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(54) **FLOW TUBE**

STRÖMUNGSROHR

TUBE D'ÉCOULEMENT

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Description

[0001] This invention relates to a flow tube and more particularly a flow tube of an apparatus for use in providing a liquid seal around a variable diameter conduit which may be moved through the apparatus.

[0002] Wireline refers to a strand of wire that is used to run a variety of tools down a wellbore for several purposes. It is used during well intervention and monitoring operations in the oil and gas industry.

[0003] Multiple-conductor and single conductor cable is typically referred to as wireline. Multiple strand wire braided to form a single cable is referred to as braided wireline. Wirelines are electric cables that transmit data about the well and are used for both intervention and formation evaluation operations.

[0004] It is common in oilfield operations to affect a grease seal around braided wireline cable when operating slick line in high pressure/high temperature wells. A liquid seal stuffing box incorporating a grease injection control head is used to provide a pressure seal around the wireline cable thereby preventing escape of well fluids to the environment. The grease injection control head is typically deployed on top of the pressure control equipment used to control pressure in the well.

[0005] The control head typically comprises a housing with a bore extending from one end to the other. A flow tube assembly comprising a plurality of steel flow tubes extend through the bore providing a path for the slick line through the housing. The methodology for this sealing mechanism is to pump a high viscous grease into the tight annulus between the outer surface of the cable and the inner surface of the flow tubes.

[0006] The flow tube assemblies consists of a number of close fitting steel tubes through which the wire line passes. Each flow tube is approximately 14 inches (35.5cm) long and these are slipped onto the wire and connected together with a fast collar connection to build up the required length.

[0007] Viscous grease is injected between the inner surface of the bore of the flow tube and the outside of the wire and travels along the length of the flow tube stack creating a pressure drop. Grease injection pressure can then be increased to about 20% - 25% more than the well pressure to create a liquid seal that allows the wire to move but prevents the escape of well fluids.

[0008] The inside diameter of the flow tubes needs to be from 0.003 to 0.008 inches (0.0076 to 0.02 cm) larger than the actual wire diameter for the seal to be effective so the flow tubes must be selected based on the wire being used. As the diameter of the wireline increases, the internal diameter of the flow tubes must therefore be increased.

[0009] As noted, the geometry and the viscosity combine to provide sufficient back pressure that can be practically maintained by the grease control head such that the pressure generated exceeds the pressure of the well. In this situation the well pressure is effectively controlled

and the escape of well fluids is prevented providing the grease pressure exceeds the well. With the seal in place it is then possible to deploy or remove the wire into the well to perform the necessary downhole operation.

[0010] The length of the flow tubes required depends on a number of different factors such as the well pressure, the wire size, the flow tube size, the grease viscosity and pump rate. The effectiveness of the seal will depend on the pull out speed of the wire. The relationship for the pressure drop can be expressed mathematically by Couettes flow equation. This shows that the clearance between the wire and the flow tube has a great effect on the pressure drop created as so this is the most important parameter to consider.

[0011] Figure 1 shows a typical wireline cable passing through a flow tube of a control head. Couettes flow equation is expressed as :

$$P_2 - P_1 = 6L\mu Q / Rh^3$$

[0012] Where:

P₂= Grease injection pressure at flow tube (psi)

P₁=Grease outlet pressure at flow tube (psi)

L=length of flow tube (in)

μ=Grease viscosity (lb/sec/in²)

h=Flow tube ID minus wireline OD (in)

R=Wireline radius (in)

Q=Grease flow rate (in³/sec)

[0013] The actual diameter for the wire must be measured and recorded to allow the correct diameter of flow tube to be selected. The condition of the wire must also be considered as mud or rust can cause the wire to swell which would affect the measured diameter of the wire. Consideration also needs to be given to the wear of the flow tubes as these tend to wear in the middle where it is most difficult to measure the bore. All of these factors will affect the efficiency of the grease seal around the wireline and therefore the ability for the control head to seal around the wireline against well pressure.

[0014] In operation, the grease is injected above the first flow tube in the flow tube arrangement and exists after the last one. Since the grease is continuously moving along the flow tubes within the housing, and some is being lost to the well, the injection process is continuous. In order to create sufficient flow rate it may be necessary to inject at two locations depending on the well pressure.

[0015] The main challenge with this grease sealing method is the relationship between the outside diameter of the cable and the inside diameter of the flow tube. It is desirable to have the annular gap as small as possible but the tolerance on the diameter of the cable and the flow tube must be considered to ensure that the cable does not become stuck. Typically, a gap of 0.006 inch (0.015cm) diameter clearance is sought, which requires careful measurement of the wire and selection of the flow

tube bore to ensure safe operation. Within these limitations there would be a need for four or more flow tubes of 12 inch (30.48cm) length to practically seal against typical well head pressures.

[0016] The number of flow tubes can be varied depending on well fluids (gas) and the clearance that has been used between wire and flow tube and also the viscosity of the grease being used. This can lead to complexities in the planning of the rig up and can also lead to restricted running speed of the wire as that can disrupt the annular flow of the grease.

[0017] Recently there have been developments in cable design that has encapsulated the braided wire within a plastic coating. The intention of this is to create a smooth surface on the cable so that conventional contact sealing can be achieved against an elastomeric sleeve that is compressed to affect a seal on the cable to prevent well fluids from escaping. The challenge for this solution is to provide adequate adhesion between the encapsulation and the braided cable such that the encapsulation is not stripped off or damaged as the cable passes through the compressed packing. This has led to damage to the cable and loss of sealing capability during well operations, which results in unsafe practices which are to be avoided.

[0018] It has been proposed that the grease seal described above can be used on the encapsulated cable to remove the direct contact with the cable. The practicality of this is difficult to achieve because the tolerance on the outside diameter of the encapsulated cable is more significant than the tight clearance that needs to be maintained between the cable and the steel flow tube such that the grease pump can still maintain the required pressure. In effect it is impossible to create a satisfactory set up that will work.

[0019] It is an aim of the present invention to provide a solution to or at least to mitigate against the above problems associated with known flow tubes.

[0020] It is a further aim of the present invention to provide a method of forming a grease seal around a wireline deployed into the well which mitigates against the above described problems associated with known control heads.

