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An agency of Industry Canada

CA 2450751 C 2011/09/27

(11)(21) **2 450 751**

(12) **BREVET CANADIEN**
CANADIAN PATENT

(13) **C**

(86) Date de dépôt PCT/PCT Filing Date: 2002/06/13
(87) Date publication PCT/PCT Publication Date: 2002/12/27
(45) Date de délivrance/Issue Date: 2011/09/27
(85) Entrée phase nationale/National Entry: 2003/12/15
(86) N° demande PCT/PCT Application No.: CA 2002/000884
(87) N° publication PCT/PCT Publication No.: 2002/103156
(30) Priorités/Priorities: 2001/06/15 (CA2,350,681); 2001/07/18 (CA2,353,249)

(51) Cl.Int./Int.Cl. *E21B 17/00* (2006.01), *E21B 17/08* (2006.01), *E21B 17/10* (2006.01), *E21B 29/00* (2006.01), *E21B 43/10* (2006.01)

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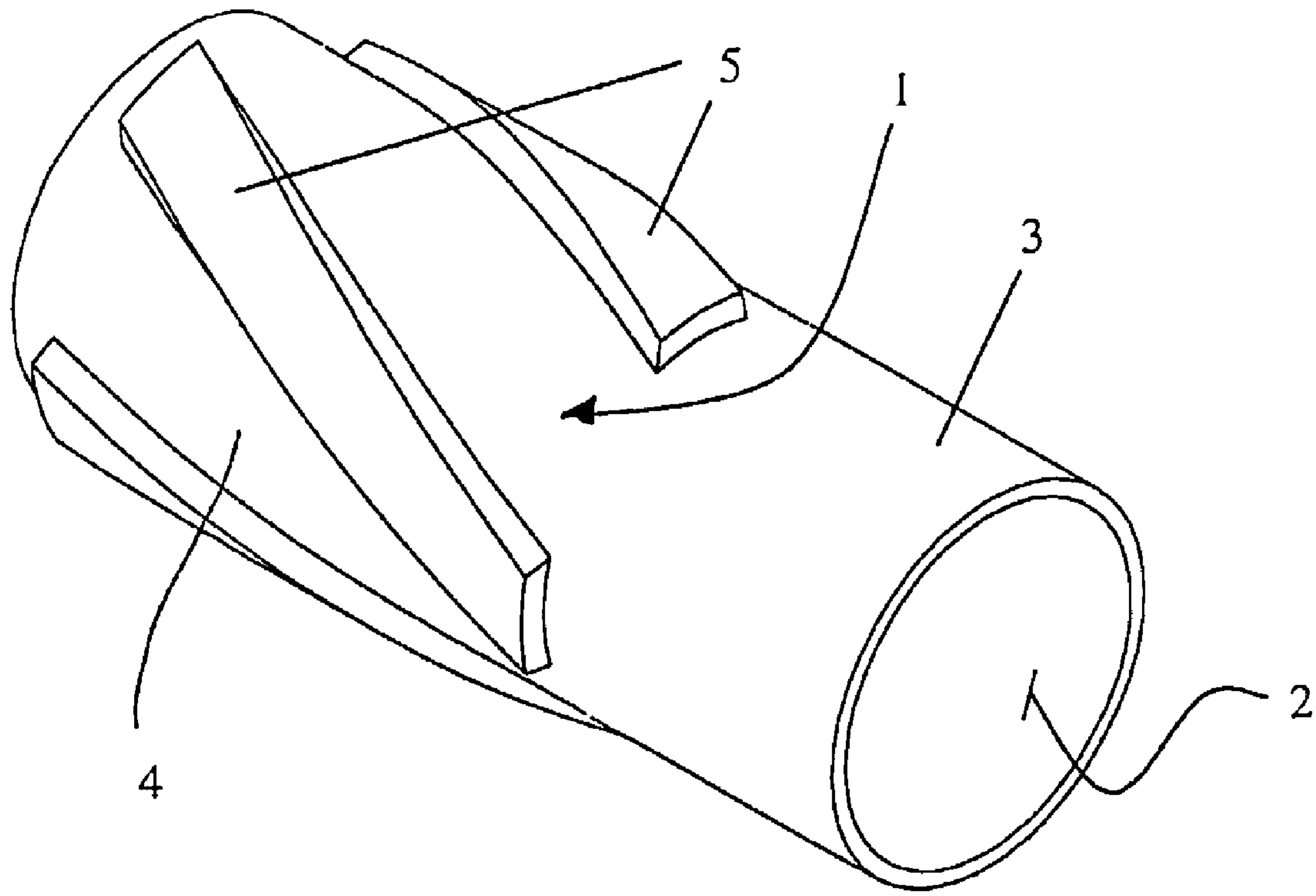
(54) Titre : PROCEDE DE PREPARATION D'UN TUBAGE DE PUITS POUR SON INSTALLATION
(54) Title: METHOD FOR PREPARING WELLBORE CASING FOR INSTALLATION



(57) Abrégé/Abstract:
A method has been invented for enhancing the installability of wellbore casing such as for use to line a borehole through a formation or to act as a drill string and to remain in hole, after drilling, to line the borehole created by its use. A device supporting the installation of wellbore casing into a wellbore is crimped onto the outer surface of the casing. An interference fit is created by plastic deformation inwardly in radial direction. The device supporting casing installation can be to facilitate (1) run in through the borehole (2), to maintain positioning relative to the borehole (3) or to accommodate wear against the wall of the borehole into which the casing is run. The devices supporting the installation of wellbore casing are attached to the casing to create a connection having structurally significant axial and torque load transfer capacity.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 December 2002 (27.12.2002)

PCT

(10) International Publication Number
WO 02/103156 A1

(51) International Patent Classification[7]: E21B 43/10, 17/10, 29/00

(21) International Application Number: PCT/CA02/00884

(22) International Filing Date: 13 June 2002 (13.06.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2,350,681 15 June 2001 (15.06.2001) CA
2,353,249 18 July 2001 (18.07.2001) CA

