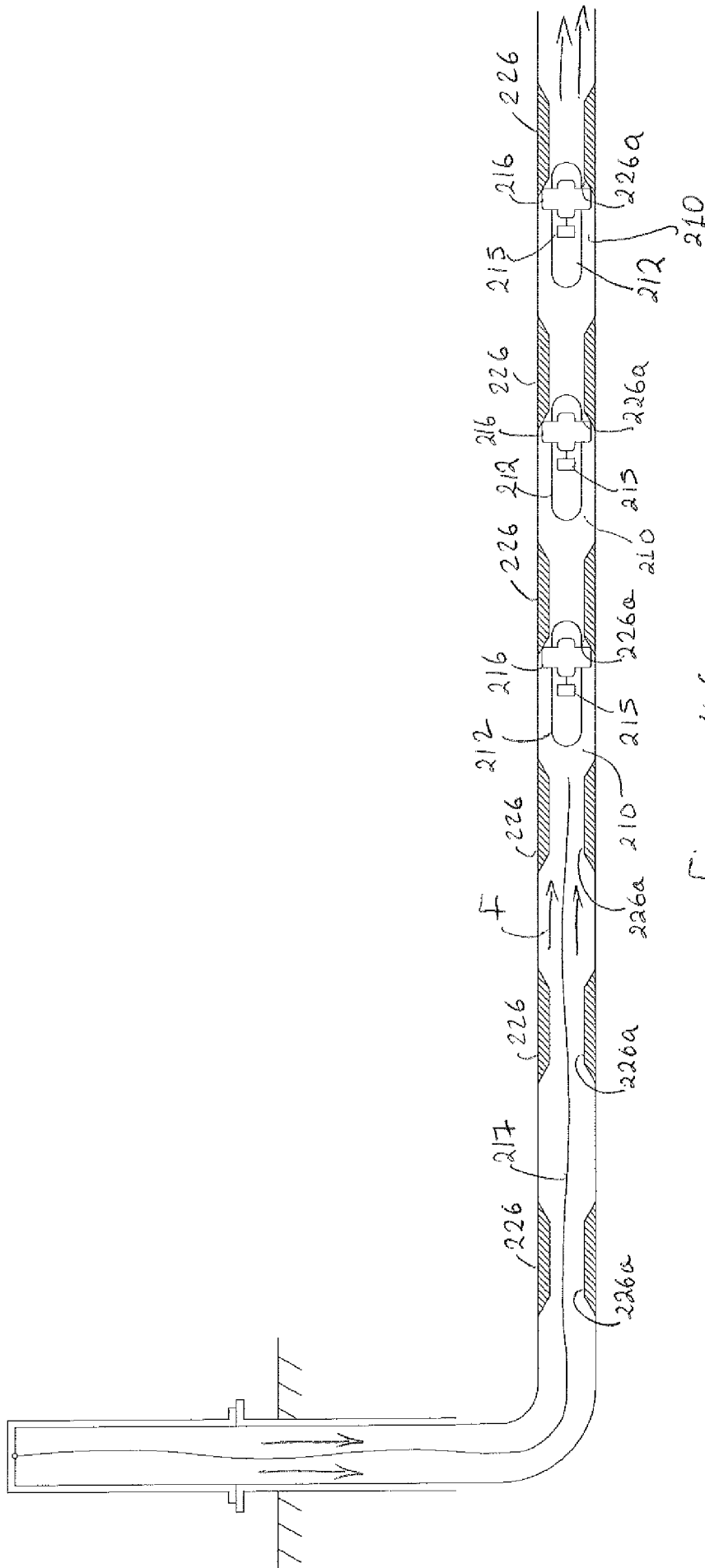


Figure 46