[0021] According to one aspect of the present invention there is provided a flow tube for a control head for an apparatus for forming a liquid seal around a conduit, cable or wire for intervention into a well, the flow tube comprising a flexible body, the flexible body comprises a plastics material and/or polytetrafluoroethylene which is capable of stretching to accommodate localised variations in the external diameter of the conduit, cable or wire while maintaining a close contact with the external surface of the conduit, cable or wire.

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[0022] US2,943,682 describes a wireline control head for use with an elongated element that is to be inserted

into or removed from a zone of higher fluid pressure. The control head includes a rigid flow tube which provides an elongated axial passage or bore through which a wireline or cable passes.

5 **[0023]** GB2,136,477 describes a grease injection control head for maintaining a seal about a wire performing wireline operations in a well. A flow tube is formed of a plurality of rigid tubular members which each include a bore for passage of the wireline.

10 **[0024]** Preferably the flexible body comprises one or more sections.

[0025] Advantageously, each section comprises a substantially T-shaped member having a longitudinal portion and a radial portion which extends perpendicular to the longitudinal section and is formed at one end of the longitudinal section. Preferably, the flexible body of the flow tube comprises a plastics material.

[0026] Advantageously the flexible body comprises polytetrafluoroethylene.

20 **[0027]** Preferably the flexible body comprises a conductive material.

[0028] Conveniently, the flexible body comprises a metallic coating.

25 **[0029]** Advantageously, the metallic coating comprises bronze or carbon.

[0030] Advantageously, the radial portion of the liner section is integrally formed with the longitudinal portion of the liner section.

30 **[0031]** Alternatively each liner section is substantially cylindrical

[0032] Preferably each liner section is mounted within a bushing mounted in the housing.

[0033] Advantageously each bushing has a circumferential groove in the outer surface.

35 **[0034]** Conveniently a sealing means such as an O-ring is mounted in the groove of the bushing to provide a seal between the outer surface of the bushing and the inner surface of the bore of the housing.

40 **[0035]** Advantageously a spacer may be mounted between one liner section and the subsequent liner section.

[0036] According to a second aspect of the present invention, there is provided a control head for an apparatus for forming a liquid seal around a conduit, cable or wire for intervention into a well, the control head comprising a flow tube according to the first aspect of the present invention.

45 **[0037]** Conveniently, the control head further comprises a housing, the housing having a bore extending from one end to the other through the housing the flow tube providing a pathway for a conduit, cable or wire through the housing, the control head further comprising grease ports for pumping grease into the flow tube to provide a grease seal between the outer surface of the wire and the inner surface of the flow tube to allow the conduit, cable or wire to move longitudinally within the flow tube.

55 **[0038]** Advantageously the control head further comprises one or more bushings mounted in the housing, the bushing(s) supporting the flow tube and mounting the

flow tube in the housing.

[0039] Conveniently, the or each bushing has a circumferential groove in the outer surface.

[0040] Preferably, a sealing means is mounted in the groove of the bushing to provide a seal between the outer surface of the bushing and the inner surface of the bore of the housing.

[0041] Preferably the housing comprises steel.

[0042] Preferably also the bore is centrally located through the housing.

[0043] According to a further aspect of the present invention, there is provided a liquid seal stuffing box comprising a control head according to the second aspect of the present invention.

[0044] According to a fourth aspect of the present invention, there is provided a method of providing a grease seal around a conduit, cable or wire deployed into a well for operations including intervention and formation evaluation operations, the method comprising the steps of deploying a control head according to the second aspect of the present invention on pressure control equipment on the well, passing a conduit, cable or wire through the flow tube within the bore of the housing of the control head, the flow tube providing a close fit to the outer diameter of the wireline and accommodating any localised variations in outer diameter of the conduit, cable or wire and pumping grease into the flow tube to provide a grease seal between the outer surface of the conduit, cable or wire and the inner surface of the flow tube to allow the conduit, cable or wire to move backwards and forwards through the flow tube.

[0045] The present invention can be retro fitted to known control heads to improve functionality and extends the operation whilst achieving the significant benefits of the present invention.

[0046] An embodiment of the present invention will now be described with reference to and as shown in the accompanying drawings in which:-

Figure 1 is a standard view of a flow tube;

Figure 2 is a perspective view of an apparatus for creating a grease seal around a wire line incorporating a control head according to one embodiment of the present invention;

Figure 3 is a cross sectional view of the stuffing box of figure 2;

Figure 4 is an enlarged view of a part of the flow tube arrangement of the stuffing box of Figure 2 incorporating the expandable liner of the present invention;

Figure 5 is an enlarged view of an alternative embodiment of the expandable liner of the present invention, and

Figure 6 is an enlarged view of a liner section of figure 5 in which holes are drilled to aid equalization of pressure across the liner.

[0047] Turning now to the figures, Figure 2 shows a perspective view of an apparatus 1 for providing and

maintaining a grease seal around a wireline cable 2 when operating in a high pressure/high temperature well during intervention and/or formation evaluation operations.

[0048] Figure 3 shows a cross section through the apparatus shown in Figure 2.

[0049] The apparatus comprises a number of standard components which are shown in Figure 2. The apparatus comprises a hollow tubular sub member which has a first stuffing box portion 3 and a second control head portion 4. The control head portion comprises an outer mandrel 5 having a first portion 6 and a second portion 7 separated by a mid-portion 8 of reduced outer diameter. An injection port 9 is provided in each of the first and second portions on either side of the mid portion. The injection ports 9 are connected to fluid passageways within the tubular sub as will be described further below. A threaded collar 10 having an outer diameter greater than the outer diameter of the outer mandrel 5, is mounted over one end of the outer mandrel. A connector sub 11 is attached to the other end of the outer mandrel, remote from the collar. A piston 12 is mounted within the stuffing box section, remote from the collar.

[0050] The outer mandrel 5 of the control head portion has a bore 13 extending through the mandrel from one end to the other. The bore has a generally continuous diameter as it extends through the outer mandrel of the control head portion. A cylindrical housing 14 is mounted within the bore. The housing is shorter than the length of the bore in the outer mandrel 5 as shown in Figure 3 and is spaced from each end of the bore.

[0051] The housing 14 comprises a substantially metallic body, for example the housing may be a steel body. The housing has a central bore 15 extending from one end to the other. The bore is concentrically aligned with the bore 13 through the outer mandrel of the control head portion. When the housing 14 is in position in the bore 13 of the outer mandrel, a continuous pathway is formed through the bore of the housing within the outer mandrel.