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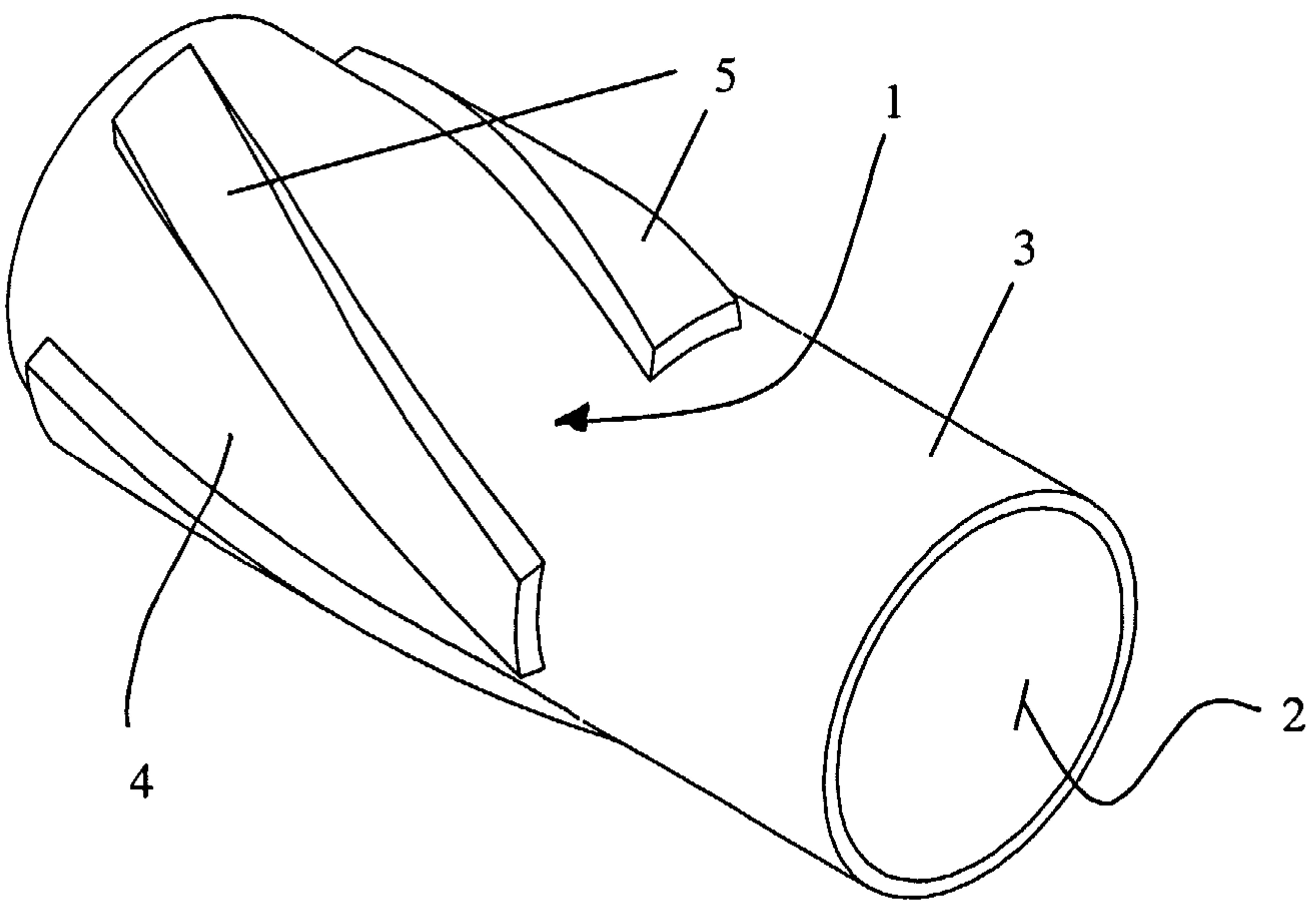
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD FOR PREPARING WELLBORE CASING FOR INSTALLATION



(57) Abstract: A method has been invented for enhancing the installability of wellbore casing such as for use to line a borehole through a formation or to act as a drill string and to remain in hole, after drilling, to line the borehole created by its use. A device supporting the installation of wellbore casing into a wellbore is crimped onto the outer surface of the casing. An interference fit is created by plastic deformation inwardly in radial direction. The device supporting casing installation can be to facilitate (1) run in through the borehole (2), to maintain positioning relative to the borehole (3) or to accommodate wear against the wall of the borehole into which the casing is run. The devices supporting the installation of wellbore casing are attached to the casing to create a connection having structurally significant axial and torque load transfer capacity.

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METHOD FOR PREPARING WELLBORE CASING FOR INSTALLATION

Field of the Invention

The present invention relates to method for enhancing the installability of wellbore casing and in particular, a method for preparing wellbore casing for installation.

Background of the Invention

Within the context of petroleum drilling and well completions, wells are typically constructed by drilling the well bore using one tubular string, largely comprised of drill pipe, then removing the drill pipe string and completing by installing a second tubular string, referred to as casing, which is subsequently permanently cemented in place. The installation of casing, in this typical construction requires that the casing be run into long boreholes, some having horizontal stretches. In these horizontal stretches, the casing must be installed by pushing it along the borehole. In so doing the casing is pushed in engagement with the borehole wall.

Recent advances in drilling technology have enabled wells to be drilled and completed with a single casing string, eliminating the need to 'trip' the drill pipe in and out of the hole to service the bit and make room for the casing upon completion of drilling. This change is motivated by potential cost savings arising from reduced drilling time and the expense of providing and maintaining the drill string, plus various technical advantages, such as reduced risk of well caving before installation of the casing.

However, casing installation through deviated wellbores or by drilling with casing challenge the performance requirements of the casing. Installation can place severe structural demands on casing since they must survive extended periods of time in contact with the borehole wall. Devices, such as centralizers can be mounted onto the casing to act as bearing surfaces that preferentially accommodate contact with and space the casing from the borehole wall. However, such devices must be cost effective, since they remain downhole and are not recovered. In addition, these devices must be connected to the casing in such a way that they do not compromise the casing integrity either by their means of attachment or the wear they induce.

Summary of the Invention

A method has been invented for enhancing the installability of wellbore casing such as for example, in preparation, for use to line a borehole through a formation or to act as a drill string and to remain in hole, after drilling, to line the borehole created by its use. In the method, a device supporting the installation of wellbore casing into a wellbore is crimped onto the outer surface of the casing. The device supporting casing installation can be to facilitate run in through the borehole, to maintain positioning relative to the borehole or to accommodate wear against the wall of the borehole into which the casing is run. The devices supporting the installation of wellbore casing are attached to the casing to create a connection having structurally significant axial and torque load transfer capacity. When using methods according to the present invention, the load transfer capacity of the connection between the device and the casing can be arranged to substantially prevent significant relative movement of the device on the casing under loads that may be encountered when installing one or more of the casing joints as a liner into a wellbore which has been drilled using a conventional drilling operation or when using one or more of the casing joints as components of a tubular string used for drilling and lining a well bores.

Thus, in accordance with one aspect of the present invention, there is provided a method for increasing the installability of wellbore casing, selecting a joint of casing having an outer diameter and an outer surface and capable of receiving a device thereon by crimping and selecting a device supporting the installation of wellbore casing, the device having an outer facing surface, an inner bore sufficiently large to allow insertion therethrough of the joint of casing, and at least one tubular section on the body, the portion of the inner bore extending through the tubular section having an internal diameter capable of loosely fitting about the outer diameter of the joint of casing; positioning the device on the joint of casing such that the joint of casing extends through the inner bore; and crimping the device onto the joint of casing by applying an inward, substantially radially-directed force to a plurality of points about an outer circumference of the tubular section causing it to plastically deform inwardly and come into contact with the outer surface of the joint of casing, applying such additional inward, substantially radially directed force as required to force both the tubular section of the device and the outer surface of the casing to displace inwardly an amount at least great enough so that when the force is released, an interference fit is created between the device and the casing.

The step of applying substantially radially-directed force to a plurality of points about an outer circumference of the tubular section is termed herein as "crimping".

Preferably, by selection of casing, device supporting casing installation and/or force applied, the inward displacement of the casing outer surface is not so great that the drift diameter of the casing is excessively reduced. In one embodiment, the casing is not displaced inwardly beyond the drift diameter. However, in another embodiment, the inward displacement of the casing outer surface causes the inner diameter of the casing to be reduced beyond the drift diameter of the casing.