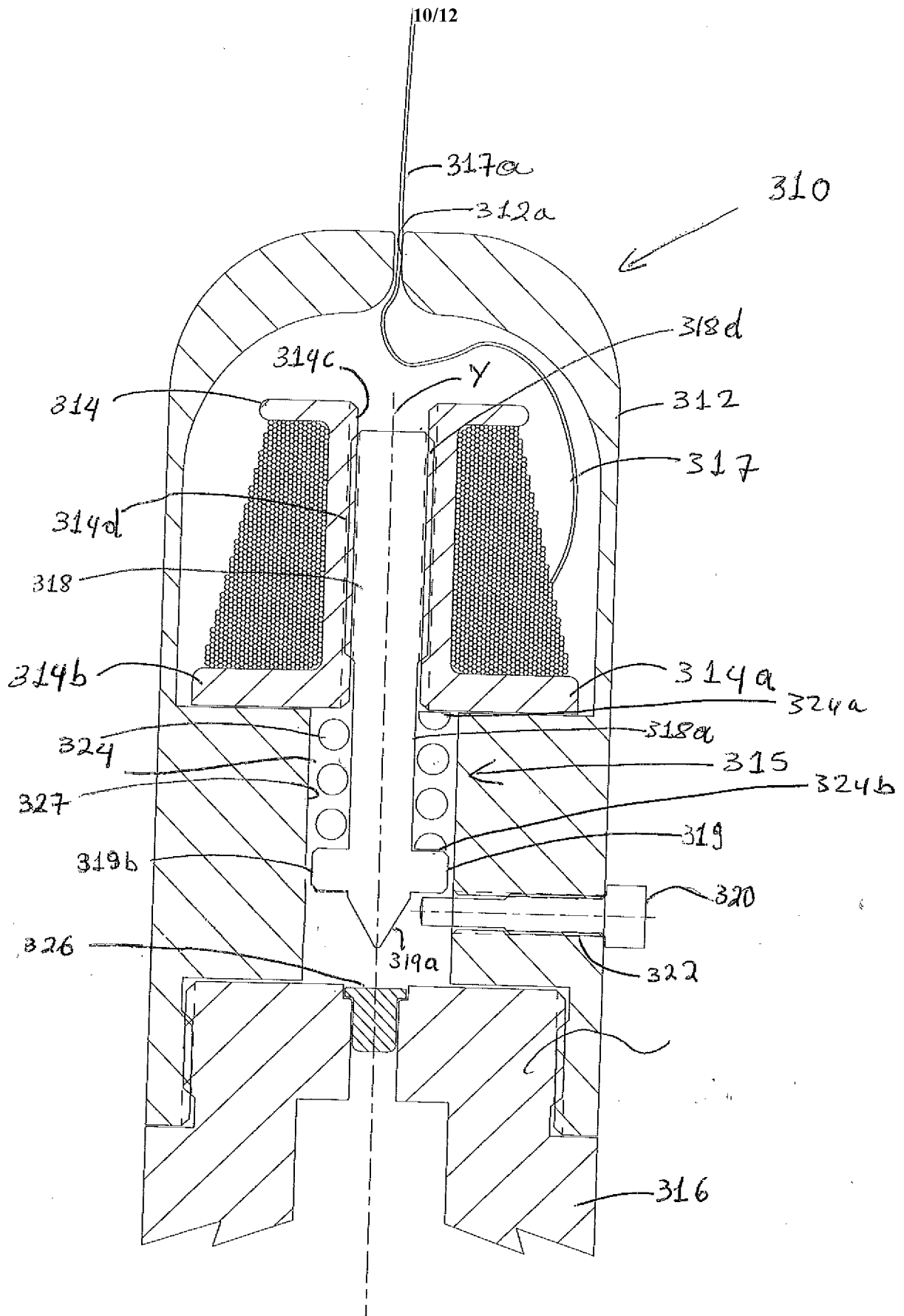


Figure 5