[0052] Figure 4 is an enlarged cross sectional view of a part of the metallic housing 14 within the control head portion of the apparatus.

[0053] The diameter of the central bore 15 through the housing 14 is constant. A flow tube comprising a flexible liner 16 is mounted within the bore 15 and passes from the opening of the bore at one end of the housing to the other end of the housing. The liner replaces the known rigid flow tube assemblies that are shown in the prior art stuffing box shown in Figure 1. The liner comprises plastic and or polytetrafluoroethylene (PTFE). Preferably also the liner comprises a coating of metal such as for example bronze or carbon. Bronze has been identified as giving particularly good wear characteristics to the liner. Alternatively, particles of the metal may be incorporated into the material of the flexible liner as it is formed, providing similar attributes to the liner.

[0054] The liner comprises a plurality of liner sections 17, each section having a substantially T-shaped cross-section. Four such sections are shown in Figure 4. Each

section of liner comprises a first longitudinal portion 18 that extends co-axially within the bore 15 of the housing 14 and a second radial portion 19 that extends perpendicularly from one end of the longitudinal portion. The radial portion of the liner forms an annular lip around one end of the longitudinal portion of the liner. The annular lip is provided substantially perpendicular to the longitudinal portion 18 of the liner. The annular lip of the liner is integrally formed with the longitudinal portion of the liner.

[0055] Each liner section 17 is mounted within an annular bushing 20. As shown in figure 4, the annular bushings are mounted within the bore 15 in the housing 14. Each bushing 20 has a cylindrical form with an internal diameter which substantially matches the external diameter of the liner sections 17 and an outer diameter which provides a close fit with the internal diameter of the bore 15.

[0056] Sealing means are provided between the outer surface of the bushings 20 and the internal surface of the bore 15. As shown in Figure 4, an annular groove 21 is provided in the outer surface of the bushing and a sealing means such as for example an O-ring or gasket 22 is seated within the groove.

[0057] Each bushing 20 has a male pin 23 at one end and a female socket 24 at the other such that a number of bushings can be mounted within the bore of the housing, each bushing providing a female socket within which the male pin of the subsequent bushing can locate.

[0058] The outer diameter of the male pin 23 at the first end of the bushing matches the outer diameter of the annular lip of the liner. The internal diameter of the female socket 24 of the bushing is slightly larger than the outer diameter of the male pin member 23 to enable a male pin member of one bushing to fit closely and be received securely within the female socket of an adjacent bushing.

[0059] As shown in Figure 4, when a number of liner sections 17 are mounted with the bore to form a flow tube, the annular lip of each liner section is encapsulated between the female socket 24 of one bushing and the male pin member 23 of the next adjacent bushing.

[0060] When the liner is mounted within the housing, an annulus 25 is formed between the outer surface of the liner and the inner surface of the central bore 15 through the housing. The bushings 20 close off the annulus at each end of the housing. The sealing means 22 provided around the bushings provide a seal to close off the annulus.

[0061] As shown in Figures 2 and 3, the grease injection ports 9 are provided along the control head portion 4 for injecting grease both into the interior of the liner but also into the annulus formed between the outer surface of the liner and the inner surface of the bore through the housing. Grease return ports are also provided along the control head portion for the return of injected grease from both the interior of the flexible liner and the annulus between the liner and the interior of the housing. Grease is therefore recirculated between the injection ports and the return ports to provide a continuous supply of grease

along the length of the wireline as it passes through the liner and also along the annulus between the outer surface of the liner and the inner surface of the housing. The grease injection ports and return ports are standard and work in the same way as in a conventional stuffing box as shown in Figure 2.

[0062] In use of the present invention, a wireline 2 is inserted through the liner 16 within the bore 15 of the housing of the control head portion 4 to provide for intervention into the well.

[0063] The flexibility of the liner 16 ensures that the liner can accommodate any localised variations in outer diameter of the wireline 2 while still ensuring that the gap between the outer diameter of the wireline and the inner surface of the liner is sufficiently small to allow a supply of high pressure grease to be pumped into the liner to form a grease seal around the wireline. In other words, the liner can expand to accommodate any variation in outer diameter of the wireline while still maintaining a light contact on the outer surface of the wireline along the whole length of the liner.

[0064] Grease is then pumped via the grease injection ports 9 both into the liner between the internal surface of the liner and the wireline, but also around the liner between the outer surface of the liner and the inner surface of the bore of the housing. As grease is injected into the liner, a grease seal is provided around the wireline. As the liner is flexible, any localised variations in the diameter of the wireline can be accommodated and the liner will stretch over any localised area while maintaining a close fit along the whole length of the wireline. This provides a significant advantage over a rigid flow tube, because in order to accommodate any variation in outer diameter of the wireline, a larger internal diameter of flow tube would be required, thus increasing the size of the gap between the outer surface of the wireline and the inner surface of the flow tube which makes maintaining the grease seal more difficult due to the larger cross sectional area of the annulus created around the wireline.

[0065] As grease is pumped into the liner, the grease exerts a pressure against the end of the first flexible liner section 17 and pushes the flexible liner section forwards such that the annular lip of the flexible liner portion is forced against the female socket 24 of the subsequent bushing 20 mounting the next flexible liner section. As the first flexible liner section is sealed against the female socket of the subsequent bushing, the annular lip of the flexible liner section within the subsequent bushing is forced in the same way against the female socket of the next bushing within the housing. This maintains a seal at each annular lip of the respective liner sections against the female socket of the next bushing in the housing.

[0066] Continued pumping of grease into the liner maintains the grease seal around the wireline within the liner and enables the liner to be used with wireline having localised variations in diameter without loss of seal pressure. Where the flow tubes of a conventional control head can only handle wireline of a small range of diameters,

the flexible liner of the present invention can accommodate wireline of a much larger range of diameters.

[0067] Furthermore, as grease is simultaneously pumped between the outer surface of the flexible liner and inner surface of the bore of the housing from the same source, the outer surface of the liner is held off the surface of the bore of the housing and the pressure acting across the thin flexible liner is zero such that the liner itself is not subject to the pressure being pumped.

