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(71) Applicant (for all designated States except US): **KAI SERVICES INC.** [CA/CA]; 5140 Yonge Street, Suite 2250, Toronto, Ontario M2N 2L7 (CA).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **NIZIENKO, Yuri Kontantinovich** [RU/RU]; Sirenevt Bulevar 5-124, Troitsk, MosKovskaya obl 142190 (RU). **BELILOVSKIY,**

Victor [RU/CA]; 99 Avenue Road, Suite 708, Toronto, Ontario M5R 2G5 (CA).

(74) Agent: **BERESKIN & PARR LLP/S.E.N.C.R.L., S.R.L.**; 40 King Street West, Suite 4000, Toronto, Ontario M5H 3Y2 (CA).

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(54) Title: HERMETIC THREADED CONNECTING DEVICE FOR DRILL OR CASING PIPES OF TECHNICAL CASING OF GEOLOGICAL PROSPECTING DRILLING RIG

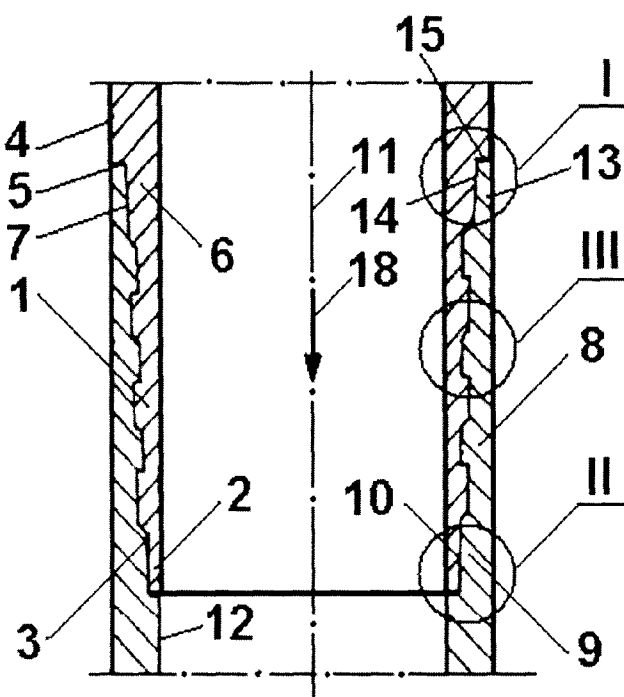


FIG. 1

(57) Abstract: Embodiments of this invention relate to the field of geological prospecting, in particular to hermetic tapered threaded connections for tubular structures (sections) in the construction of drilling and/or casing strings used for drilling geological prospecting wells to investigate the subsurface earth's crust to determine the presence of useful minerals.



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TITLE: HERMETIC THREADED CONNECTING DEVICE FOR DRILL OR
CASING PIPES OF TECHNICAL CASING OF GEOLOGICAL
PROSPECTING DRILLING RIG

FIELD

5 [0001] Embodiments of this invention relate to the field of geological prospecting, in particular to hermetic tapered threaded connections for tubular structures (sections) in the construction of drilling and/or casing strings used for drilling geological prospecting wells to investigate the subsurface earth's crust to determine the presence of useful minerals.

10 [0002] More specifically, variants of the invention relate to a tapered threaded connection, containing means for changing the direction of load on the thread as well as a number of independent seals that are sensitive to external stimuli (pressure), spaced in the axial direction relative to the seal, which is formed by direct mutual engagement of the structural sectional
15 elements of the thread, with the aim of insulating the thread from the effects of the fluid medium both inside the pipe channel, as well as from the outer surface of the connected tubular structures.

INTRODUCTION

[0003] The task of sealing tapered threaded connections can be
20 reduced essentially to their compaction by some means or other, that is, it consists of the task of closing off along the cross-section in any area of the threaded connection the apertures of the four channels of leakage, namely:

[0004] - the channel between the spiral of peaks of the box thread and the spiral of valleys of the pipe (pin) thread;

25 [0005] - the channel between the spiral of valleys of the box thread and the spiral of vertices of the pipe (pin) thread;

[0006] - the channel between the spirals of the lateral frontal surfaces of the threads of the box and the pipe (pin);

[0007] - the channel between the spirals of the lateral rear
30 surfaces of the threads of the box and the pipe (pin).

[0008] From the prior art is known a hermetic threaded connecting device for the drill or casing pipes of the technical casing of a geological prospecting drilling rig, having a through channel, the diameter of which corresponds to the inner diameter of the connecting pipes, and equipped with means for fastening to the connecting pipes, including:

[0009] - a tapered tool joint pin with a threaded part positioned in the central region of its outer tapered surface, by an axially directed projection with a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the valleys of the smaller diameter thread, as well as with a bearing sealing shoulder, radially extending in the direction of the periphery with respect to the threaded part on the side of its larger diameter and axially distanced with respect to the threaded part by the magnitude of the axially directed section with a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the peaks of said thread in this zone;

[0010] - a tool joint box structurally organized with the possibility of screwing into it the tapered tool joint pin, with the formation of a tapered threaded interlocking connection in the central region of its inner tapered surface, which on the side of the box thread with the smaller diameter is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the peaks of the thread in this zone, which is bounded by a shoulder radially directed toward the axis of the connection, and from the side of the larger diameter thread said tapered surface is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the valleys of the thread in this zone and bound by the bearing end surface of the box, engaged with the matching surface of the bearing shoulder of the tapered tool joint pin at an angle to the axis of connection with the formation of a tapered surface of engagement with the vertex turned toward the means of fastening the tapered tool joint pin to the pipe;

[0011] - said end surface of axially directed projection of the tapered tool joint pin and the opposite surface of the shoulder of the tool joint box, radially directed toward the axis of the connection are spatially separated by an axial gap;

- 5 [0012] - the geometrical parameters of the opposite engaging sealing surfaces of the tapered tool joint pin and tool joint box are chosen from the conditions for providing in the engagements an inter-metallic sealing interaction in the process of tightening the connection;

- [0013] - the profiles of the thread in the tapered threaded interlocking
10 connection are similar figures in the form of unequal sided trapezoids, principally, with rounded vertices, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces of the thread, oriented at a negative angle relative to the perpendicular to the axis of the connection, the gently sloping lateral fixed
15 surfaces are spatially distanced with a relative gap;

[0014] - herewith, the height of the profile elements, that is, the peaks and valleys, of the tapered tool joint pin exceeds the height, in the operational state of the connection, of the profile elements of the thread of the tool joint box (US, No. 5,788,401, 1998).

- 20 [0015] It should be added to the disadvantages of this known art that there is inadequate hermeticity of the connection formed by adjoining pipes in connection with the implementation of sealing circular structures (smooth sealing surfaces) of cylindrical form with inter-metallic contact directly on the metal of the connected (adjoining) pipe elements, which (in performing
25 repeated assembly and disassembly of a connection with a tight fit, that is, an interference fit) leads to abrasions on the engaging sealing surfaces and, as a consequence, a loss of hermeticity and penetration of fluid into the zone of threaded engagement, and this reduces the working life of the threaded connection as a whole (due to progressive corrosion), as well as its reliability
30 in relation to acceptance of workload.

[0016] Another drawback of the reviewed known art solution is the relatively uneven distribution of load between the structural sectional elements of the thread in the operational state of the pipe with relative misalignments of adjoining pipes in the process of employment, due to the absence of specific structural means in the area of connection to ensure that (under certain operating conditions, that is, with the formation of misalignments and bending moments in the zone of the thread) there is a redistribution of load between the turns of the thread. This also reduces the reliability and lifetime of the connection as a whole.

10 SUMMARY

[0017] The claimed technical solution was based on the challenge of improving the lifetime of the pipe in its operational condition and the reliability of the connection to adjoining pipes, while ensuring optimal conditions for performing repeated assembly and disassembly without damaging the integrity (quality) of the engaging sealing surfaces.

[0018] In this way, the technical result is an increase in the hermeticity of the tapered threaded connection through the use of the claimed pipe and the provision of even distribution of workload over all the turns of the thread in the process of employment in order to improve the durability and reliability of the combined technological system as a whole.

[0019] This technical result (according to the first embodiment of the invention) is achieved by there being in the hermetic threaded connecting device for the drill or casing pipes of the technical casing of a geological prospecting drilling rig, having a through channel, the diameter of which corresponds to the inner diameter of the connecting pipes, and equipped with means for fastening to the connected pipes, which include:

[0020] - a tapered tool joint pin with a threaded part positioned in the central region of its outer tapered surface, by an axially directed projection with a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the valleys of the smaller

diameter thread, as well as with a bearing sealing shoulder, radially extending in the direction of the periphery with respect to the threaded part on the side of its larger diameter and axially distanced with respect to the threaded part by the magnitude of the axially directed section with a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the peaks of said thread in this zone;

[0021] - a tool joint box structurally organized with the possibility of screwing into it the tapered tool joint pin, with the formation of a tapered threaded interlocking connection in the central region of its inner tapered surface, which on the side of the box thread with the smaller diameter is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the peaks of the thread in this zone, which is bounded by a shoulder radially directed toward the axis of the connection, and from the side of the larger diameter thread said tapered surface is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the valleys of the thread in this zone and bound by the bearing end surface of the box, engaged with the matching surface of the bearing shoulder of the tapered tool joint pin at an angle to the axis of connection with the formation of a tapered surface of engagement with the vertex facing in the direction of the device for fastening the tapered tool joint pin to the pipe.

[0022] In some examples, said end surface of axially directed projection of the tapered tool joint pin and the opposite surface of the shoulder of the tool joint box, radially directed toward the axis of the connection are spatially separated by an axial gap.

[0023] In some examples, the geometrical parameters of the opposite engaging sealing surfaces of the tapered tool joint pin and tool joint box are chosen from the conditions for providing in the engagements an inter-metallic sealing interaction in the process of tightening the connection.

[0024] In some examples, the profiles of the thread in the tapered threaded interlocking connection are similar figures in the form of unequal sided trapezoids, principally, with rounded vertices, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces of the thread, oriented at a negative angle relative to the perpendicular to the axis of the connection, the gently sloping lateral fixed surfaces are spatially distanced with a relative gap.

[0025] In some examples, while the height, at least, of part of the profile elements, that is, the peaks and valleys, of the tapered tool joint pin exceeds the height (in the operational state of the connection) of the matching profile elements of the thread of the tool joint box.