In one embodiment the method can be used to produce casing for wellbore completion and in another embodiment the method can be used to produce casing for use in a drill string. The device supporting the installation can be selected from those useful for facilitating run in of the casing, those for controlling the positioning of the casing within the borehole, those for accommodating wear against the wall of the borehole into which the casing is run or those providing combinations of the foregoing.

Frictional forces enabled by the interference fit at the inwardly displaced section provide the mechanism by which structurally significant axial and torsional load may be transferred between the device and the casing substantially without slippage therebetween.

The casing on for use in the present invention must be capable of accepting the hoop stresses of crimping without becoming unstable, for example, without buckling or crumpling. This generally requires that the casing be thick-walled, for example, having an external diameter to thickness ratio ("D/t") less than 100 and preferably less than 50.

To be most generally useful for this method, the devices supporting installation should be amenable to rapid field installation on joints of casing having at least one non-upset end.

The tubular section of the device under application of load at a plurality of points about its circumference has an elastic resiliency less than the elastic resiliency of the casing onto which it is crimped. The tubular section can be cylindrical or largely cylindrical with some radial or axial variations to the internal diameter or outer surface. The tubular section should be substantially circumferentially continuous such that a hoop stress can be set up during the radially inward displacement at a plurality of points about the circumference of the outer surface of the section. The tubular section should be capable of accepting the hoop stresses of crimping without becoming unstable, for example, without buckling or crumpling. This generally requires that the section be thick-walled, for example, having an external diameter to thickness ratio ("D/t") less than 100 and preferably less than 50.

The loose fit of the section about the casing must be sufficient to accommodate the variations of the outer diameter of the casing intended to be used.

A device selected to facilitating run in of the casing can include a ramped leading edge to facilitate riding over surface contours on the borehole wall or to facilitate raising the casing such that protrusions, such as casing connections, on the casing outer surface can pass along the borehole without digging into the formation or getting hung up on shoulders in the borehole wall.

A device selected to accommodate wear against the wall of the borehole into which the casing is run can include bearing surfaces capable of withstanding extended abrasion against borehole surfaces and sufficient to withstand the rigors encountered during installation into or the drilling of at least one well. The bearing surfaces should withstand abrasion better than the material of the casing and can be, for example, hard facing, which is the treatment of steel to increase its hardness, ribs, lines of weldments, hardened inserts, etc.

A device selected from those useful for controlling the positioning of the casing within the borehole can provide for spacing the casing from the borehole wall in which it is to be used and, in particular, centralizing or stabilizing the casing within the hole. Thus, in one embodiment, the thickness of the device is selected such that once the bearing member is crimped onto the casing, the device extends radially out beyond the outer surface of the casing. In addition, the thickness of the bearing member at the bearing surfaces can be selected such that the bearing member acts as a centralizer or a stabilizer, with consideration as to the inner diameter of the borehole in which the casing is to be used.

In some aspects of the present invention, differential temperature may be used to control interference between the casing and the device according to the well known methods of *shrink fitting*, whereby the differential temperature is obtained by heating the device, cooling the casing, or both, prior to crimping.

However, it is preferable to avoid the requirement to either heat the device or cool the casing to obtain an interference fit. In particular, preferably sufficient interference in the crimped connection is obtained substantially only by mechanical means, without requiring a significant temperature differential between the device and the casing at the time of crimping. This purpose is realized by selecting the elastic limit of the device material, in the section to be crimped, to be less than that of the casing on which the centralizer is to be installed. In this context, the elastic limit generally refers to the strain at which the materials of the parts yield. Having the material properties thus selected, it will be apparent to one skilled in the art, that when the radial displacement applied during crimping is sufficient to force the hoop strain of the metal casing to be at least equal to its elastic limit, upon release of the load causing the radial displacement, the metal casing will tend to radially 'spring back' an amount greater than the centralizer, were both parts separated. Since the parts are not separated, the difference in this amount of spring back or resiliency is manifest as interference and fulfills the desired purpose of creating interference substantially only by mechanical means.

While a purely mechanical method of obtaining interference through crimping is desirable for most applications, the present invention can use both thermal and mechanical methods for attachment of the device to the casing.

To facilitate the frictional engagement of the crimped bearing member to the thick-wall casing, the inside surface of the device, at least over the section to be crimped (i.e. at least a portion of the inner surface defining the inner bore through the tubular section), can be provided with a roughened surface finish. In another embodiment, a friction enhancing material such as, for example, a grit-epoxy mixture is disposed in the interfacial region of the crimped section. Similarly, various bonding materials may be disposed in the interfacial region prior to crimping to act as glues augmenting the frictional aspects of the connection once their shear strength is developed after setting.

Brief Description of the Drawings

A further, detailed, description of the invention, briefly described above, will follow by reference to the following drawings of specific embodiments of the invention. These drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope. In the drawings:

Figure 1 is a perspective view of a device in the form of a casing centralizer useful in the present invention;

Figure 2 is a perspective view of the device shown in Figure 1 placed on a joint of casing as it might appear before crimping;

Figure 3 is a partial sectional schematic view through the wall of a device positioned coaxially on a casing joint and inside a collet crimping tool prior to application of radial crimping displacement;

Figure 4 is the partial sectional schematic view of the assembly shown in Figure 3 as it would appear after application of radial crimping displacement;

Figure 5 is a perspective view of a device supporting installation, the device being in the form of a casing wear band tool; and

Figure 6 is an axial sectional view through another device supporting installation of casing shown crimped on a joint of casing.

Description of the Preferred Embodiment

The installability of wellbore casing can be enhanced by attachment thereto of devices supporting the installation of the casing. Attachment by crimping provides a rugged interference fit between the casing and the device that is capable of withstanding the axial and radial load of casing installation and substantially does not compromise casing integrity.

A device useful in the present invention is shown in Figure 1. The device is a centralizer useful for supporting casing installation by at least maintaining the position of the casing relative to the borehole and accommodating wear against the wall of the borehole into which the casing is run. The centralizer includes metal body 1 containing an internal bore 2, a cylindrical end 3 forming a section suitable for crimping, and a centralizing section 4 on which ribs 5 are placed.

The cylindrical end and the centralizing section are formed integral on the body and the internal bore passes through both of them. While the crimpable section in the illustrated embodiment is cylindrical end 3, it is to be noted that the crimpable section can be formed intermediate a pair of centralizing sections, if desired, rather than on an end. Also, it is to be noted that more than one crimpable section and more than one centralizing section can be provided on the centralizer, as desired.

Ribs 5 are evenly spaced around the centralizing section. There are at least three ribs spaced about the circumference of the centralizing section. Preferably, each rib is helically shaped and the number, length and pitch of the rib helixes are arranged to ensure that the starting circumferential position of each rib overlaps the ending circumferential position of at least one adjacent rib. The ribs may be placed on the centralizer body by a variety of methods including milling, casting, welding or hydroforming.

The internal bore 2 of the centralizer body is selected to loosely fit over at least one end of a thick-wall metal casing 6, shown as a threaded casing joint in Figure 2 onto which a coupling has been threaded. As shown, the internal diameter of bore 2 allows the centralizer to be readily inserted over an end of the casing 6 and placed somewhere along the length of the casing joint prior to crimping. Thus placed, crimping provides a means to obtain a significant interference fit even where the centralizer and casing material are at similar temperatures prior to crimping. In applications where significant heating of the casing and centralizer, after centralizer installation, is anticipated, the centralizer is preferably selected to have a thermal expansion coefficient that is equal to or less than that of the casing. Similarly in applications where cooling subsequent to crimping is anticipated, the opposite relationship between thermal expansion coefficients is preferred.