[0068] As a result, the gap between the cable and the flexible liner acting as a flow tube, is always effectively zero and as such the flow rate required is greatly reduced as is the length of the flow tube required. This provides additional benefits of reduced rig heights, the ability to safely seal on a variable diameter of cable and avoid the contact stress on the encapsulated surface of the cable.

[0069] It will of course be appreciated that the present invention can be useful in retrofitting to an existing stuffing box which incorporates rigid flow tube sections such as that shown in Figures 2 of the drawings. The rigid flow tube sections can be stripped out of the housing and a cylindrical housing 14 incorporating a flexible liner 16 as described above can then be mounted in the control head portion. Thus existing equipment can be retrofitted with a flexible liner to provide the same advantages as those described above while avoiding the need to redesign or replace existing equipment. This leads to significant benefits in relation to cost savings as existing equipment can be quickly and efficiently upgraded with the flexible liner of the present invention.

[0070] Additionally, the present invention provides significant environmental benefits as there is no need to decommission existing equipment which will significantly reduce wastage of original operating equipment. Reconfiguring existing equipment with the present invention not only ensures that the operating life of the equipment is increased, but also ensures less material is wasted.

[0071] As the flexible liner 16 of the present invention provides for smoother operation of the control equipment, it is anticipated that this will lead to less seepage of grease through the control head portion, thereby reducing the amount of grease lost to the environment surrounding the control head in use, thus leading to a reduction in contamination of the seawater surrounding the subsea control equipment. Therefore, the present invention provides additional environmental advantages over known equipment.

[0072] It is a further advantage of the present invention is that the overall length of the string required using rigid flow tube sections can be decreased when replacing the rigid flow tube sections with a flexible liner 16 as described above because the annular gap between the outer surface of the wireline cable and the inner surface of the liner is effectively zero as the flexible liner stretches over any localised variation in diameter of the wireline whilst remaining in close contact with the outer surface of the wireline along the entire length of the wireline cable. Furthermore, as the gap between the outer surface of

the cable and the inner surface of the liner is effectively zero, this leads to a reduction in leakage of grease from between the outer surface of the cable and the inner surface of the liner which provides a further significant advantage both in terms of operational costs and also environmental factors.

[0073] In an alternative embodiment of the invention shown in figure 5, the liner sections may be formed as tubular sections with only a longitudinal portion 18 rather than the T-shaped sections of the previous embodiment. In this embodiment, the liner sections are mounted between a bottom sub 26 at one end of the housing and a top sub 27 at the other. A spacer 28 may be provided between the first two flexible liner sections to provide an end stop to locate the liner axially within the housing. As grease is pumped into the liner, this creates a force that pushes each liner section forwards against the end of the next respective tubular liner section. This embodiment may be particularly advantageous for use in operations where the flow tube is required to operate at higher pressures as all of the force applied to the liner sections is transferred through the subsequent sections without any significant axial force being transferred into a radial lip.

[0074] In this and other embodiments, small holes may be drilled through the side walls of the tubular sections of the liner to further aid in balancing the pressure across the liner, especially when a wireline cable is being removed from the liner. Figure 6 illustrates a liner section in which holes 29 are drilled as described above.

[0075] In a further (non-illustrated) embodiment, the bushings 20 may be redesigned as substantially cylindrical bodies. The bushings at either end of the string would be modified such that the internal diameter of these bushings would be reduced to provide an undercut within the body at each end bushing. The flexible liner of this embodiment would be provided within the bushings and extend from the internal shoulder of the undercut at one end bushing to the internal shoulder of the undercut at the other end bushing. In this embodiment, each bushing would similarly be provided with an external annular groove to seat a sealing means such as an O-ring or gasket.

[0076] As with the earlier embodiments, the flexible liner can accommodate any localised variations in outer diameter of the wireline thus ensuring that the effective gap between the outer surface of the wireline and the inner surface of the liner is zero thus reducing the flow rate required to maintain a grease seal around the outer surface of the wireline to allow the wireline to move longitudinally within the liner during well operations.

Claims

1. A flow tube for a control head (4) for an apparatus for forming a liquid seal around a conduit, cable or wire (2) for intervention into a well, the flow tube com-

- prising a flexible body (16), **characterised in that** the flexible body comprises a plastics material and/or polytetrafluoroethylene which is capable of stretching to accommodate localised variations in the external diameter of the conduit, cable or wire while maintaining a close contact with the external surface of the conduit, cable or wire.
2. A flow tube according to claim 1, wherein the flexible body (16) comprises one or more sections (17).
 3. A flow tube according to claim 2, wherein each section (17) comprises a substantially T-shaped member having a longitudinal portion (18) and a radial portion (19) which extends perpendicular to the longitudinal section and is formed at one end of the longitudinal section.
 4. A flow tube according to any of the preceding claims, wherein the flexible body (16) comprises a metallic coating.
 5. A flow tube according to claim 4, wherein the metallic coating comprises bronze or carbon.
 6. A control head (4) for an apparatus for forming a liquid seal around a conduit, cable or wire (2) for intervention into a well, the control head comprising a flow tube according to any of claims 1-5.
 7. A control head (4) according to claim 6, further comprising a housing, (14) the housing having a bore (15) extending from one end to the other through the housing, the flow tube providing a pathway for a conduit, cable or wire (2) through the housing, the control head further comprising grease ports (9) for pumping grease into the flow tube to provide a grease seal between the outer surface of the wire and the inner surface of the flow tube to allow the conduit, cable or wire to move longitudinally within the flow tube.
 8. A control head (4) according to claim 7, further comprising one or more bushings (20) mounted in the housing, the bushing(s) supporting the flow tube and mounting the flow tube in the housing.
 9. A control head (4) according to claim 8, wherein the or each bushing (20) has a circumferential groove (21) in the outer surface.
 10. A control head (4) according to claim 9, wherein a sealing means (22) is mounted in the groove (21) of the bushing (20) to provide a seal between the outer surface of the bushing and the inner surface of the bore of the housing.
 11. A control (4) head according to any of claims 7-10, wherein the housing comprises steel.
 12. A liquid seal stuffing box (3) comprising a control head (4) according to any of claims 7-11.
 13. A method of providing a grease seal around a conduit, cable or wire (2) deployed into a well for operations including intervention and formation evaluation operations, the method comprising the steps of deploying a control head (4) according to any of claims 7-11 on pressure control equipment in the well, passing a conduit, cable or wire (2) through the flow tube within the bore (15) of the housing (14) of the control head, the flow tube providing a close fit to the outer diameter of the conduit, cable or wire and accommodating any localised variations in outer diameter of the conduit, cable or wire and pumping grease into the flow tube to provide a grease seal between the outer surface of the conduit, cable or wire and the inner surface of the flow tube to allow the conduit, cable or wire to move backwards and forwards through the flow tube.