[0026] In some examples, in the body of the axially directed section with a smooth sealing outer surface, which [section] is positioned on the side of the larger diameter thread of the tapered tool joint pin, as well as in the body of the axially directed section with a smooth sealing inner surface, which [section] is positioned on the side of the smaller diameter thread of the tool joint box, are executed circular profiled grooves, which are functionally a means of changing the direction of load on the corresponding thread, while the maximum depth of said grooves, principally, exceeds the height of the profile of the corresponding thread.

[0027] It is optional that, at least, part of the area of the engaging surfaces of the tapered tool joint pin and the tool joint box be formed in the shape of elements of conical form.

[0028] It is acceptable for the engaging sealing surfaces of the tapered tool joint pin and the tool joint box to be executed in cylindrical form.

[0029] It is most reasonable for the engaging sealing surfaces of the tapered tool joint pin and the tool joint box to be executed with an anti-friction and/or corrosion-resistant coating composed of a material with a modulus of elasticity not exceeding, principally, the lower value of the modulus of elasticity of the material of the elements of the connection.

[0030] The delivered technical result (according to the second embodiment of the invention) is achieved by there being in the hermetic threaded connecting device for the drill or casing pipes of the technical casing of a geological prospecting drilling rig, having a through channel, the diameter of which corresponds to the inner diameter of the connecting pipes, and
5 equipped with means for fastening to the connected pipes, which include:

[0031] - a threaded tool joint pin with a threaded part positioned in the central region of its outer tapered surface, by an axially directed projection with a smooth sealing outer surface, which is physically a continuation of the
10 threaded part and is formed within the diameter of the valleys of the smaller diameter thread, as well as with a bearing sealing shoulder, radially extending in the direction of the periphery with respect to the threaded part on the side of its larger diameter and axially distanced with respect to the threaded part by the magnitude of the axially directed section with a smooth sealing outer
15 surface, which is structurally an extension of the threaded part and formed within the diameter of the protrusions mentioned thread in this zone;

[0032] - a tool joint box structurally organized with the possibility of screwing into it the tapered tool joint pin, with the formation of a tapered threaded interlocking connection in the central region of its inner tapered
20 surface, which on the side of the box thread with the smaller diameter is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the peaks of the thread in this zone, which is bounded by a shoulder radially directed toward the axis of the connection, and from the side of the larger diameter thread said tapered
25 surface is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the valleys of the thread in this zone and bound by the bearing end surface of the box, tightly engaged with the matching surface of the bearing shoulder of the tapered tool joint pin at an angle to the axis of the connection to form a tapered surface of engagement
30 with the vertex facing in the direction of the device for fastening the tapered tool joint pin to the corresponding pipe.

[0033] In some examples, said end surface of axially directed projection of the tapered tool joint pin and the opposite surface of the shoulder of the tool joint box, radially directed toward the axis of the connection are spatially separated by an axial gap.

- 5 [0034] In some examples, the geometrical parameters of the opposite engaging sealing surfaces of the tapered tool joint pin and tool joint box are chosen from the conditions for providing in the engagements an inter-metallic sealing interaction in the process of tightening the connection.

- 10 [0035] In some examples, the profiles of the thread in the tapered threaded interlocking connection are similar figures in the form of unequal sided trapezoids, principally, with rounded vertices, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces of the thread, oriented at a negative angle relative to the perpendicular to the axis of the connection, the gently sloping lateral fixed
15 surfaces are spatially distanced with a relative gap.

[0036] In some examples, the height, at least, of part of the profile elements, that is, the peaks and valleys, of the thread of the tool joint box exceeds the height of the matching, in the operational state of the connection, profile elements of the tapered tool joint pin.

- 20 [0037] It is expedient in the body of the axially directed section with a smooth sealing outer surface, which [section] is positioned on the side of the larger diameter thread of the tapered tool joint pin, as well as in the body of the axially directed section with a smooth sealing inner surface, which [section] is positioned on the side of the smaller diameter thread of the tool
25 joint box, that there are executed circular profiled grooves, which are functionally a means of changing the direction of load on the corresponding thread, while the maximum depth of said grooves, principally, exceeds the height of the profile of the corresponding thread.

[0038] It is reasonable that, at least, part of the area of the engaging sealing surfaces of the tapered tool joint pin and tool joint box be formed in the shape of elements of conical form.

[0039] It is acceptable for the engaging sealing surfaces of the tapered tool joint pin and the tool joint box to be executed in cylindrical form.

[0040] It is most optimal for the engaging sealing surfaces of the tapered tool joint pin and the tool joint box to be executed with an anti-friction and/or corrosion-resistant coating composed of a material with a modulus of elasticity not exceeding (principally, lower than) the modulus of elasticity of the material of the elements of the connection.

[0041] The delivered technical result (according to the third embodiment of the invention) is achieved by there being in the hermetic threaded connecting device for the drill or casing pipes of the technical casing of a geological prospecting drilling rig, having a through channel, the diameter of which corresponds to the inner diameter of the connecting pipes, and equipped with means for fastening to the connected pipes, which include:

[0042] - a threaded tool joint pin with a threaded part positioned in the central region of its outer tapered surface, by an axially directed projection with a bearing end and a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the valleys of the smaller diameter thread, and also with a shoulder radially extending in the direction of the periphery with respect to the threaded part on the side of its larger diameter and axially distanced with respect to the threaded part by the magnitude of the axially directed section with a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the peaks of said thread in this zone;

[0043] - a tool joint box structurally organized with the possibility of screwing into it a conical tip to form a tapered threaded interlocking connection in the central region of the inner tapered surface, which on the side of the box thread with the smaller diameter is transformed into an axially

directed section with a smooth sealing inner surface formed within the diameter of the peaks of the thread in this zone, which is bounded by a bearing shoulder radially directed towards the axis of the connection, and from the side of the larger diameter thread said tapered surface is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the valleys of the thread in this zone, bounded by the end surface, spatially separated from the opposite surface of the shoulder of the tapered tool joint pin by means of a gap;

[0044] In some examples, the geometrical parameters of the opposite engaging sealing surfaces of the tapered tool joint pin and tool joint box are chosen from the conditions for providing in the engagements an inter-metallic sealing interaction in the process of tightening the connection.

[0045] In some examples, the profiles of the thread in the tapered threaded interlocking connection are similar figures in the form of unequal sided trapezoids with rounded apexes, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces of the thread, oriented at a negative angle relative to the perpendicular to the axis of the connection, while the gently sloping oppositely-positioned lateral fixed surfaces are spatially arranged with a relative gap.

[0046] In some examples, the height, at least, of part of the profile elements, that is, the peaks and valleys, of the tapered tool joint pin exceeds the height, in the operational state of the connection, of the profile elements of the tool joint box.

[0047] In some examples, in the body of the axially directed section with a smooth sealing outer surface, which [section] is positioned on the side of the larger diameter thread of the tapered tool joint pin, as well as in the body of the axially directed section with a smooth sealing inner surface, which [section] is positioned on the side of the smaller diameter thread of the tool joint box, are executed circular profiled grooves, which are functionally a

means of changing the direction of load on the corresponding thread, while the maximum depth of said grooves, principally, exceeds the height of the profile of the corresponding thread.

[0048] In some examples, the engaged surfaces of the bearing
5 shoulder of the box and the bearing end of the tapered tool joint pin are spatially oriented at an angle to the axis of the connection to form a tapered surface of engagement with the vertex facing in the direction of the device for fastening the tapered tool joint pin to the pipe.

[0049] It is practicable that, at least, part of the area of the engaging
10 sealing surfaces of the tapered tool joint pin and tool joint box be formed in the shape of elements of conical form.

[0050] It is acceptable for the engaging sealing surfaces of the tapered tool joint pin and the tool joint box to be executed in cylindrical form.

[0051] It is most optimal for the engaging sealing surfaces of the
15 tapered tool joint pin and the tool joint box to be executed with an anti-friction and/or corrosion-resistant coating composed of a material with a modulus of elasticity not exceeding, principally, the lower value of the modulus of elasticity of the material of the elements of the connection.

[0052] The delivered technical result (according to the fourth
20 embodiment of the invention) is achieved by there being in the hermetic threaded connecting device for the drill or casing pipes of the technical casing of a geological prospecting drilling rig, having a through channel, the diameter of which corresponds to the inner diameter of the connecting pipes, and equipped with means for fastening to the connected pipes, which include:

25 [0053] - a threaded tool joint pin with a threaded part positioned in the central region of its outer tapered surface, by an axially directed projection with a bearing end and a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the valleys of the smaller diameter thread, and also with a shoulder radially

extending in the direction of the periphery with respect to the threaded part on the side of its larger diameter and axially distanced with respect to the threaded part by the magnitude of the axially directed section with a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the peaks of said thread in this zone;

[0054] - a tool joint box structurally organized with the possibility of screwing into it the tapered tool joint pin, with the formation of a tapered threaded interlocking connection in the central region of its inner tapered surface, which on the side of the box thread with the smaller diameter is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the peaks of the thread in this zone, which is bounded by a bearing shoulder radially directed towards the axis of the connection, and from the side of the larger diameter thread said tapered surface is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the valleys of the thread in this zone, bounded by an end surface, spatially separated from the opposite surface of the shoulder of the tapered tool joint pin by means of a gap.

[0055] In some examples, the geometrical parameters of the opposite engaging sealing surfaces of the tapered tool joint pin and tool joint box are chosen from the conditions for providing in the engagements an inter-metallic sealing interaction in the process of tightening the connection.

[0056] In some examples, the profiles of the thread in the tapered threaded interlocking connection are similar figures in the form of unequal sided trapezoids, principally, with rounded vertices, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces of the thread, oriented at a negative angle relative to the perpendicular to the axis of the connection, while the gently sloping oppositely-positioned lateral fixed surfaces are spatially arranged with a relative gap.

[0057] In some examples, the height, at least, of part of the profile elements, that is, the peaks and valleys, of the thread of the tool joint box exceeds the height of the matching, in the operational state of the connection, profile elements of the thread of the tool joint pin.

5 [0058] In some examples, the engaged surfaces of the bearing shoulder of the box and the bearing end of the tapered tool joint pin are spatially oriented at an angle to the axis of the connection to form a tapered surface of engagement with the vertex facing in the direction of the device for fastening the tapered tool joint pin to the pipe.