Radial displacement required to crimp the centralizer cylindrical end 3 to the casing joint 6, on which it is placed, may be accomplished by various methods such as by hydroforming, as described in Canadian application 2,328,190, filed December 14, 2000. However, a fixture employing a tapered 'collet in housing' architecture has been found to work well in practice. This well known method of applying uniform radial displacement, and consequently radial force when in contact with the exterior of a cylindrical work piece, employs a device as shown schematically in Figure 3. The device retains the externally tapered fingers or jaws 7 of a collet (segments of an externally conical sleeve) inside a matching internally tapered solid housing 8. Application of axial setting force to the housing 8, as shown by vector F, which is reacted at the face 7a of the collet jaws 7, as shown by vector R, tends to induce the collet jaws 7 to penetrate into the collet housing 8 along the angle of its conical bore. This causes the jaws 7 to move radially inwardly and engage the work piece to be gripped, in the present case, shown as the cylindrical end 3 of a centralizer. (Alternately, the action of the collet may be described in terms of setting displacement, understood as axial displacement of the collet housing 8 with respect to the collet jaws 7. In this case the setting force is understood to arise correlative with the setting displacement.) The axial force F and reaction R are readily applied by, for example, a hollow bore hydraulic actuator (not shown), arranged with an internal bore greater than the casing 6 outside diameter.

With this arrangement, upon application of sufficient force (F), the jaws may be forced inward to first cause sufficient radial displacement to plastically deform the centralizer cylindrical end 3 and bring it into contact with the casing 6. This amount of radial displacement removes the annular clearance of the loose fit initially required for placing and positioning the centralizer on the casing 6. Application of additional setting force then forces both the centralizer cylindrical end 3, and the underlying wall of the casing 6, inward. In the preferred embodiment, the setting displacement is preferably applied until the hoop strain in the casing wall at the crimp location equals or slightly exceeds its elastic limit. It will be apparent to one skilled in the art that radial displacement beyond this point will cause little increase in residual interference but will have the effect of reducing the drift diameter of the casing joint 6. Figure 4 schematically shows the collet, centralizer and casing as they might appear in the fully crimped position. After the desired radial displacement is achieved, the setting displacement of the collet is reversed which releases it from the centralizer allowing the collet to be removed, leaving the centralizer crimped to the casing.

To ensure that this method of cold crimping (i.e., mechanical crimping unassisted by thermal effects) results in sufficient residual interference between the centralizer cylindrical end 3 and the casing 6, the centralizer material at the cylindrical end 3 has an elastic limit less than that of the casing 6. As is typically the case, the centralizer and casing material are both made from carbon steel having nearly the same elastic modulii. Therefore, the elastic limit may be expressed in terms of yield strength, since elastic limit is generally given by yield stress divided by elastic modulus.

For example, in one trial conducted to assess the torque capacity to be obtained by crimping a centralizer to 7inch diameter API grade L80 26ppf casing material (minimum specified yield strength of 80,000psi), steel centralizer material having a measured yield strength of 47,000psi was selected. The centralizer elastic limit was thus less than 50% that of the casing. Using this material, a centralizer having an outside diameter of 7.625inches, an inside diameter of 7.125inches and a machined inside bore, was constructed for one trial. After crimping this centralizer to the casing over a 3.5inch section using the method of the present invention described above, the axial force required to displace the centralizer was measured to be approximately 20,000 lbf. Had this sliding force been applied through torsion, the required torque to induce sliding rotation of the centralizer relative to the casing would be 5833 ftlb. This may be compared to the maximum expected total drilling torque for this size of casing, which is in the order of 20,000ftlb. Given this crimped centralizer configuration, the torque transferred between just one such centralizer and casing, would need to exceed 25% of the total worst case drilling torque, to induce slippage of the centralizer on the casing.

However, in certain applications it may be desirable to further enhance the load transfer capacity of a centralizer attached to casing, without increasing the crimped length, by improving the frictional engagement achieved for a given level of interference. While this may be accomplished by various means, roughening one or both of the cylindrical end inner wall or the casing outer surface on which the centralizer was to be crimped, was found to be particularly effective. In one trial using a centralizer configured similar to that described in the preceding example, but where the wall surface 9 defining the internal bore 2 of the centralizer was roughened by grit blasting prior to crimping, the equivalent torque capacity was increased approximately 70%.

The length of the section crimped will in general linearly affect the load transfer capacity of the crimped connection. For centralizers attached to full length casing joints, the length of section suitable for crimping, provided by the cylindrical end 3 may be extended almost without limit. Similarly the length of the collet jaws 7, do not limit length that may be crimped. The collet tool may be used to apply the required radial displacement at multiple axial locations to incrementally crimp an extended length cylindrical end 3. Increased load transfer capacity may thus be readily achieved by increasing the crimped section length.

Referring to Figure 5, another device supporting the installation of wellbore casing is shown that is useful in the present invention. While centralizers as shown in Figure 1 could be attached to the casing at frequent enough intervals to prevent wear, other less elaborate devices, such as the wear band tool of Figure 5 can be used to facilitate run in and/or to accommodate wear.

The wear band tool includes a metal body 101 containing an internal bore 102, a cylindrical mid-section 103 forming a section suitable for crimping, and two end intervals 104 on which hard-faced wear bands 105 are placed. As shown, a concentric wear band 105 is placed at each end of the wear band tool forming slightly raised diameter intervals. These wear bands are formed by attaching hard-facing material as commonly known to the industry to metal body 101. The wear band tool is attached to casing by crimping over a portion of cylindrical mid-section 103 using the methods described above for the centralizer tool.

Another wear band tool is shown in Figure 6 in crimped form on a joint of casing 6. The wear band includes a metal body 101 containing an internal bore 102, a cylindrical end section 106 forming a section suitable for crimping, and an interval 104 on which a hard-faced wear band 105 is securely mounted. An end 108 of the wear band tool is ramped to facilitate passage thereover of discontinuities in the borehole. End 108 has a leading edge ramp angle α of preferably of less than 60° and preferably less than 45°.

The wear band tool can, therefore, be used alone to space the casing from the borehole wall and to accommodate wear, since the hard-faced wear band 105 can withstand wear better than the casing or standard couplings on the casing. The wear band tool can also be used downhole of a shoulder on the casing, such as a coupling, wherein the ramped leading edge 108 can facilitate passage of the casing through the borehole by preventing the casing shoulder from digging into the formation.

It will be apparent that these and many other changes may be made to the illustrative embodiments, while falling within the scope of the invention, and it is intended that all such changes be covered by the claims appended hereto.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method for preparing wellbore casing for installation comprising: selecting a joint of casing having an outer diameter and an outer surface and capable of receiving a device thereon by crimping and selecting the device for supporting the installation of wellbore casing, the device having a body including an outer facing surface, an inner bore sufficiently large to allow insertion therethrough of the joint of casing, and at least one tubular section on the body, the portion of the inner bore extending through the tubular section having an internal diameter capable of loosely fitting about the outer diameter of the joint of casing; positioning the device on the joint of casing such that the joint of casing extends through the inner bore; and crimping the device onto the joint of casing by applying an inward, substantially radially-directed force to a plurality of points about an outer circumference of the tubular section causing it to plastically deform inwardly and come into contact with the outer surface of the joint of casing, applying such additional inward, substantially radially directed force as required to force both the tubular section of the device and the outer surface of the casing to displace inwardly an amount at least great enough so that when the force is released, an interference fit is created between the device and the casing.