Patentansprüche

1. Ein Strömungsrohr für einen Steuerkopf (4) für eine Vorrichtung zum Bilden einer Flüssigkeitsdichtung um eine Leitung, ein Kabel oder einen Draht (2) zum Eingriff in ein Bohrloch, wobei das Strömungsrohr einen biegsamen Körper (16) beinhaltet, **dadurch gekennzeichnet, dass** der biegsame Körper ein Kunststoffmaterial und/oder Polytetrafluorethylen beinhaltet, das sich dehnen kann, um lokalisierte Variationen in dem externen Durchmesser der Leitung, des Kabels oder des Drahts aufzufangen, während enger Kontakt mit der äußeren Oberfläche der Leitung, des Kabels oder des Drahts aufrechterhalten wird.
2. Strömungsrohr gemäß Anspruch 1, wobei der biegsame Körper (16) einen oder mehrere Teilabschnitte (17) beinhaltet.
3. Strömungsrohr gemäß Anspruch 2, wobei jeder Teilabschnitt (17) ein im Wesentlichen T-förmiges Element mit einem länglichen Abschnitt (18) und einem radialen Abschnitt (19), der sich senkrecht zu dem länglichen Teilabschnitt erstreckt, beinhaltet und an einem Ende des länglichen Teilabschnitts gebildet ist.
4. Strömungsrohr gemäß einem der vorhergehenden Ansprüche, wobei der biegsame Körper (16) eine metallische Beschichtung beinhaltet.
5. Strömungsrohr gemäß Anspruch 4, wobei die metallische Beschichtung Bronze oder Kohlenstoff beinhaltet.

6. Ein Steuerkopf (4) für eine Vorrichtung zum Bilden einer Flüssigkeitsdichtung um eine Leitung, ein Kabel oder einen Draht (2) zum Eingreifen in ein Bohrloch, wobei der Steuerkopf ein Strömungsrohr gemäß einem der Ansprüche 1-5 beinhaltet. 5
7. Steuerkopf (4) gemäß Anspruch 6, der ferner ein Gehäuse (14) beinhaltet, wobei das Gehäuse eine Bohrung (15) aufweist, die sich von einem Ende zu dem anderen durch das Gehäuse erstreckt, wobei das Strömungsrohr ein Medium für eine Leitung, ein Kabel oder einen Draht (2) durch das Gehäuse bereitstellt, wobei der Steuerkopf ferner Schmiernippel (9) zum Pumpen von Schmiere in das Strömungsrohr beinhaltet, um eine Schmierdichtung zwischen der äußeren Oberfläche des Drahts und der inneren Oberfläche des Strömungsrohrs bereitzustellen, um der Leitung, dem Kabel oder dem Draht zu ermöglichen, sich in Längsrichtung innerhalb des Strömungsrohrs zu bewegen. 10
8. Steuerkopf (4) gemäß Anspruch 7, der ferner eine oder mehrere Buchsen (20) beinhaltet, die in dem Gehäuse befestigt sind, wobei die Buchse(n) das Strömungsrohr stützt/stützen und das Strömungsrohr in dem Gehäuse befestigt/befestigen. 15
9. Steuerkopf (4) gemäß Anspruch 8, wobei die oder jede Buchse (20) eine Umfangsrille (21) in der äußeren Oberfläche aufweist. 20
10. Steuerkopf (4) gemäß Anspruch 9, wobei ein Dichtungsmittel (22) in der Rille (21) der Buchse (20) befestigt ist, um eine Dichtung zwischen der äußeren Oberfläche der Buchse und der inneren Oberfläche der Bohrung des Gehäuses bereitzustellen. 25
11. Ein Steuerkopf (4) gemäß einem der Ansprüche 7-10, wobei das Gehäuse Stahl beinhaltet. 30
12. Eine Stopfbox (3) der Flüssigkeitsdichtung, die einen Steuerkopf (4) gemäß einem der Ansprüche 7-11 beinhaltet. 35
13. Ein Verfahren zum Bereitstellen einer Schmierungs- 40
dichtung um eine Leitung, ein Kabel oder einen Draht (2), eingesetzt in ein Bohrloch für Operationen, die Eingriffs- und Formationsbewertungsoperationen umfassen, wobei das Verfahren die Schritte des Einsetzens eines Steuerkopfs (4) gemäß einem der Ansprüche 7-11 auf Drucksteuerungsausrüstung in dem Bohrloch, das Führen einer Leitung, eines Kabels oder eines Drahts (2) durch das Strömungsrohr innerhalb der Bohrung (15) des Gehäuses (14) des Steuerkopfs, wobei das Strömungsrohr eine dichte 45
Passung an den äußeren Durchmesser der Leitung, des Kabels oder des Drahts bereitstellt und jegliche lokalisierte Variationen im äußeren Durchmesser

der Leitung, des Kabels oder des Drahts auffängt und das Pumpen von Schmiere in das Strömungsrohr beinhaltet, um eine Schmierdichtung zwischen der äußeren Oberfläche der Leitung, des Kabels oder des Drahts bereitzustellen, um der Leitung, dem Kabel oder dem Draht zu ermöglichen, sich rückwärts und vorwärts durch das Strömungsrohr zu bewegen.