10 [0059] It is expedient in the body of the axially directed section with a smooth sealing outer surface, which [section] is positioned on the side of the larger diameter thread of the tapered tool joint pin, as well as in the body of the axially directed section with a smooth sealing inner surface, which [section] is positioned on the side of the smaller diameter thread of the tool
15 joint box, that there are executed circular profiled grooves, which are functionally a means of changing the direction of load on the corresponding thread, while the maximum depth of said grooves, principally, exceeds the height of the profile of this thread.

[0060] It is optional that, at least, part of the area of the engaging
20 sealing surfaces of the tapered tool joint pin and tool joint box be formed in the shape of elements of conical form.

[0061] It is acceptable for the engaging sealing surfaces of the tapered tool joint pin and the tool joint box to be executed in cylindrical form.

[0062] It is most optimal for the engaging sealing surfaces of the
25 tapered tool joint pin and the tool joint box to be executed with an anti-friction and/or corrosion-resistant coating composed of a material with a modulus of elasticity not exceeding (principally, lower than) the modulus of elasticity of the material of the elements of the connection.

[0063] An analysis of the level of technology conducted by the applicant, including search in patent and scientific-technical information sources and the identification of sources containing information about analogues of the claimed invention, has made it possible to establish that no
5 analogues are found characterized by features and the links between them identical to all of the essential features of the claimed technical solution, while the prototype selected from the identified analogues as the closest analogue in its array of features allowed the identification of an array of significant (relative to the technical result reviewed by the applicant) distinctive features
10 of the claimed invention, set forth in the summary of the invention.

DRAWINGS

[0064] For a better understanding of the embodiments described herein and to show more clearly how they may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings which
15 show at least one exemplary embodiment, and in which:

[0065] Figure 1 is a general view of embodiment 1 of the claimed technical solution in operational state;

[0066] Figure 2 is a detail view of point I in figure 1 (nodes of the radial and end seal, and also a means of changing the direction of the load on the
20 threads in the form of a circular profiled groove on the upper section of the connection);

[0067] Figure 3 is a detail view of point II in figure 1 (node of the radial seal and a means of changing the direction of the load on the thread in the form of a circular profiled groove on the lower section of the connection);

25 [0068] Figure 4 is a detail view of point III in figure 1 (the geometry of the profile of the threaded connection),

[0069] Figure 5 is a general view of embodiment 2 of the claimed technical solution in operational state.

[0070] Figure 6 is a detail view of point IV in figure 5 (nodes of the radial and end seal and also a means of changing the direction of the load on the threads in the form of a circular profiled groove on the upper section of the connection);

- 5 [0071] Figure 7 is a detail view of point V in figure 5 (node of the radial seal and a means of changing the direction of the load on the thread in the form of a circular profiled groove on the lower section of the connection);

[0072] Figure 8 is a detail view of point VI in figure 5 (the geometry of the profile of the threaded connection);

- 10 [0073] Figure 9 is a general view of the claimed technical solution for embodiment 3 in operational state.

[0074] Figure 10 is a detail view of point VII of figure 9 (nodes of the radial and end seal and also a means of changing the direction of the load on the thread in the form of a circular profiled groove on the lower section of the connection);

15

[0075] Figure 11 is a detail view of point VIII in figure 9 (a node of the radial seal and also a means of changing the direction of the load on the thread in the form of a circular profiled groove on the upper section of the connection);

- 20 [0076] Figure 12 is a detail view of point IX in figure 9 (the geometry of the profile of the threaded connection);

[0077] Figure 13 is a general view of the claimed technical solution for embodiment 4 in operational state;

[0078] Figure 14 is a detail view of point X in figure 13 (nodes of the radial and end seal and also a means of changing the direction of the load on the thread in the form of a circular profiled groove on the lower section of the connection);

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[0079] Figure 15 is a detail view of point XI in figure 13 (a node of the radial seal and also a means of changing the direction of the load on the

thread in the form of a circular profiled groove on the upper section of the connection); and

[0080] Figure. 16 is a detail view of point XII of figure 13 (the geometry of the profile of the threaded connection).

5 [0081] For simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or
10 analogous elements.

DESCRIPTION OF VARIOUS EMBODIMENTS

[0082] Various apparatuses or processes will be described below to provide an example of an embodiment of each claimed invention. No
15 embodiment described below limits any claimed invention and any claimed invention may cover processes or apparatuses that are not described below. The claimed inventions are not limited to apparatuses or processes having all of the features of any one apparatus or process described below or to features common to multiple or all of the apparatuses described below. It is
20 possible that an apparatus or process described below is not an embodiment of any claimed invention. Any invention disclosed in an apparatus or process described below that is not claimed in this document may be the subject matter of another protective instrument, for example, a continuing patent application, and the applicants, inventors or owners do not intend to abandon,
25 disclaim or dedicate to the public any such invention by its disclosure in this document.

[0083] In the drawings the corresponding constructional elements and structures are indicated by the following locations.

- [0084] 1 – tool joint pin (tapered with a central threaded part on the outer surface).
- [0085] 2 – projection (of tool joint pin 1 axially directed with smooth sealing outer surface 3).
- 5 [0086] 3 – surface (sealing, on projection 2).
- [0087] 4 – shoulder (of tool joint pin 1).
- [0088] 5 – surface (end, of shoulder 4).
- [0089] 6 – section (of tool joint pin 1, with smooth sealing outer surface 7).
- 10 [0090] 7 – surface (sealing, of section 6).
- [0091] 8 – box (interlocking, with the internal threaded tapered surface in the central part).
- [0092] 9 – section (of the inner surface of box 8, with a smooth sealing inner surface 10).
- 15 [0093] 10 – surface (inner sealing, of box 8 on section 9).
- [0094] 11 – axis (longitudinal, of the tapered threaded connection).
- [0095] 12 – shoulder (of box 8 on the side of the thread with the smaller diameter).
- [0096] 13 – section (with smooth sealing surface 14, of the inner
20 surface of box 8 on the side of its thread with the larger diameter).
- [0097] 14 – surface (smooth sealing, of box 8 on section 13).
- [0098] 15 – surface (end, of box 8, on section 13).
- [0099] 16 – vertex (of tapered surface 17, interfacing with bearing facing surface of tool joint pin 1 and tool joint box 8).
- 25 [00100] 17 – surface (of interface, tapered, of bearing facing surfaces of tool joint pin 1 and tool joint box 8).

- [0100] 18 – direction (of drilling, indicated by the arrow).
- [0101] 19 – gap (between the mutually facing end surfaces of tool joint pin 1 and tool joint box 8).
- 5 [0102] 20 - surface (steep lateral bearing, with a negative angle of incline to the thread of tool joint pin 1).
- [0103] 21 – surface (lateral gently sloping fixed, of tool joint pin 1).
- [0104] 22 – surface (steep lateral bearing, with a negative angle α of slope to the thread of tool joint box 8)
- [0105] 23 – surface (lateral gently sloping fixed, of tool joint box 8).
- 10 [0106] 24 – gap (between the lateral gently sloping fixed surfaces 21 and 23 of the thread of tool joint pin 1 and tool joint box 8, respectively).
- [0107] 25 – groove (circular, executed in the body of tool joint pin 1, functionally serving as a means of changing the direction of load on the thread).
- 15 [0108] 26 – groove (circular, executed in the body of the tool joint box, functionally serving as a means of changing the direction of load on the thread).
- [0109] 27 – coating (anti-friction and/or corrosion resistant).
- [0110] The features of the structural-design implementation of the
20 claimed technical solution according to the first embodiment of the invention are as follows.
- [0111] Referring to Figures 1-4, a hermetic threaded connection device for the drilling or casing pipes of the technical casing of a geological prospecting drilling rig, having a through channel, the diameter of which
25 corresponds to the inner diameter of the connected pipes of the casing and equipped with means for fastening to the connected pipes (by convention not shown in the graphic material) includes:

[0112] a tapered tool joint pin 1 with a threaded part positioned in the central region of its outer tapered surface, by axially directed projection 2 with smooth sealing outer surface 3, which is physically a continuation of the threaded part and is formed within the diameter of the valleys of the smaller diameter thread, and also with an inclined sealing shoulder 4 (having a sealing surface 5), radially extending towards the periphery with respect to the threaded part on the side of its larger diameter and axially distanced with respect to the threaded part by the magnitude of axially directed section 6 with a smooth sealing outer surface 7, which is physically a continuation of the threaded part and is formed within the diameter of the peaks of said thread in this zone;

[0113] - tool joint box 8, structurally organized to allow the possibility of screwing into it the tapered tool joint pin 1 to form a tapered threaded interlocking connection in the central region of its inner tapered surface, which on the side of the box thread with the smaller diameter is transformed into an axially directed section 9 with a smooth sealing inner surface 10, formed within the diameter of the peaks of the thread in this zone, which (that is, section 9) is bounded by shoulder 12 radially directed toward axis 11 of the connection, and on the side of the larger diameter thread said tapered threaded surface of the central region of box 8 is transformed into an axially directed section 13 with a smooth sealing inner surface 14, formed within the diameter of the valleys of the thread in this zone and bounded by oblique bearing end surface 15 of box 8, engaged with the matching surface 5 of the inclined bearing shoulder 4 of the tapered tool joint pin 1 at an angle to the axis 11 of the connection to form a tapered surface 17 of engagement with vertex 16, facing in the direction of the device for fastening the tapered tool joint pin 1 to the corresponding pipe (that is, an axially opposite direction 18 to the drilling – indicated by an arrow in graphic material).

[0114] Said end surface of the axially directed projection 2 of tapered tool joint pin 1 and the opposite surface of the shoulder, radially directed

toward axis 11 of the connection, of the tool joint box 8 are spatially separated by an axial gap 19.

[0115] The geometric parameters of the oppositely positioned engaging sealing surfaces 3 and 7 of the tapered tool joint pin 1 and tool joint box 8 (surfaces 10 and 13) are chosen from the conditions which will allow in the engagements an inter-metallic sealing interaction in the process of tightening the connection.

[0116] The profiles of the thread in the tapered threaded interlocking connection are similar figures in the form of unequal sided trapezoids, principally, with rounded vertices, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces 20 and 22 of the thread, oriented at a negative angle α with respect to the perpendicular to the axis 11 of the connection, the gently sloping lateral fixed surfaces 21 and 23 are spatially positioned with a relative gap 24.