2. The method of claim 1 wherein the casing is for wellbore completion.

3. The method of claim 1 wherein the casing is for use in a drill string.

4. The method of claim 1 wherein the device supporting the installation is selected from those useful for facilitating run in of the casing.

5. The method of claim 4 wherein the device supporting the installation includes a ramped leading edge and the device is installed such that the ramped leading edge is positioned facing downhole.

6. The method of claim 1 wherein the device supporting the installation is selected from those for accommodating wear against the wall of the borehole into which the casing is run.

7. The method of claim 1 wherein the device supporting installation has a bearing surface on its outer facing surface, the bearing surface being selected to withstand wear against the borehole wall to a degree greater than the casing.

8. The method of claim 7 wherein the bearing surface includes hard-facing.

9. The method of claim 1 wherein the device supporting the installation is selected from those useful for positioning the casing in a borehole in which the casing is to be run.

10. The method of claim 1 wherein the device supporting installation is a centralizer.

11. The method of claim 1 wherein the device supporting installation is a wear band tool.

12. A method for attaching a centralizer to a metal pipe by crimping, the metal pipe having an outer surface, such method comprising the steps of: providing a metal pipe; providing a centralizer having a body with an inner bore therethrough sufficiently large to allow insertion therethrough of the metal pipe, a plurality of outward facing bearing surfaces on the body and at least one tubular section on the body having an internal diameter

capable of fining about the outer surface of the metal pipe; inserting the metal pipe through the inner bare of the centralizer, applying an inward, substantially radially-directed force to a plurality of points about an outer circumference of the tubular section causing it to plastically deform inwardly and come into contact with the outer surface of the pipe at points corresponding to the plurality of points; and applying such additional inward, substantially radially directed force as required to force both the centralizer and the outer surface of the metal pipe to displace inwardly an amount at least great enough so that when released, an interference fit is created between the centralizer and the metal pipe.

13. The method of claim 12 wherein at least one of the outer surface of the pipe arid an inner surface of the tubular section is roughened to facilitate frictional engagement therebetween.

14. A wellbore casing assembly comprising: at least a section of wellbore casing; and a wellbore casing centralizer crimped onto the at least a section of wellbore casing, the wellbore casing centralizer including a body having a first end and of second end opposite the first end, an outer facing surface and an inner bore extending therethrough from the first end to the second end sufficiently large to allow insertion therethrough of the external diameter the section of wellbore casing, at least one crimpable tubular section on the body through which the wellbore casing centralizer is crimped about the external diameter of the section of wellbore casing at a plurality of points about an outer circumference of the crimpable tubular section causing it to plastically deform inwardly and come into contact with an outer surface of the wellbore casing at points corresponding to the plurality of points creating a connection having axial and torque load transfer capabilities between the wellbore casing centralizer and the

wellbore casing, and a centralizing section on the body including a plurality of bearing surfaces extending outwardly from the outer facing surface.

15. The wellbore casing assembly of claim 14 wherein the crimpable tubular section has an external diameter to thickness ratio of less than 100.

16. The wellbore casing assembly of claim 14 wherein the crimpable tubular section has an external diameter to thickness ratio of less than 50.

17. The wellbore casing assembly of claim 14 wherein the crimpable tubular section is circumferentially continuous such that hoop stress can be generated therein.

18. A method for attaching a wear band tool to a pipe by crimping, the pipe having an outer surface, such method comprising the steps of: providing a pipe; providing a wear band tool having a body with an inner bore therethrough sufficiently large to allow insertion therethrough of the pipe, at least one outward facing bearing surface on the body and at least one tubular section on the body having an internal diameter capable of fitting about the outer surface of the pipe; inserting the pipe through the inner bore of the wear band tool, applying an inward, substantially radially-directed force to a plurality of points about an outer circumference of the tubular section causing it to plastically deform inwardly and come into contact with the outer surface of the pipe at points corresponding to the plurality of points; and applying such additional inward, substantially radially directed force as required to force both the wear band tool and the outer surface of the pipe to displace inwardly an amount at least great enough so that when released, an interference fit is created between the wear band tool and the pipe.

19. The method of claim 18 wherein at least one of the outer surface of the pipe and an inner surface of the tubular section is roughened to facilitate frictional engagement therebetween.

20. A wellbore casing assembly comprising: at least a section of well bore casing; and a wellbore casing wear band tool crimped onto the at least a section of well bore casing, the wellbore casing wear band tool including: a body having a first end and a second end opposite the first end, an outer facing surface and an inner bore extending therethrough from the first end to the second end sufficiently large to allow insertion therethrough of the external diameter of the well bore casing, at least one crimpable tubular section on the body through which the wellbore casing wear band tool is crimped about the external diameter of the well bore casing at a plurality of points about an outer circumference of the crimpable tubular section causing it to plastically deform inwardly and come into contact with an outer surface of the wellbore casing at points corresponding to the plurality of points creating a connection having axial and torque load transfer capabilities between the wellbore casing wear band tool and the wellbore casing, and a bearing surface on the outer facing surface.

21. The wellbore casing assembly of claim 20 wherein the bearing surface being selected to withstand wear to a greater degree than the remainder of the wear band tool.

22. The wellbore casing assembly of claim 20 wherein the crimpable tubular section has an external diameter to thickness ratio of less than 100.

23. The wellbore casing assembly of claim 20 wherein the crimpable tubular section has an external diameter to thickness ratio of less than 50.

24. The wellbore casing assembly of claim 20 wherein the crimpable tubular section is circumferentially continuous such that hoop stress can be generated therein.