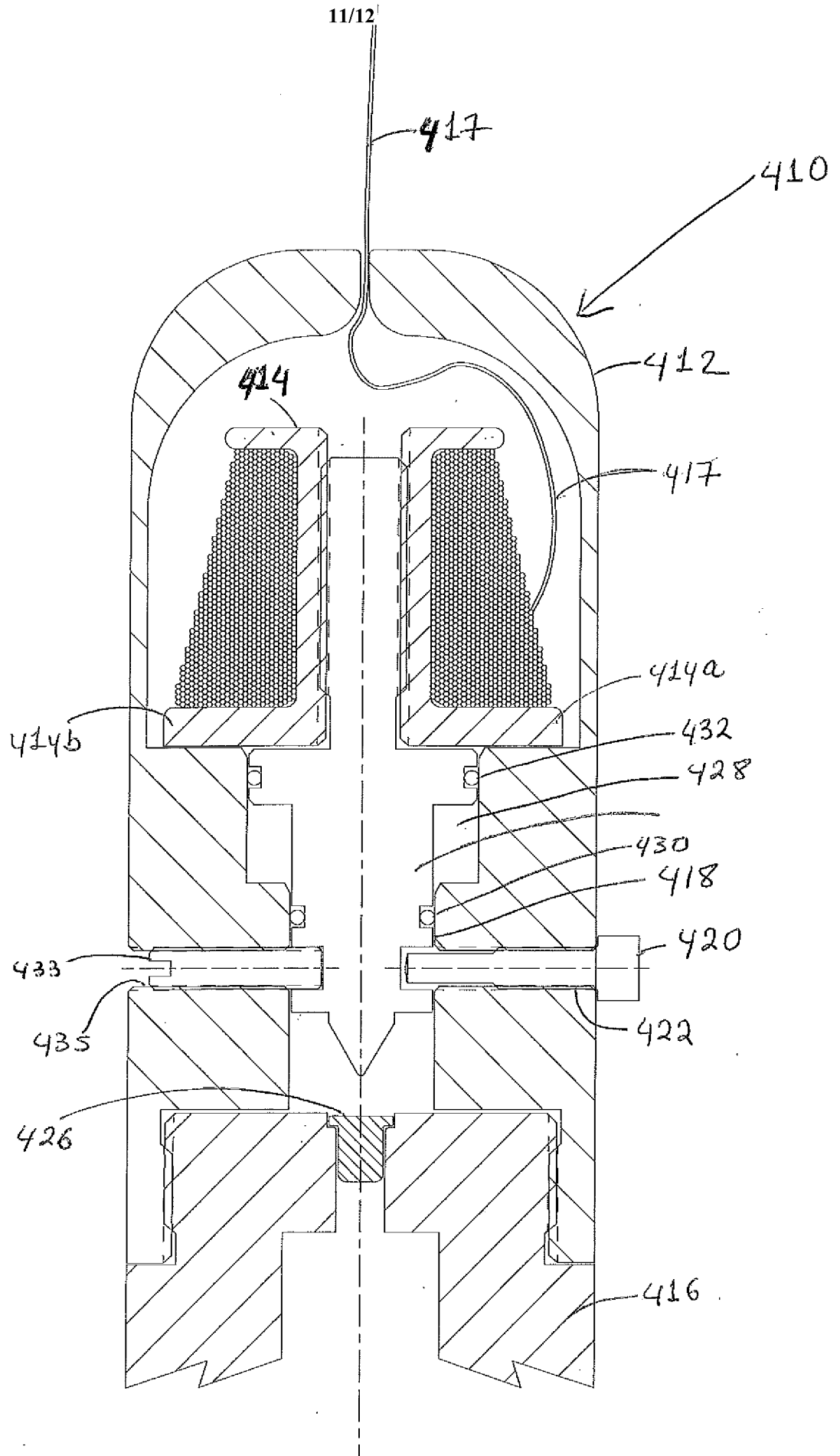


Figure 6