[0117] While the height, at least, of part of the profile elements, that is, the peaks and valleys, of tapered tool joint pin 1 exceeds the height of the matching (in the operational state of the connected pipes) profile elements of the thread of tool joint box 8;

[0118] According to one embodiment of the invention, in the body of axially directed section 6 with smooth sealing outer surface 7, positioned on the side of the thread of larger diameter of tapered tool joint pin 1, as well as in the body of the axially directed section 9 with smooth sealing inner surface 10, positioned on the side of the thread of smaller diameter of tool joint box 8, are executed circular profiled grooves 25 and 26, respectively, which are functionally a means of changing the direction of load on the corresponding thread, while the maximum depth of said grooves 25 and 26, principally, exceeds the height of the profile of the corresponding thread.

[0119] It is optional that, at least, a part of the area of the engaging sealing surfaces 3 and 7 of the tapered tool joint pin 1 and tool joint box 8

(sealing surfaces 10 and 14, respectively) be formed in the shape of elements of conical form.

[0120] It is acceptable for sealing surfaces 3 and 7 of the tapered tool joint pin 1 and tool joint box 8 (sealing surfaces 10 and 14, respectively) to be executed in a cylindrical form.

[0121] It is most reasonable that the engaging sealing surfaces 3 and 7 of the tapered tool joint pin 1 and tool joint box 8 (sealing surfaces 10 and 14, respectively) are executed with anti-friction and/or corrosion-resistant coating 27 of a material with a modulus of elasticity not exceeding, principally, the lower value of the modulus of elasticity of the material of the elements of the connection.

[0122] Referring to Figures 5-8, the features of the structural-design implementation of the claimed technical solution according to the second embodiment of the invention are essentially identical to the design features of the first variant described above.

[0123] Its distinctive features are found in the fact that the height at least, of part of the profile elements (that is, the peaks and valleys) of the thread of tool joint box 8 exceeds the height of the matching (in the operational state of the connection) profile elements of the thread of tapered tool joint pin 1.

[0124] Referring to Figures 9-12, the features of the structural-design implementation of the claimed technical solution according to the third embodiment of the invention are essentially identical to the design features of the first variant described above.

[0125] Its distinctive features are found in the fact that:

[0126] - the end surface 15 of tool joint box 8 bounding its axially directed part 13 with smooth sealing inner surface 14 (positioned on the side of the thread with larger diameter), in the operational state is spatially separated from the opposite surface 5 of the shoulder 4 of tapered tool joint

pin 1 by means of gap 19, which is spatially oriented, principally, at right angles to the axis 11 of the connection;

[0127] - herewith, the engaged surfaces of bearing shoulder 12 of box 8 and of the bearing end of tapered tool joint pin 1 are spatially oriented at an angle to the axis 11 of the connection to form tapered surface 17 of engagement with the apex 16 facing in the direction of the device for fastening the tapered tool joint pin 1 to the corresponding pipe (that is, in an axially opposite direction 18 to the drilling of the well).

[0128] Referring to Figures 13-16, the features of the structural-design implementation of the claimed technical solution according to the fourth embodiment of the invention are essentially identical to the design features of the first variant described above.

[0129] Its distinctive features are found in the fact that:

[0130] - the end surface 15 of tool joint box 8, bounding its axially directed part 13 with smooth sealing inner surface 14 (positioned on the side of the thread with larger diameter), in the operational state is spatially separated from the opposite surface 5 of the shoulder 4 of tapered tool joint pin 1 by means of gap 19, which is spatially oriented, principally, at right angles to the axis 11 of the connection;

[0131] - the engaged surfaces of bearing shoulder 12 of box 8 and of the bearing end of tapered tool joint pin 1 are spatially oriented at an angle to the axis 11 of the connection to form tapered surface 17 of engagement with the apex 16, facing in the direction of the device for fastening the tapered tool joint pin 1 to the corresponding pipe (that is, an axially opposite direction 18 to the drilling of the well);

[0132] - the height, at least, of part of the profile elements, that is, the peaks and valleys, of the thread of tool joint box 8, principally, exceeds the height of the matching (in the operational state of the connection) profile elements of the thread of tapered tool joint pin 1.

[0133] The characteristics specified in the claims of the summary are significant and interconnected to each other to form a stable array of required features sufficient to produce the desired technical result.

[0134] The properties regulated in the claimed connection as individual
5 characteristics are widely known in the art and require no further explanation (see, for example, RU, № 2117133 C1, RU № 2297512 C1, RU № 2310058 C1, RU № 2338866 C1, US № 4892337 and others).

[0135] However, it should be noted that the claimed array of essential features produces in the claimed technical solution a synergistic result
10 (greater than the sum of parts).

[0136] The device operates in the following manner.

[0137] With a relative axial displacement of tool joint pin 1 and the tool joint box 8, at the beginning of the process of screwing there initially arises an interaction of the enveloping and the enveloped elements of the connection
15 via the tapered thread, for example, as in the construction of the analogous thread of the buttress type. In the process of screwing there occurs a counter advancement of the sealing surfaces (both directed along the axis of the connection and also transversely under the specified angles) of tool joint pin 1 and tool joint box 8 prior to their engagement. As a result, in the area of
20 connection there is formed four "metal-metal" seal assemblies, one of which is a directly threaded engagement. That is, there is brought about a forced engagement of the corresponding surfaces of the connection with the production of contact stresses, the size of which should be in the region of elastic deformation. The level of contact stresses, everything else being
25 equal, is regulated by the size of the contact areas of the engaging sealing surfaces. The conical end sealing (bearing) surfaces of tool joint pin 1 and the tool joint box 2 are executed in such a way that under the action of axial force on them, produced by the screwing of the threads, the transverse component of this effort is directed towards the axis 11 of the connection. This, Firstly,
30 eliminates the phenomenon of so-called "unwinding", that is, transverse

deformation with an increase in the diameter of connected elements in the region of the bearing ends, which makes the connection less critical in exceeding the permissible torque and increases its reliability of use, and secondly, provides additional compression of the engaging sealing surfaces, forming radial nodes for the sealing of the connection. Thus, the claimed construction of the connection ensures the formation of conditions for optimal tightness for the elements of the radial seal and the optimal size of stresses in the sealing bearing elements, including the threaded engagement, due to the specific geometry of its engaging profile structures.

[0138] The elements of the construction of the hermetic tapered threaded connection (formed on the basis of the claimed technical solution) can be produced industrially with the use of modern materials and technologies in enterprises producing components of operating technical casings (both drill and casing) for geological prospecting drilling rigs.

[0139] In this way, the above data are evidence of the implementation, in the operation of the claimed technical solution, of the following set of conditions:

[0140] - the object embodying the claimed technical solution in its implementation is designed for geological exploration work and could be implemented as a hermetic tapered threaded connection of tubular structures (sections) in the construction of drilling and casing strings, used in the investigation of the earth's crust to determine the presence of useful minerals (more specifically, embodiments of the invention relate to a tapered threaded connection, which (the connection) contains several independent seals, which are sensitive to external stimuli (pressure) and spaced in the axial direction relative to the seal, formed directly by the mutual engagement of the sectional elements of the thread with the aim of insulating it from the effects of fluid both inside the pipe channel, as well as outside the connected tubular structures);

[0141] - for the claimed object in the form in which it is described in the independent points of the following summary, the possibility of its

implementation is confirmed with the use of the means and methods mentioned above in the application or known in the prior art;

[0142] - the object embodying the claimed technical solution with its realization is capable of achieving the technical result foreseen by the
5 applicant.

[0143] What has been described above has been intended to be illustrative of the invention and non-limiting and it will be understood by persons skilled in the art that other variants and modifications may be made without departing from the scope of the invention as defined in the claims
10 appended hereto.

CLAIMS:

1. A Hermetic threaded connection device for drilling or casing pipes of technical casing of geological prospecting drilling rig, having a through channel, the diameter of which corresponds to the inner diameter of the connecting pipes, and equipped with means for fastening to the connecting pipes, including: a tapered tool joint pin with a threaded part positioned in the central region of its outer tapered surface, by an axially directed projection with a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the valleys of the smaller diameter thread, as well as with a bearing sealing shoulder, radially extending in the direction of the periphery with respect to the threaded part on the side of its larger diameter and axially distanced with respect to the threaded part by the magnitude of the axially directed section with a smooth sealing outer surface, being structurally a continuation of the threaded part and formed within the diameter of the peaks of said thread in this zone; a tool joint box, structurally organized with the possibility of screwing into it the tapered tool joint pin, with the formation of a tapered threaded interlocking connection in the central region of its inner tapered surface, which on the side of the box thread with the smaller diameter is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the peaks of the thread in this zone, which is bounded by a shoulder radially directed toward the axis of the connection, and from the side of the larger diameter thread said tapered surface is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the valleys of the thread in this zone and bound by the bearing end surface of the box, engaged with the matching surface of the bearing shoulder of the tapered tool joint pin at an angle to the axis of connection with the formation of a tapered surface of engagement with the vertex facing in the direction of the device for fastening the tapered tool joint pin to the pipe; said end surface of axially directed projection of the tapered tool joint pin and the opposite surface of the shoulder of the tool joint box, radially directed toward the axis of the connection, are

spatially separated by an axial gap; the geometrical parameters of the opposite engaging sealing surfaces of the tapered tool joint pin and tool joint box are chosen from the conditions for providing, in the engagements, an inter-metallic sealing interaction in the process of tightening the connection;

5 the profiles of the thread in the tapered threaded interlocking connection are similar figures in the form of unequal sided trapezoids, principally, with rounded vertices, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces of the thread, oriented at a negative angle relative to the perpendicular to the axis of the

10 connection, the gently sloping fixed side surfaces are spatially arranged with are placed with a relative gap; while the height, at least, of part of the profile elements, that is, the peaks and valleys, of the tapered tool joint pin exceeds the height, in the operational state of the connection, profile elements of the thread of the tool joint box; wherein: in the body of the axially directed section

15 with the smooth sealing outer surface, which [section] is positioned on the side of the larger diameter thread of the tapered tool joint pin, as well as in the body of the axially directed section with a smooth sealing inner surface, which [section] is positioned on the side of the smaller diameter thread of the tool joint box, are executed circular profiled grooves, which are functionally a

20 means of changing the direction of load on the corresponding thread, while the maximum depth of said grooves, principally, exceeds the height profile of the corresponding thread.