25. The wellbore casing assembly of claim 20 wherein the bearing surface includes a ramped end.

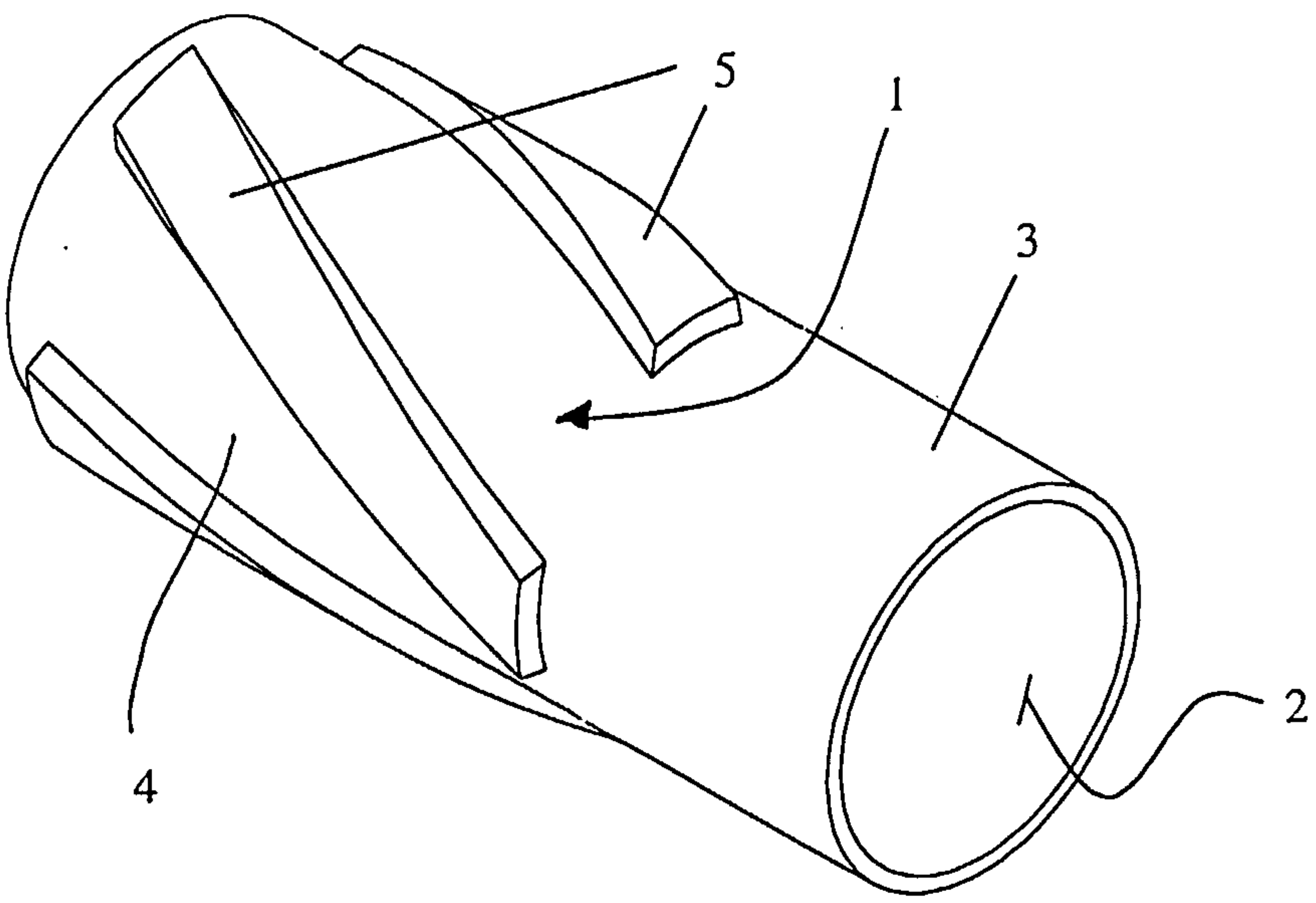

Figure 1