Revendications

1. Un tube d'écoulement pour une tête de contrôle (4) destinée à un appareil pour former une barrière liquide étanche autour d'un conduit, câble ou fil (2) en vue d'une intervention dans un puits, le tube d'écoulement comprenant un corps flexible (16), **caractérisé en ce que** le corps flexible comprend une matière plastique et/ou du polytétrafluoroéthylène qui est apte à un étirement afin de s'adapter à des variations localisées dans le diamètre externe du conduit, câble ou fil tout en maintenant un contact rapproché avec la surface externe du conduit, câble ou fil.
2. Un tube d'écoulement selon la revendication 1, dans lequel le corps flexible (16) comprend une ou plusieurs sections (17).
3. Un tube d'écoulement selon la revendication 2, dans lequel chaque section (17) comprend un élément substantiellement en forme de T présentant une portion longitudinale (18) et une portion radiale (19) qui s'étend perpendiculairement à la section longitudinale et est formée au niveau d'une extrémité de la section longitudinale.
4. Un tube d'écoulement selon n'importe lesquelles des revendications précédentes, dans lequel le corps flexible (16) comprend un revêtement métallique.
5. Un tube d'écoulement selon la revendication 4, dans lequel le revêtement métallique comprend du bronze ou du carbone.
6. Une tête de contrôle (4) destinée à un appareil pour former une barrière liquide étanche autour d'un conduit, câble ou fil (2) en vue d'une intervention dans un puits, la tête de contrôle comprenant un tube d'écoulement selon n'importe lesquelles des revendications 1 à 5.
7. Une tête de contrôle (4) selon la revendication 6, comprenant en sus un boîtier (14), le boîtier présentant un alésage (15) qui s'étend d'une extrémité à l'autre à travers le boîtier, le tube d'écoulement fournissant une voie de cheminement pour un conduit,

câble ou fil (2) à travers le boîtier, la tête de contrôle comprenant en sus des orifices à graisse (9) pour injecter de la graisse par pompage dans le tube d'écoulement afin de fournir une barrière de graisse étanche entre la surface extérieure du fil et la surface intérieure du tube d'écoulement pour permettre au conduit, câble ou fil de se mouvoir longitudinalement à l'intérieur du tube d'écoulement. 5

8. Une tête de contrôle (4) selon la revendication 7, comprenant en sus une ou plusieurs bagues (20) montées dans le boîtier, la ou les bagues supportant le tube d'écoulement et montant le tube d'écoulement dans le boîtier. 10

9. Une tête de contrôle (4) selon la revendication 8, dans laquelle la ou chaque bague (20) présente une rainure circonférentielle (21) dans la surface extérieure. 15

10. Une tête de contrôle (4) selon la revendication 9, dans laquelle un moyen d'étanchéité (22) est monté dans la rainure (21) de la bague (20) pour fournir une barrière étanche entre la surface extérieure de la bague et la surface intérieure de l'alésage du boîtier. 20 25

11. Une tête de contrôle (4) selon n'importe lesquelles des revendications 7 à 10, dans laquelle le boîtier comprend de l'acier. 30

12. Un presse-étoupe à barrière liquide étanche (3) comprenant une tête de contrôle (4) selon n'importe lesquelles des revendications 7 à 11. 35

13. Un procédé consistant à fournir une barrière de graisse étanche autour d'un conduit, câble ou fil (2) déployé dans un puits en vue d'opérations incluant des opérations d'intervention et d'évaluation de formation, le procédé comprenant les étapes consistant à déployer une tête de contrôle (4) selon n'importe lesquelles des revendications 7 à 11 sur un équipement de contrôle de pression dans le puits, à faire passer un conduit, câble ou fil (2) à travers le tube d'écoulement à l'intérieur de l'alésage (15) du boîtier (14) de la tête de contrôle, le tube d'écoulement fournissant un ajustement serré sur le diamètre extérieur du conduit, câble ou fil et s'adaptant à toutes variations localisées dans le diamètre extérieur du conduit, câble ou fil, et à injecter de la graisse par pompage dans le tube d'écoulement afin de fournir une barrière de graisse étanche entre la surface extérieure du conduit, câble ou fil et la surface intérieure du tube d'écoulement pour permettre au conduit, câble ou fil de se mouvoir en arrière et en avant à travers le tube d'écoulement. 40 45 50 55