2. The hermetic threaded connection of claim 1, wherein, at least, part of the area of the engaging sealing surfaces of the tapered tool joint pin and

25 tool joint box are formed in the shape of elements of conical form.

3. The hermetic threaded connection of claim 1, wherein the engaging sealing surfaces of the tapered tool joint pin and tool joint box are executed in cylindrical form.

4. The hermetic threaded connection of claim 1, wherein the engaging

30 sealing surfaces of the tapered tool joint pin and tool joint box are executed with an anti-friction and/or corrosion-resistant coating from a material with a

modulus of elasticity not exceeding, principally, the lower value of the modulus of elasticity of the material of the elements of the connection.

5 5. A Hermetic threaded connection device for drilling or casing pipes of technical casing of geological prospecting drilling rig, having a through
channel, the diameter of which corresponds to the inner diameter of the
connecting pipes, and equipped with means for fastening to the connecting
pipes, including: a tapered tool joint pin with a threaded part positioned in the
central region of its outer tapered surface, by an axially directed projection
with a smooth sealing outer surface, which is physically a continuation of the
10 threaded part and is formed within the diameter of the valleys of the smaller
diameter thread, as well as with a bearing sealing shoulder, radially extending
in the direction of the periphery with respect to the threaded part on the side
of its larger diameter and axially distanced with respect to the threaded part
by the magnitude of the axially directed section with a smooth sealing outer
15 surface, structurally an extension of the threaded part and formed within the
diameter of the peaks of said thread in this zone; a tool joint box, structurally
organized with the possibility of screwing into it the tapered tool joint pin, with
the formation of a tapered threaded interlocking connection in the central
region of its inner tapered surface, which on the side of the box thread with
20 the smaller diameter is transformed into an axially directed section with a
smooth sealing inner surface formed within the diameter of the peaks of the
thread in this zone, which is bounded by a shoulder radially directed toward
the axis of the connection, and from the side of the larger diameter thread
said tapered surface is transformed into an axially directed section with a
25 smooth sealing inner surface formed within the diameter of the valleys of the
thread in this zone and bound by the bearing end surface of the box, engaged
with the matching surface of the bearing shoulder of the tapered tool joint pin
at an angle to the axis of connection with the formation of a tapered surface of
engagement with the vertex facing in the direction of the device for fastening
30 the tapered tool joint pin to the pipe; said end surface of axially directed
projection of the tapered tool joint pin and the opposite surface of the shoulder

of the tool joint box, radially directed toward the axis of the connection, are spatially separated by an axial gap; the geometrical parameters of the opposite engaging sealing surfaces of the tapered tool joint pin and tool joint box are chosen from the conditions for providing in the engagements an inter-metallic sealing interaction in the process of tightening the connection; the profiles of the thread in the tapered threaded interlocking connection are similar figures in the form of unequal sided trapezoids, principally, with rounded vertices, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces of the thread, oriented at a negative angle relative to the perpendicular to the axis of the connection, the gently sloping lateral fixed surfaces are spatially distanced with a relative gap, wherein: the height, at least, of part of the profile elements, that is, the peaks and valleys, of the thread of the tool joint box exceeds the height of the matching, in the operational state of the connection, profile elements of the tapered tool joint pin.

6. The hermetic threaded connection of claim 5, wherein in the body of the axially directed section with a smooth outer surface sealing, which [section] is positioned on the side of the larger diameter thread of the tapered tool joint pin, as well as in the body of the axially directed section with a smooth sealing inner surface, which [section] is positioned on the side of the smaller diameter thread of the tool joint box, are executed circular profiled grooves, which are functionally a means of changing the direction of load on the corresponding thread, while the maximum depth of said grooves, principally, exceeds the height of the profile of the corresponding thread.

7. The hermetic threaded connection of claim 5, wherein, at least, part of the area of the engaging sealing surfaces of the tapered tool joint pin and tool joint box are formed in the shape of elements of conical form.

8. The hermetic threaded connection of claim 5, wherein in that the engaging sealing surfaces of the tapered tool joint pin and tool joint box are executed in cylindrical form.

9. The hermetic threaded connection of claim 5, wherein in that the engaging sealing surfaces of the tapered tool joint pin and tool joint box are executed with an anti-friction and/or corrosion-resistant coating from a material with a modulus of elasticity not exceeding, principally, smaller than, the modulus of elasticity of the material of the elements of the connection.

10. A Hermetic threaded connection device for drilling or casing pipes of technical casing of geological prospecting drilling rig, having a through channel, the diameter of which corresponds to the inner diameter of the connecting pipes, and equipped with means for fastening to the connecting pipes, including: a tapered tool joint pin with a threaded part positioned in the central region of its outer tapered surface, by an axially directed projection with a bearing end and a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the valleys of the smaller diameter thread, and also with a shoulder radially extending in the direction of the periphery with respect to the threaded part on the side of its larger diameter and axially distanced with respect to the threaded part by the magnitude of the axially directed section with a smooth sealing outer surface, being structurally a continuation of the threaded part and formed within the diameter of the peaks of said thread in this zone; a tool joint box, structurally organized with the possibility of screwing into it a conical tip to form a tapered threaded interlocking connection in the central region of the inner tapered surface, which on the side of the box thread with the smaller diameter is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the peaks of the thread in this zone, which is bounded by a bearing shoulder radially directed towards the axis of the connection, and from the side of the larger diameter thread said tapered surface is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the valleys of the thread in this zone, bounded by the end surface, spatially separated from the opposite surface of the shoulder of the tapered tool joint pin by means of a gap; the geometrical parameters of the opposite engaging sealing surfaces of the

tapered tool joint pin and tool joint box are chosen from the conditions for providing in the engagements an inter-metallic sealing interaction in the process of tightening the connection; the profiles of the thread in the tapered threaded interlocking connection are similar figures in the form of unequal sided trapezoids, principally, with rounded vertices, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces of the thread, oriented at a negative angle relative to the perpendicular to the axis of the connection, while the gently sloping oppositely-positioned lateral fixed surfaces are spatially arranged with a relative gap; herewith, the height, at least, of part of the profile elements, that is, the peaks and valleys, of the tapered tool joint pin exceeds the height, in the operational state of the connection, profile elements of the thread of the tool joint box; wherein: in the body of the axially directed section with the smooth sealing outer surface, which [section] is positioned on the side of the larger diameter thread of the tapered tool joint pin, as well as in the body of the axially directed section with a smooth sealing inner surface, which [section] is positioned on the side of the smaller diameter thread of the tool joint box, are executed circular profiled grooves, which are functionally a means of changing the direction of load on the corresponding thread, while the maximum depth of said grooves, principally, exceeds the height of the profile of the corresponding thread; herewith, the engaged surfaces of the bearing shoulder of the box and the bearing end of the tapered tool joint pin are spatially oriented at an angle to the axis of the connection to form a tapered surface with the vertex facing in the direction of the device for fastening the tapered tool joint pin to the pipe.

11. The hermetic threaded connection of claim 10, wherein, at least, part of the area of the engaging sealing surfaces of the tapered tool joint pin and tool joint box are formed in the shape of elements of conical form.

12. The hermetic threaded connection of claim 10, wherein the engaging sealing surfaces of the tapered tool joint pin and tool joint box are executed in cylindrical form.

13. The hermetic threaded connection of claim 10, wherein the engaging sealing surfaces of the tapered tool joint pin and tool joint box are executed with an anti-friction and/or corrosion-resistant coating from a material with a modulus of elasticity not exceeding, principally, the lower value
5 of the modulus of elasticity of the material of the elements of the connection.

14. A Hermetic threaded connection device for drilling or casing pipes of technical casing of geological prospecting drilling rig, having a through channel, the diameter of which corresponds to the inner diameter of the connecting pipes, and equipped with means for fastening to the connecting
10 pipes, including: a tapered tool joint pin with a threaded part positioned in the central region of its outer tapered surface, by an axially directed projection with a bearing end and a smooth sealing outer surface, which is physically a continuation of the threaded part and is formed within the diameter of the valleys of the smaller diameter thread, and also with a shoulder radially
15 extending in the direction of the periphery with respect to the threaded part on the side of its larger diameter and axially distanced with respect to the threaded part by the magnitude of the axially directed section with a smooth sealing outer surface, being structurally a continuation of the threaded part and formed within the diameter of the peaks of said thread in this zone; a tool
20 joint box, structurally organized with the possibility of screwing into it the tapered tool joint pin, with the formation of a tapered threaded interlocking connection in the central region of its inner tapered surface, which on the side of the box thread with the smaller diameter is transformed into an axially directed section with a smooth sealing inner surface formed within the
25 diameter of the peaks of the thread in this zone, which is bounded by a bearing shoulder radially directed towards the axis of the connection, and from the side of the larger diameter thread said tapered surface is transformed into an axially directed section with a smooth sealing inner surface formed within the diameter of the valleys of the thread in this zone,
30 bounded by an end surface, spatially separated from the opposite surface of the shoulder of the tapered tool joint pin by means of a gap; the geometrical

parameters of the opposite engaging sealing surfaces of the tapered tool joint pin and tool joint box are chosen from the conditions for providing in the engagements an inter-metallic sealing interaction in the process of tightening the connection; the profiles of the thread in the tapered threaded interlocking connection are similar figures in the form of unequal sided trapezoids, principally, with rounded vertices, while in the operational state of the connection contact is carried out along the relatively steep lateral bearing surfaces of the thread, oriented at a negative angle relative to the perpendicular to the axis of the connection, while the gently sloping oppositely-positioned lateral fixed surfaces are spatially arranged with a relative gap, wherein: the height, at least, of part of the profile elements, that is, the peaks and valleys, of the thread of the tool joint box exceeds the height of the matching, in the operational state of the connection, profile elements of the thread of the tool joint pin; herewith, the engaged surfaces of the bearing shoulder of the box and the bearing end of the tapered tool joint pin are spatially oriented at an angle to the axis of the connection to form a tapered surface of engagement with the vertex facing in the direction of the device for fastening the tapered tool joint pin to the pipe.