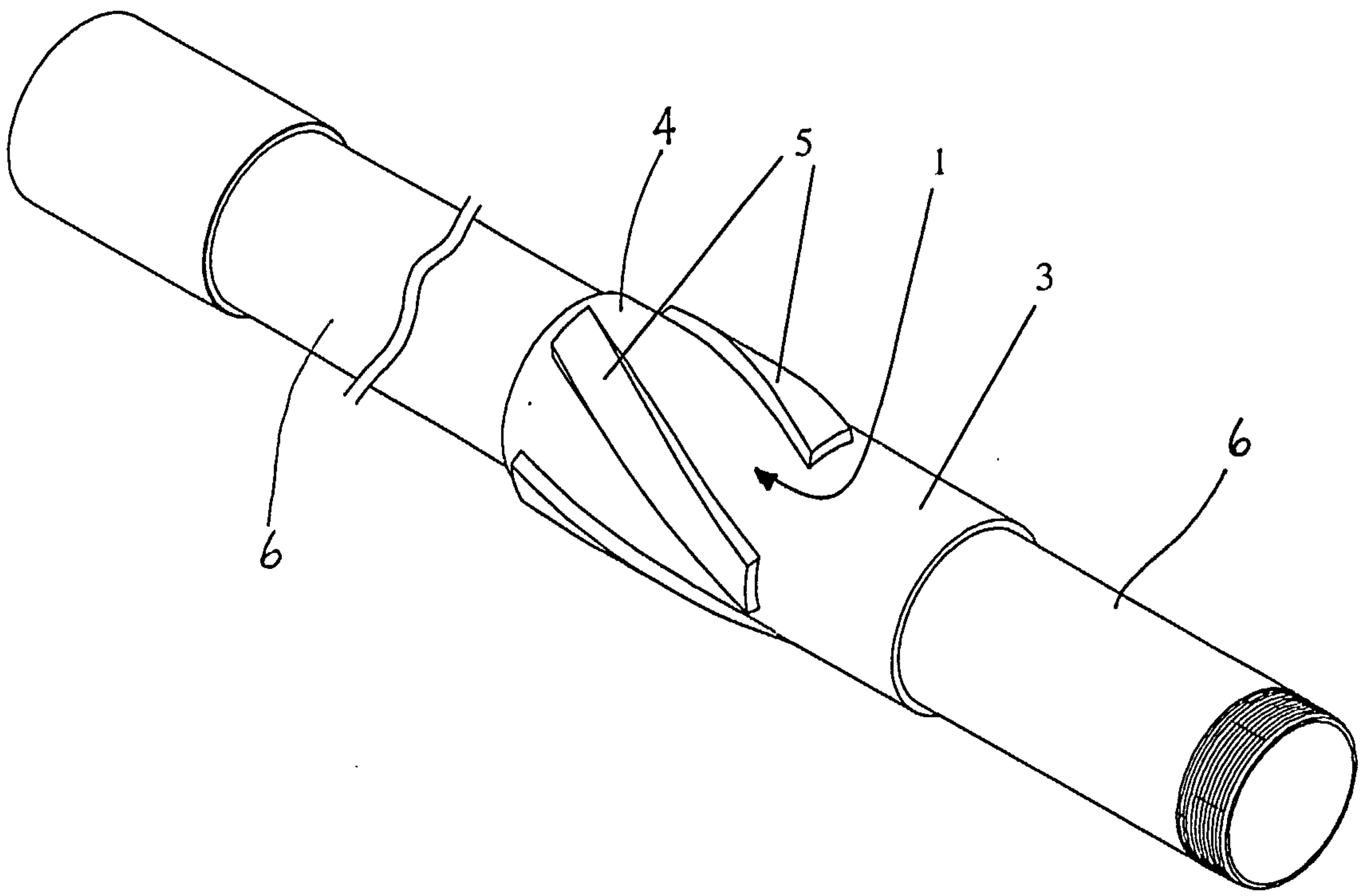

Figure 2

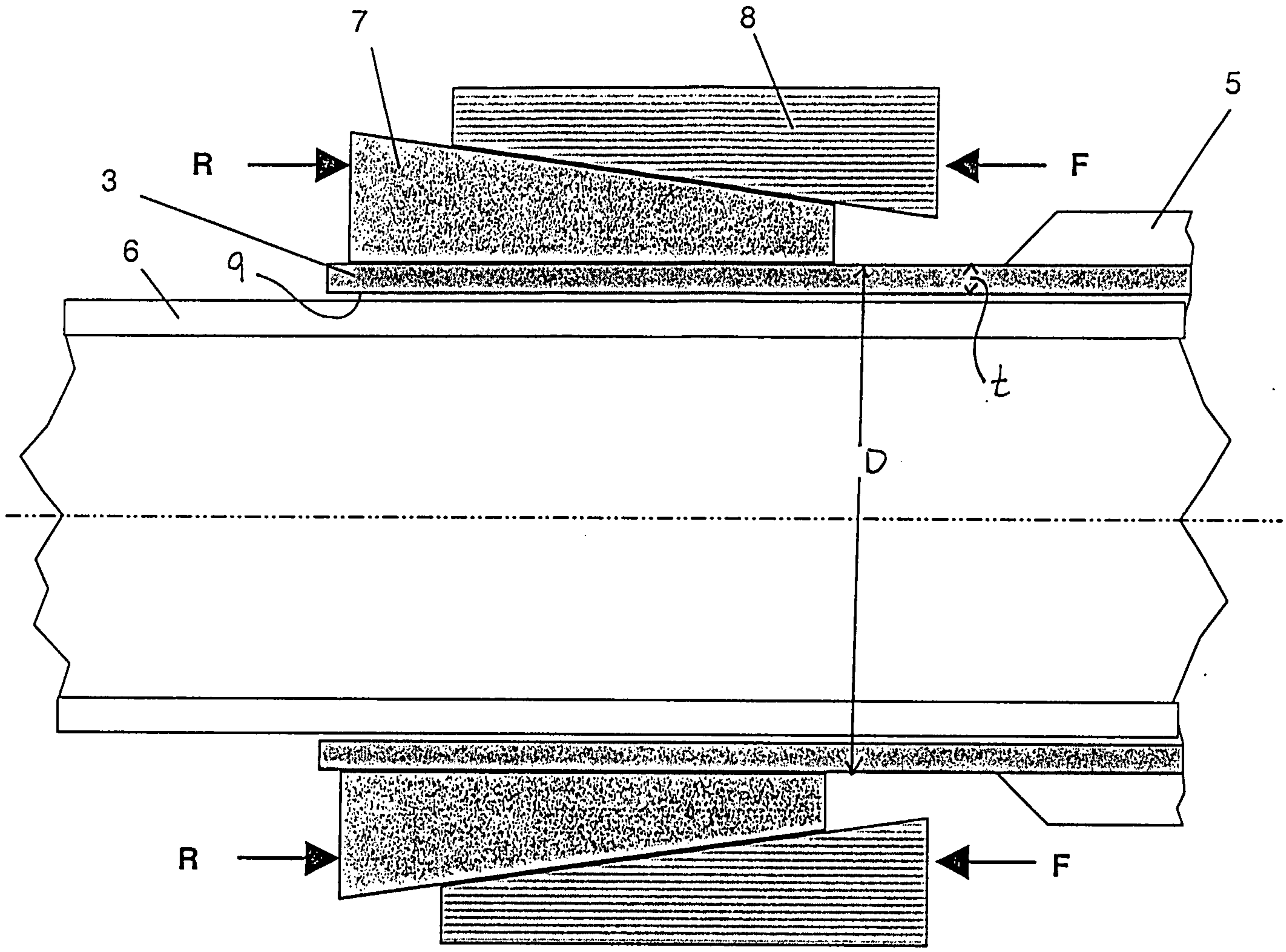

Figure 3

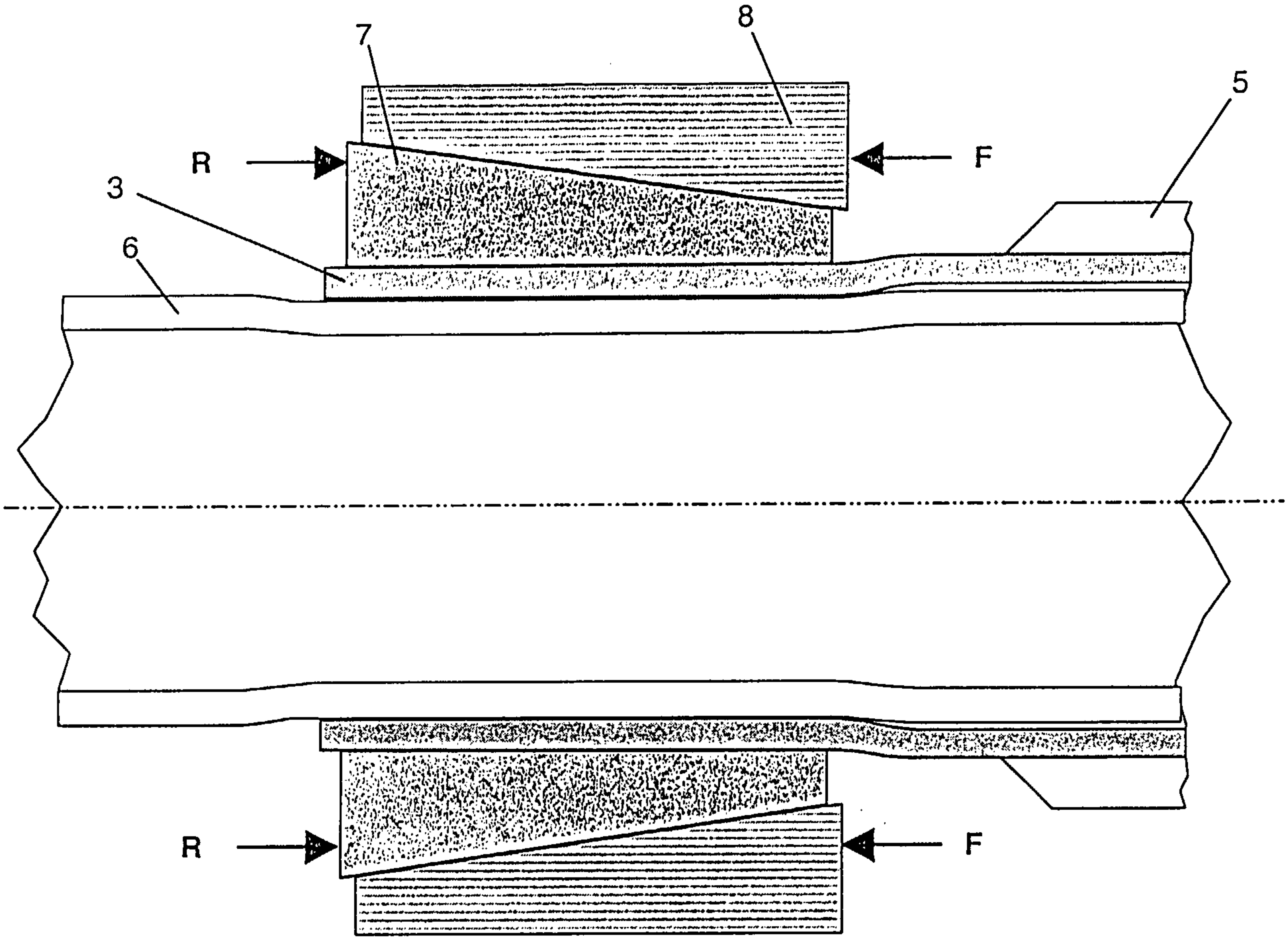

Figure 4

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