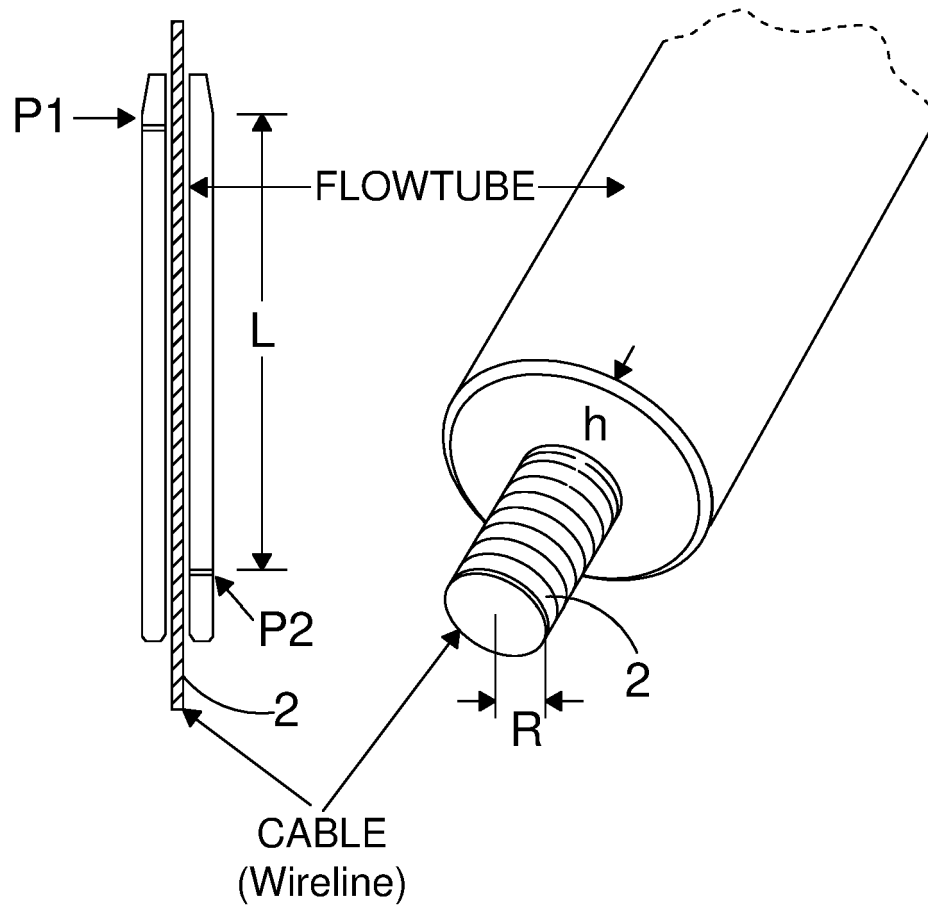


FIG. 1

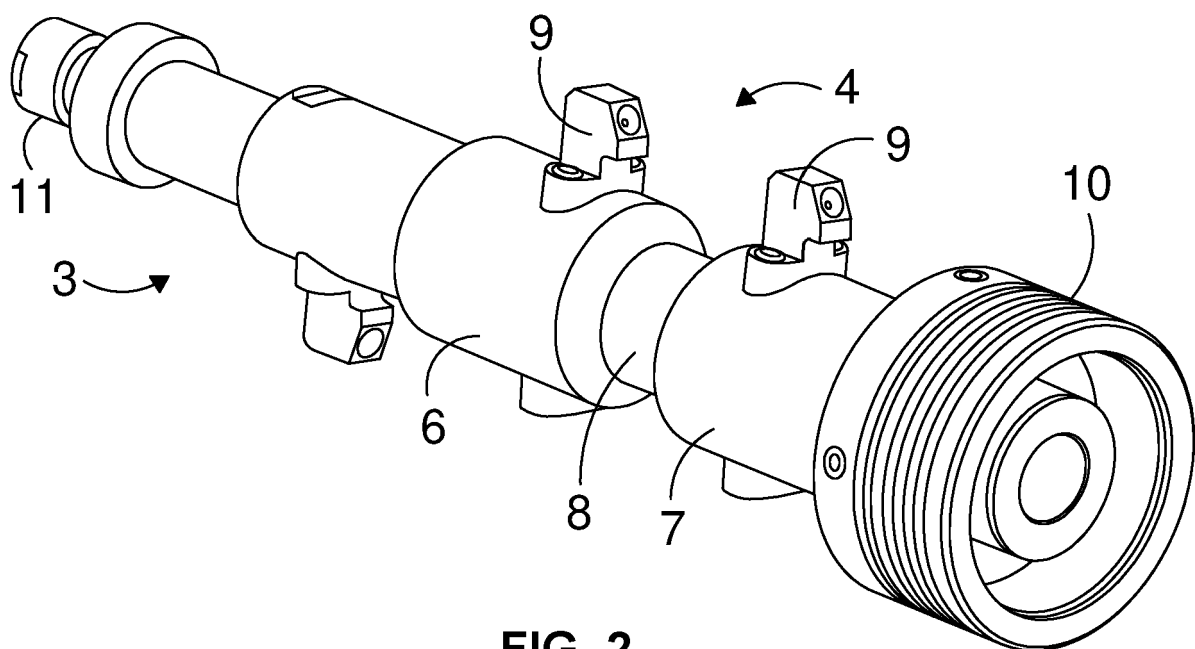
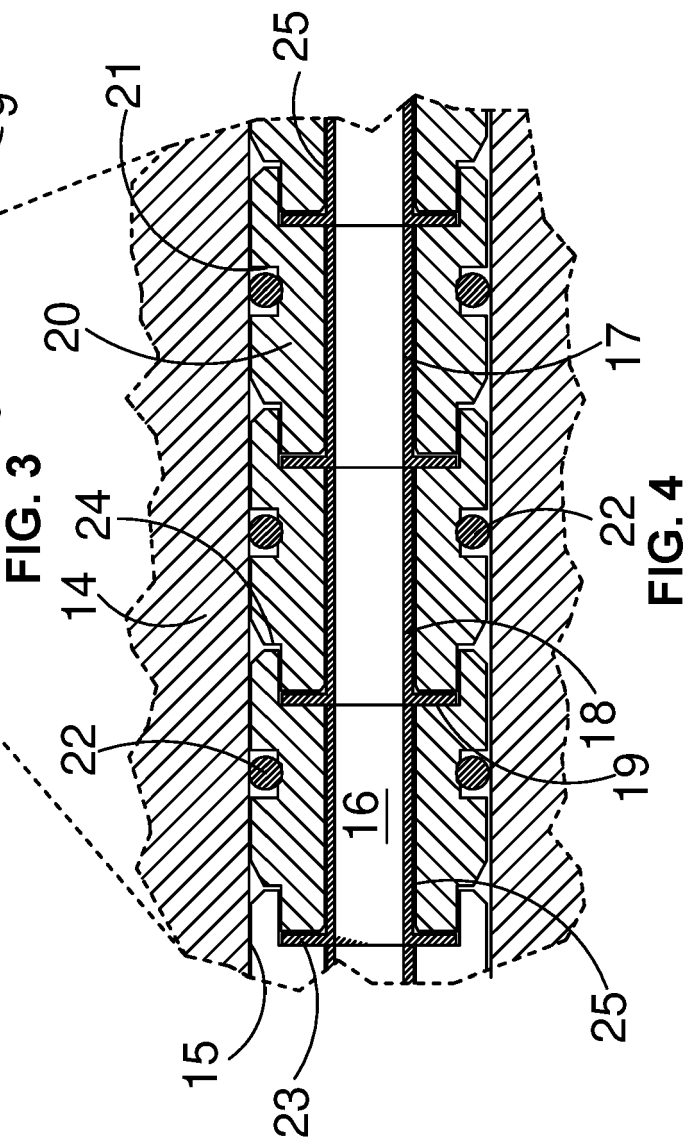
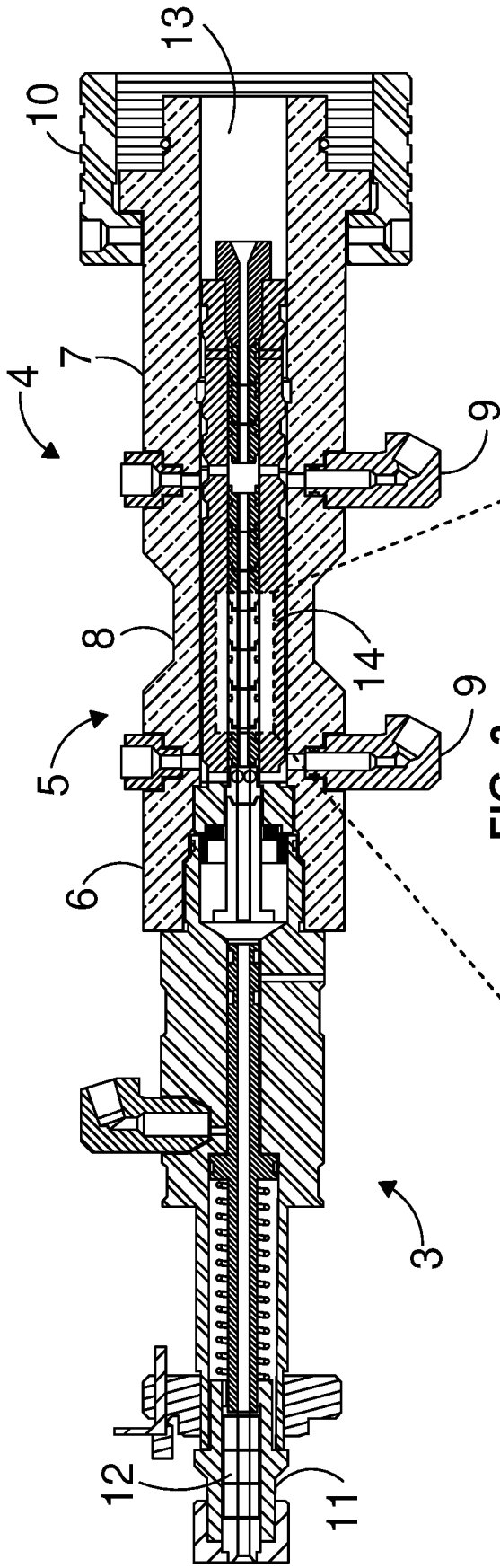