15. The hermetic threaded connection of claim 14, wherein in the body of the axially directed section with a smooth sealing outer surface, which [section] is positioned on the side of the larger diameter thread of the tapered tool joint pin, as well as in the body of the axially directed section with a smooth sealing inner surface, which [section] is positioned on the side of the smaller diameter thread of the tool joint box, are executed circular profiled grooves, which are functionally a means of changing the direction of load on the corresponding thread, while the maximum depth of said grooves, principally, exceeds the height of the profile of this thread.

16. The hermetic threaded connection of claim 14, wherein, at least, part of the area of the engaging sealing surfaces of the tapered tool joint pin and tool joint box are formed in the shape of elements of conical form.

17. The hermetic threaded connection of claim 14, wherein the engaging sealing surfaces of the tapered tool joint pin and tool joint box are executed in cylindrical form.

5 18. The hermetic threaded connection of claim 14, wherein the engaging sealing surfaces of the tapered tool joint pin and tool joint box are executed with an anti-friction and/or corrosion-resistant coating from a material with a modulus of elasticity not exceeding, principally, the lower value of the modulus of elasticity of the material of the elements of the connection.

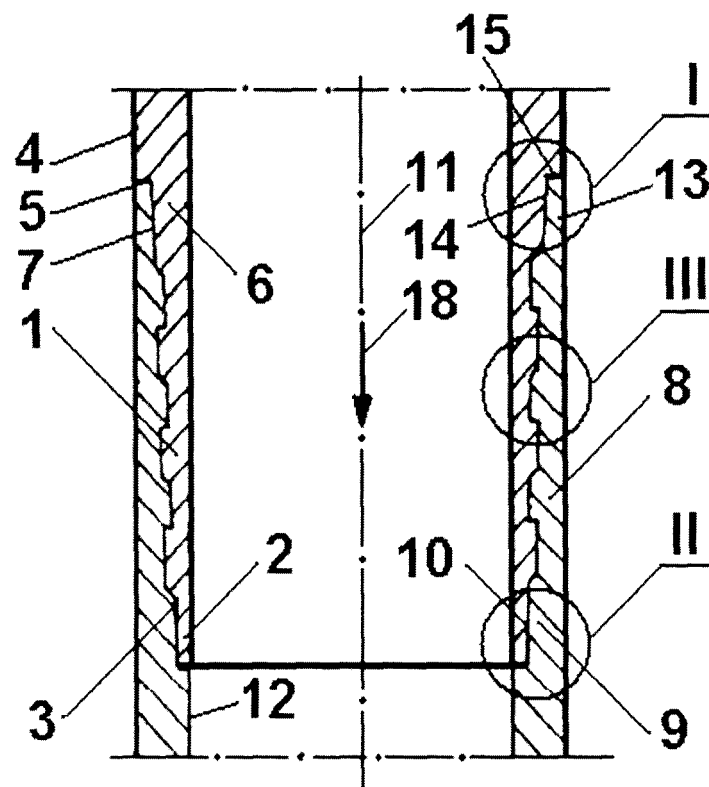


FIG. 1

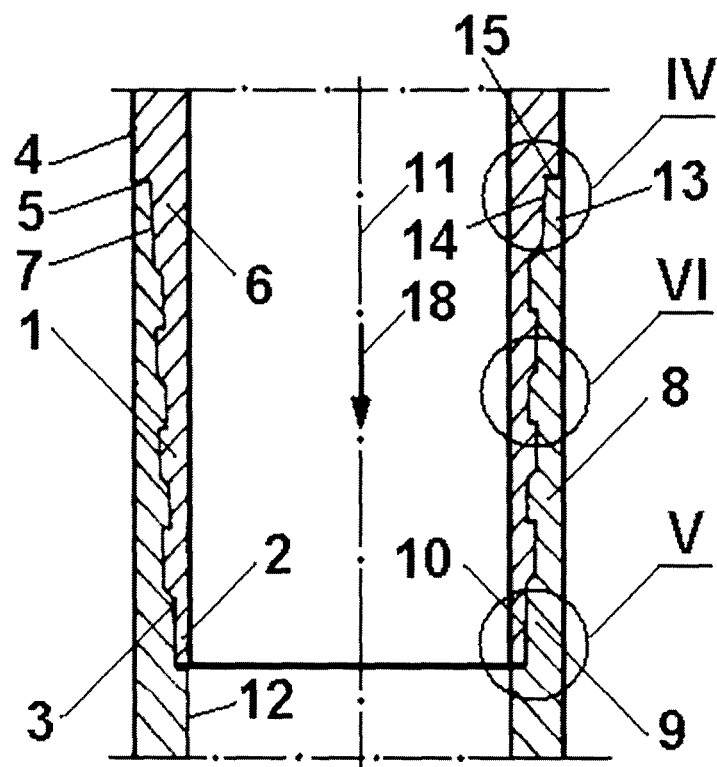


FIG. 5

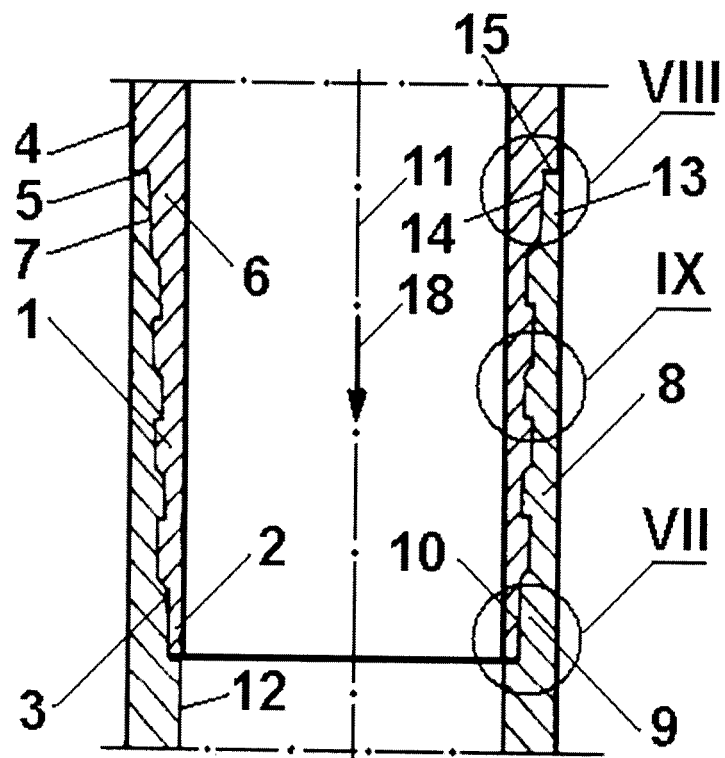


FIG. 9

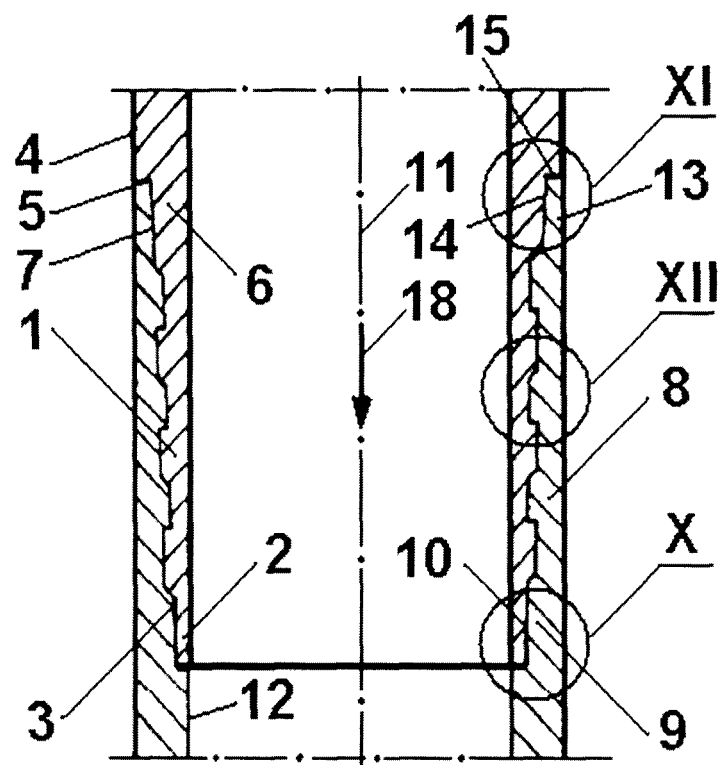


FIG. 13

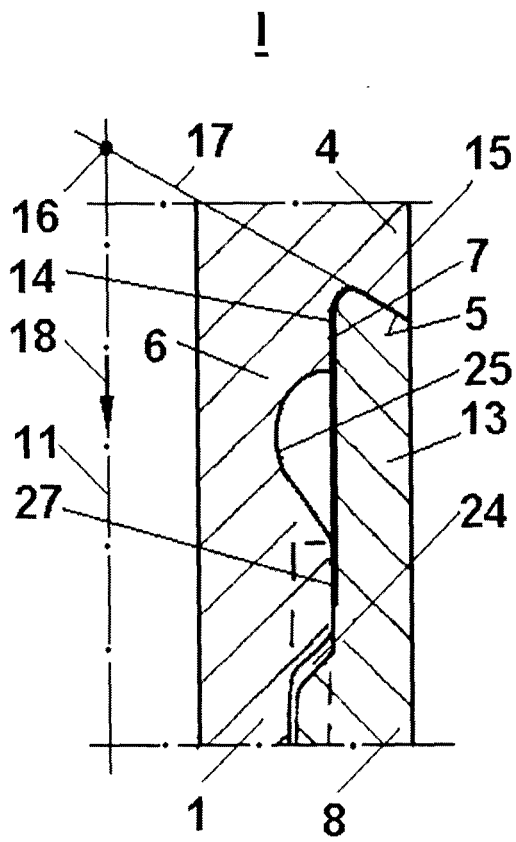


FIG. 2

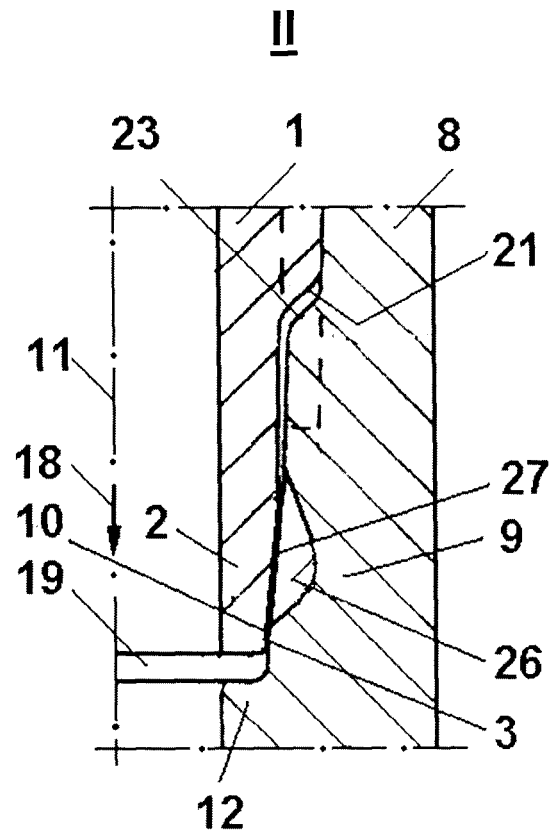


FIG. 3

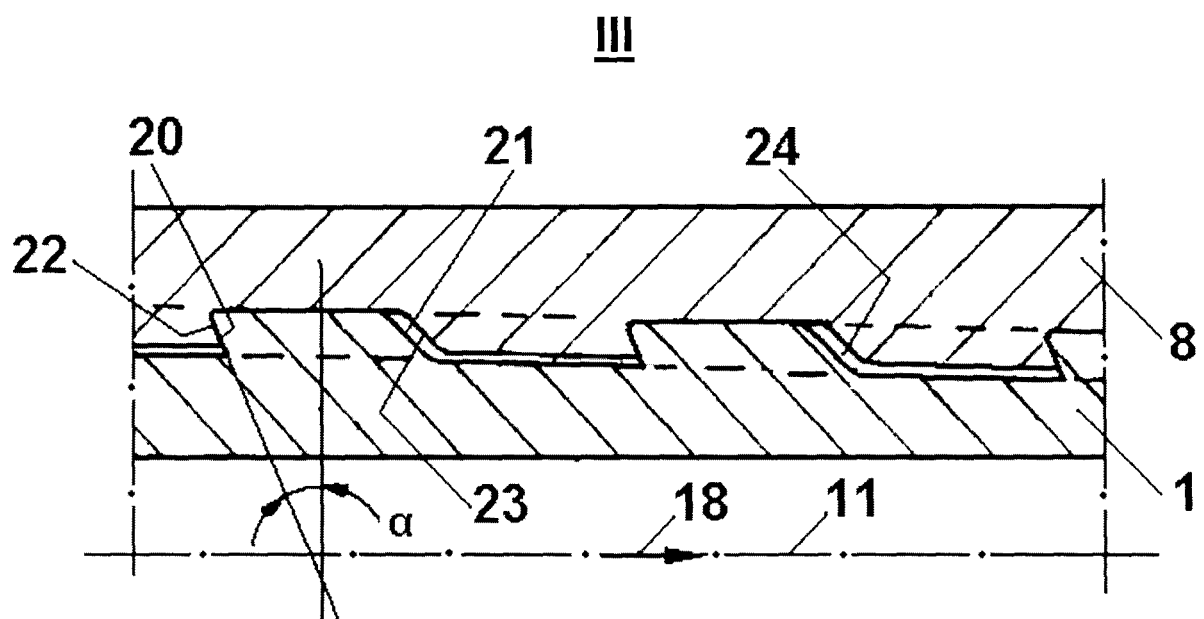


FIG. 4

IV

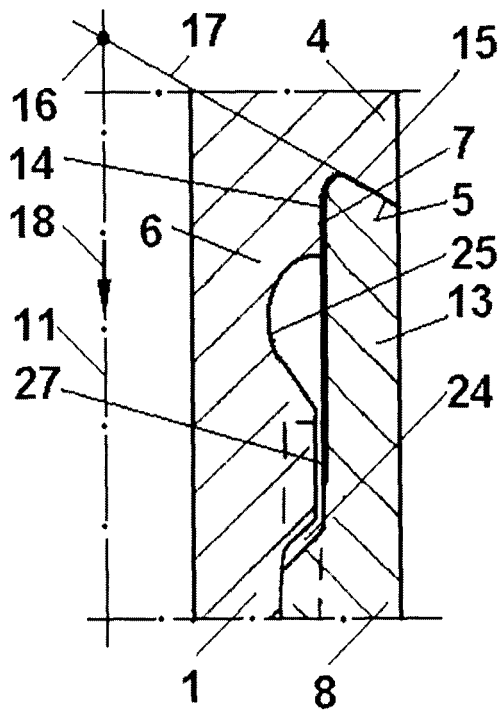


FIG. 6

V

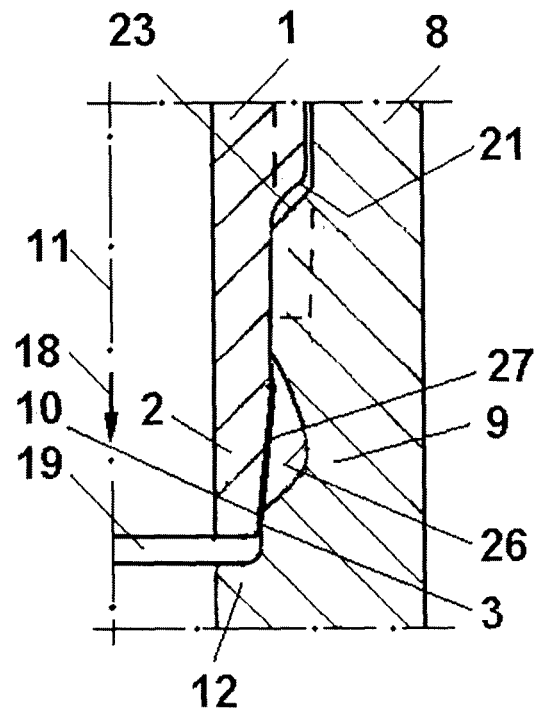


FIG. 7

VI

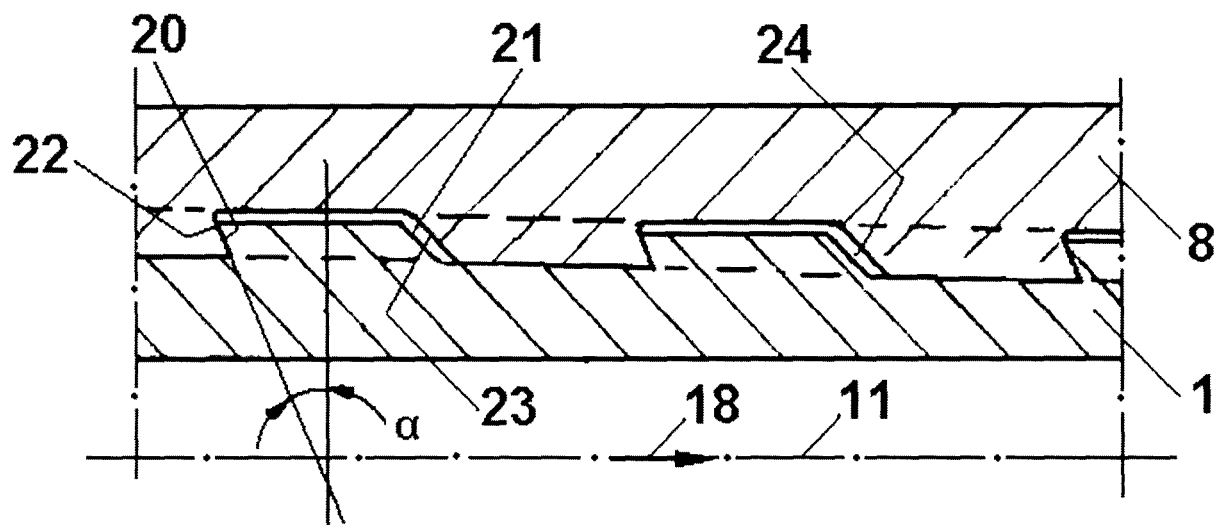


FIG. 8

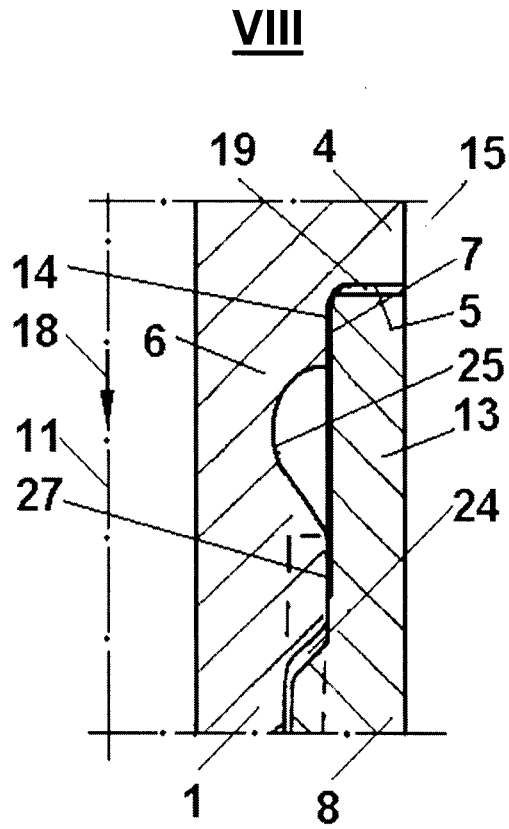


FIG. 11

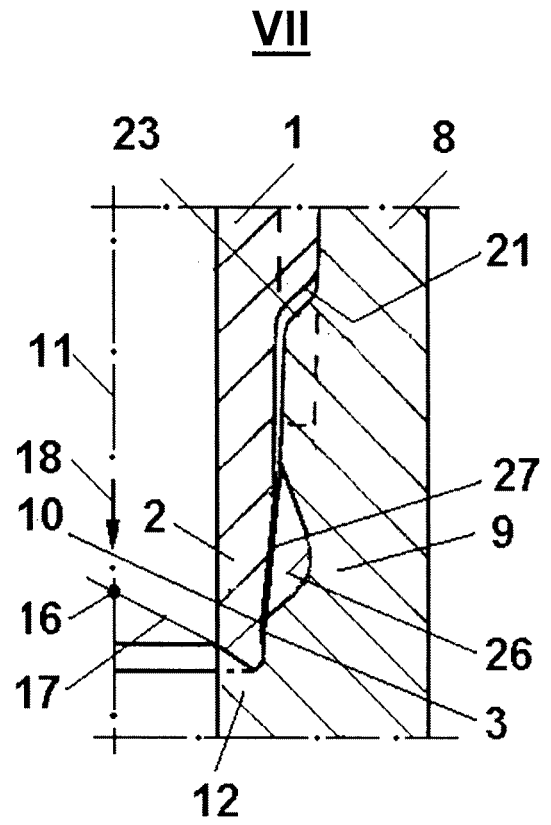


FIG. 10

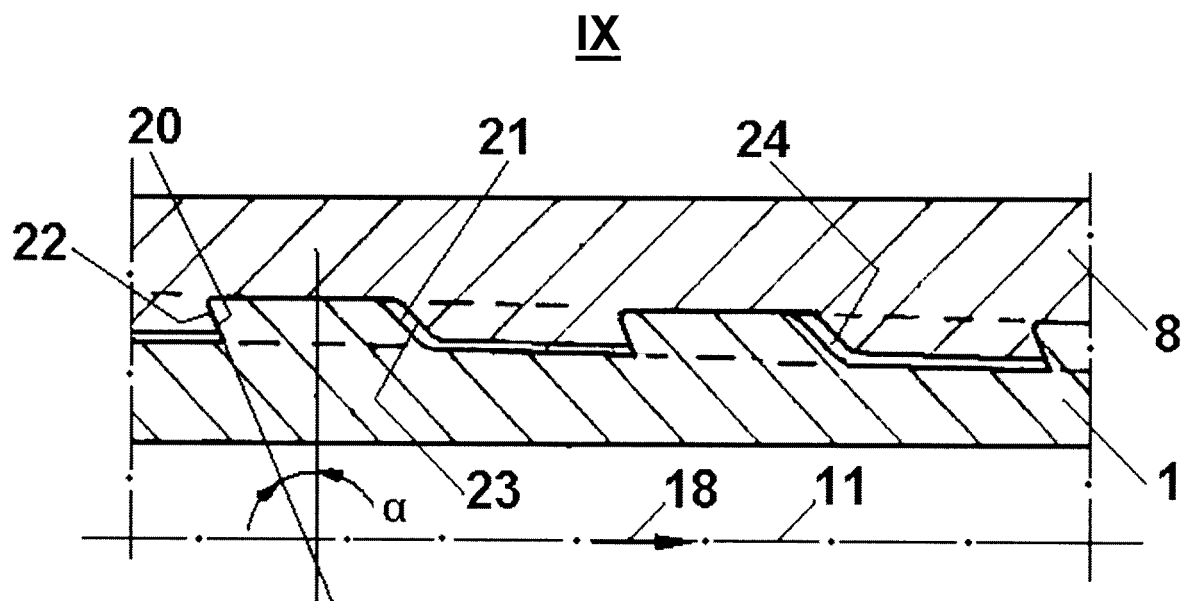


FIG. 12

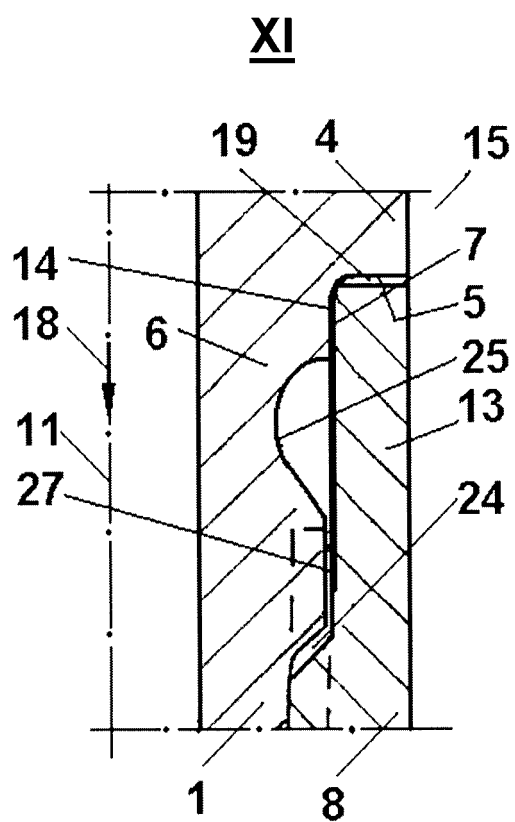


FIG. 15

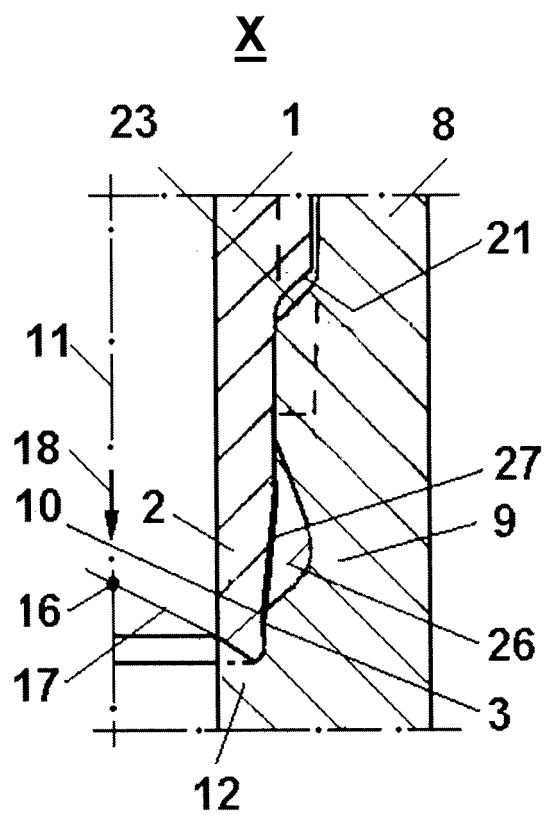


FIG. 14

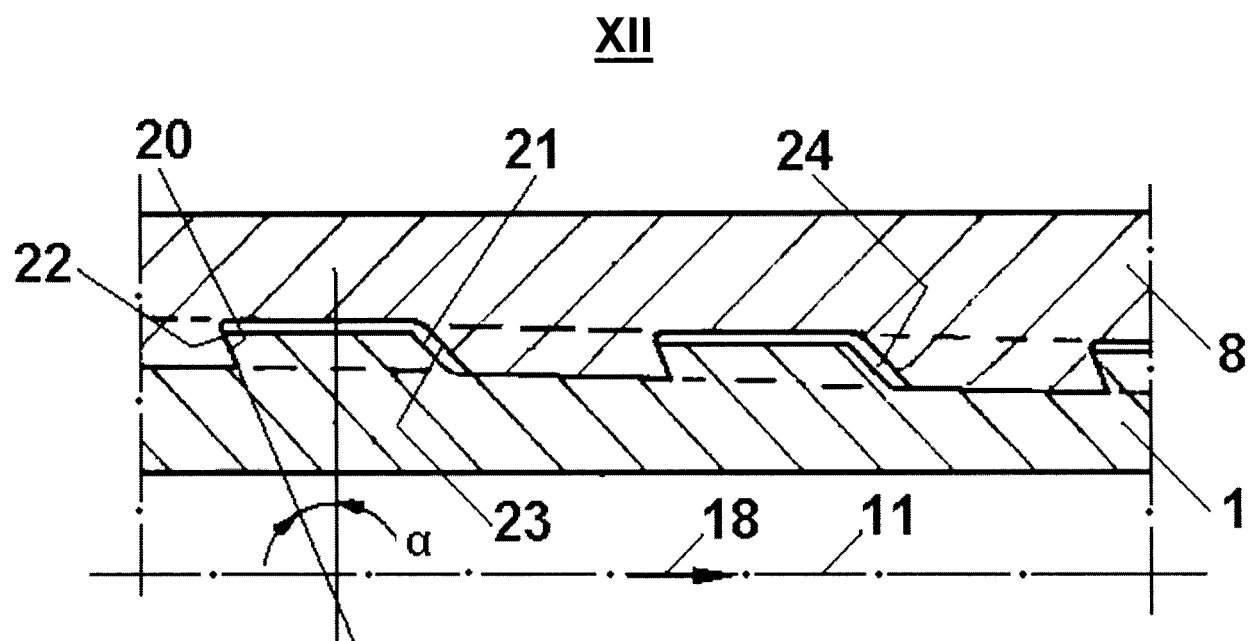


FIG. 16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2010/001630

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **E21B 17/042** (2006.01) , **E21B 17/08** (2006.01) , **F16L 15/06** (2006.01) , **F16L 15/08** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: **E21B 17/042** (2006.01) , **E21B 17/08** (2006.01) , **F16L 15/06** (2006.01) , **F16L 15/08** (2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Epoque (Epodoc, Full Text)