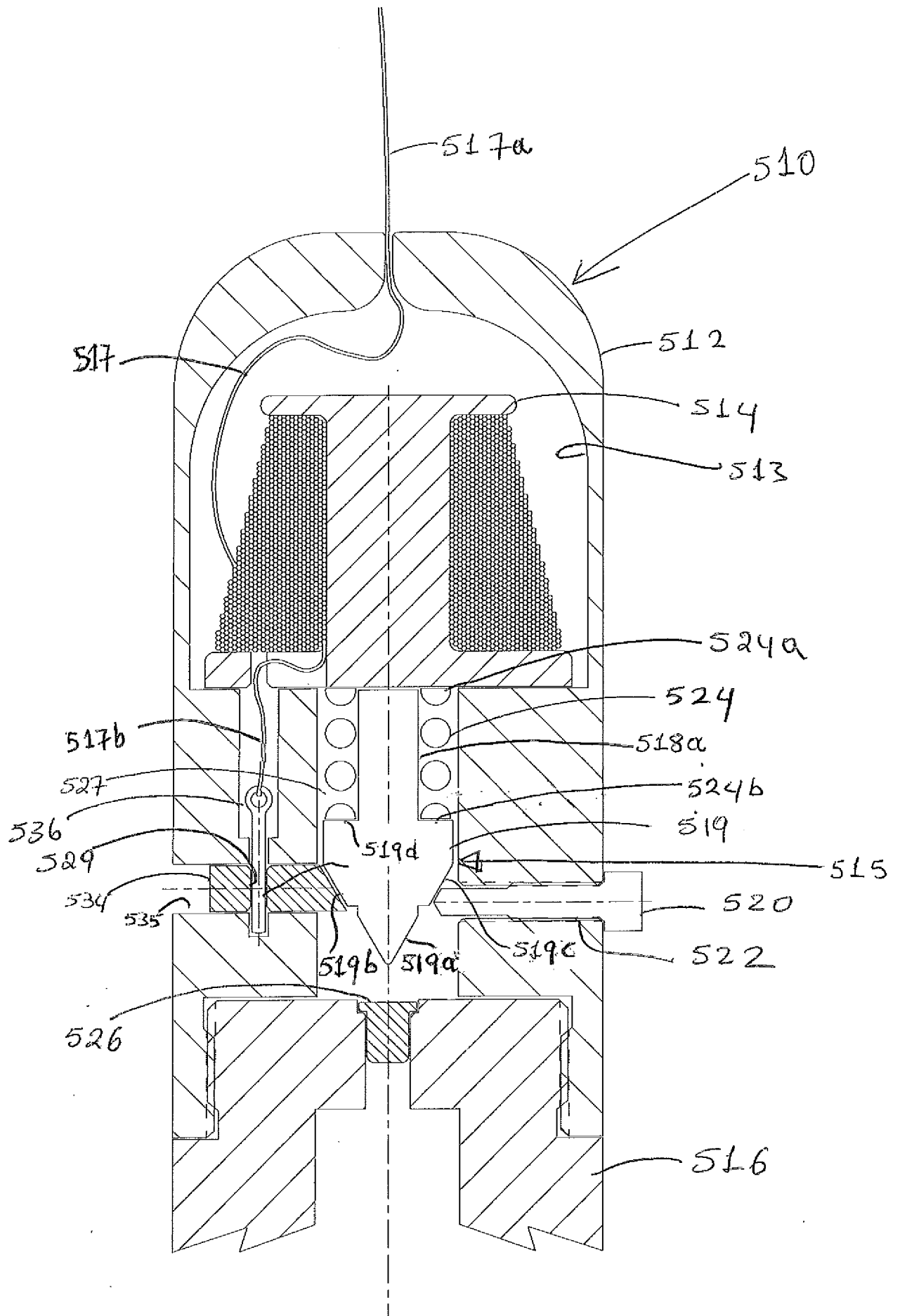


Figure 7