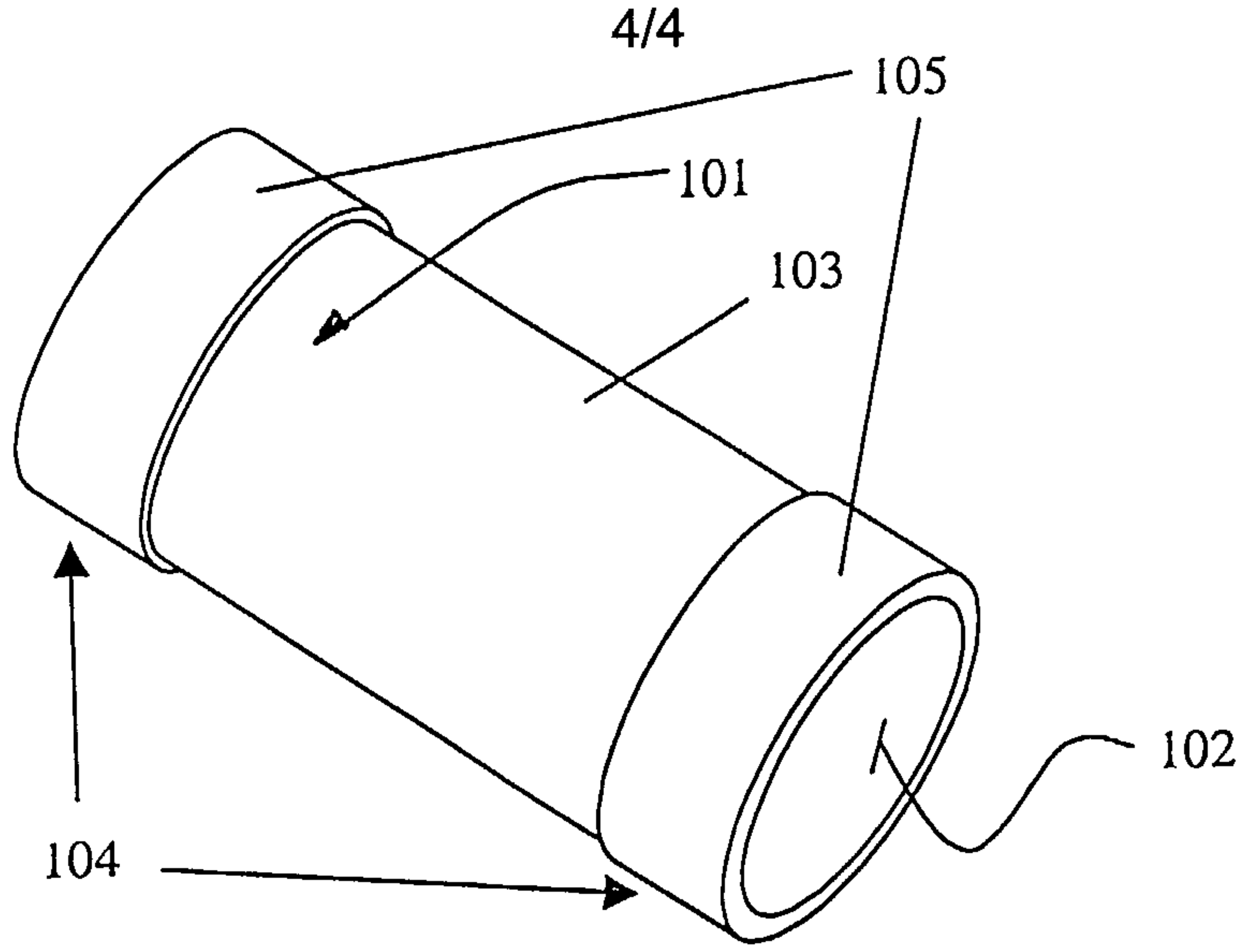
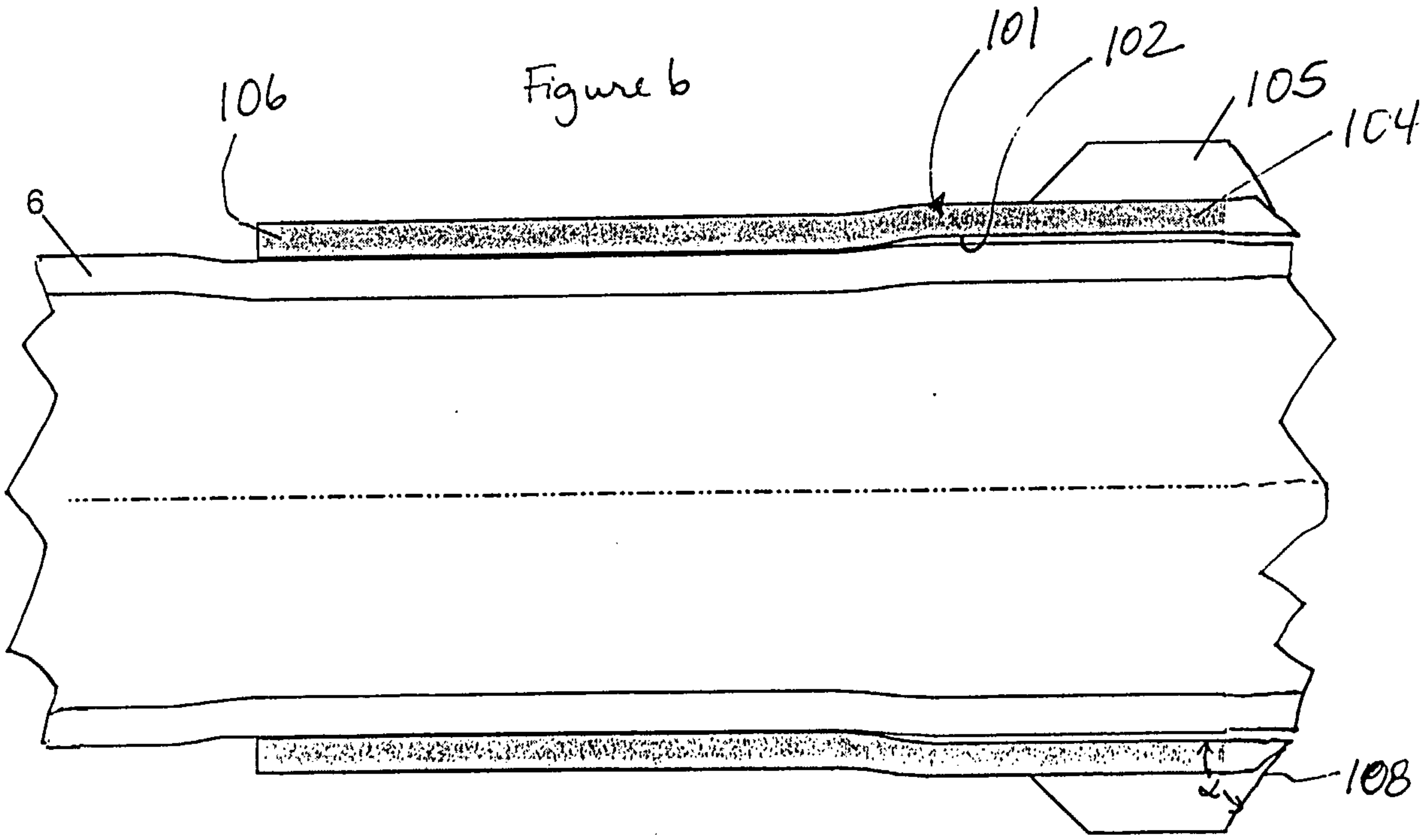


Figure 5

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