FIG. 2



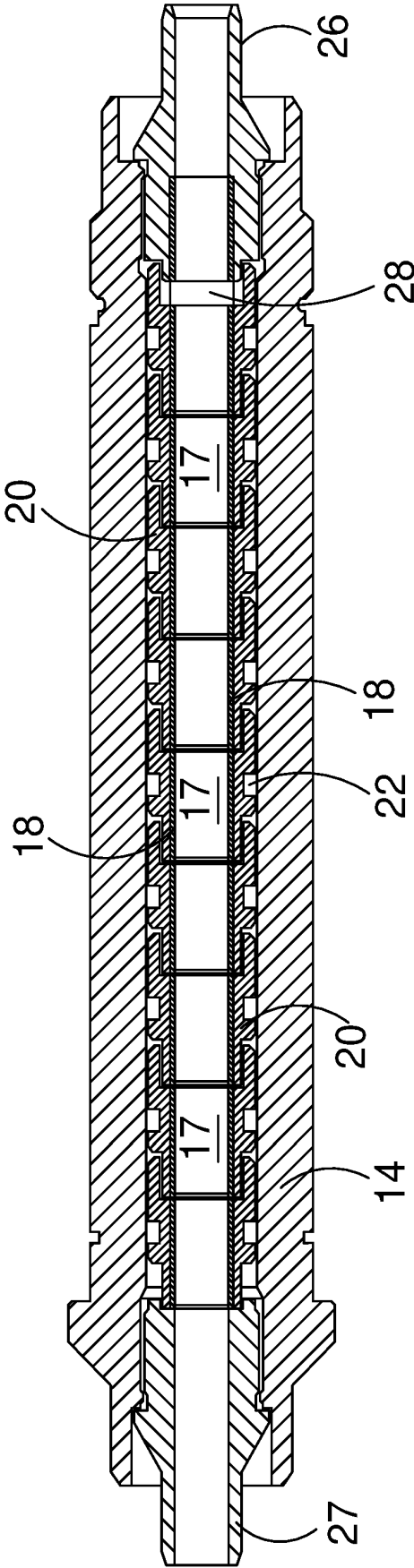


FIG. 5

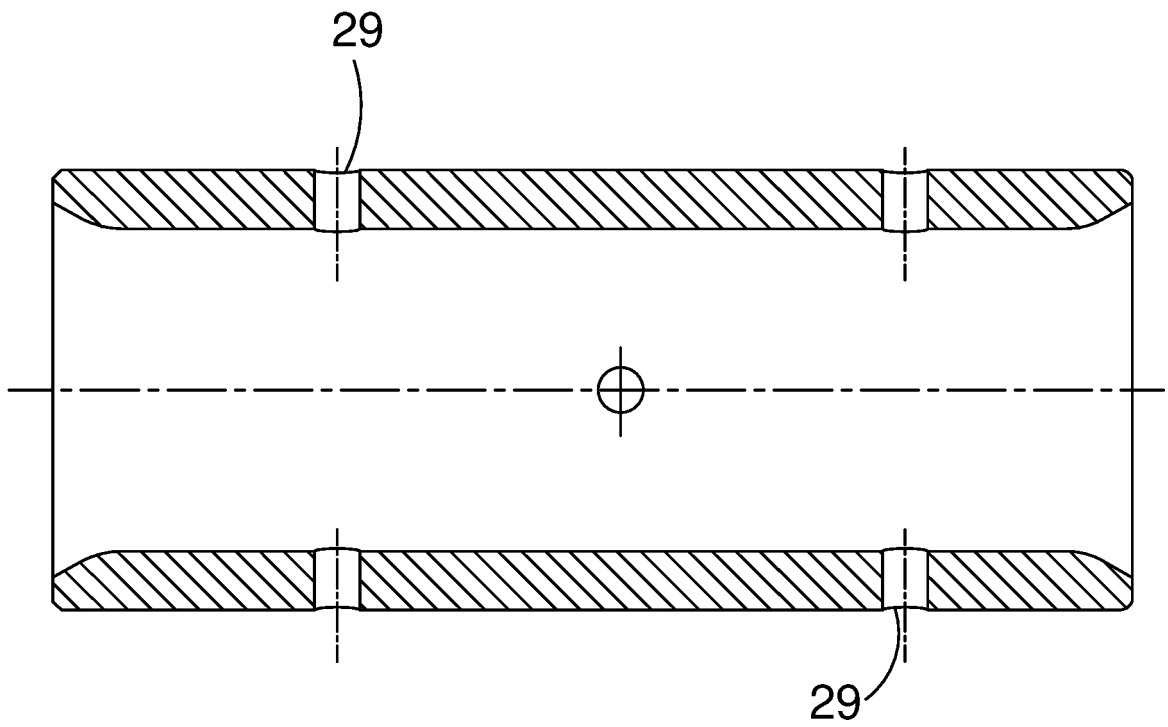


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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