Keywords: herme*, thread*, connect*, taper*, pip*, tub*, groov*, drill*, load*, direction*, ang*, conical*, joint*, pin*, etc.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,662,659 A (BLOSE, T.L. et al.) 05 May 1987 (05-05-1987) *Col. 3, lines 23 to 66, Col. 4, lines 19 to 68, Col. 5, Lines 3 to 16, Claims 1 & 3 to 7 and Figs. 1 to 4B*	5, 7-9, 14 and 16-18
X	US 5,788,401 A (DRENTH, C.L.) 04 August 1998 (04-08-1998) *Cited by applicant*	5 and 14
A	US 4,958,862 A (CAPPELLI, C. et al.) 25 September 1990 (25-09-1990) *Whole document*	1-18
A	US 4,946,201 A (TAI, W.) 07 August 1990 (07-08-1990) *Whole document*	1-18
A	US 4,688,832 A (ORTLOFF, D.J. et al.) 25 August 1987 (25-08-1987) *Whole document*	1-18

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

20 December 2010 (20-12-2010)

Date of mailing of the international search report

25 January 2011 (25-01-2011)

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Place du Portage I, C114 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
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Authorized officer

Stephane Ouellette (819) 934-0089

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2010/001630

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
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International application No.
PCT/CA2010/001630

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