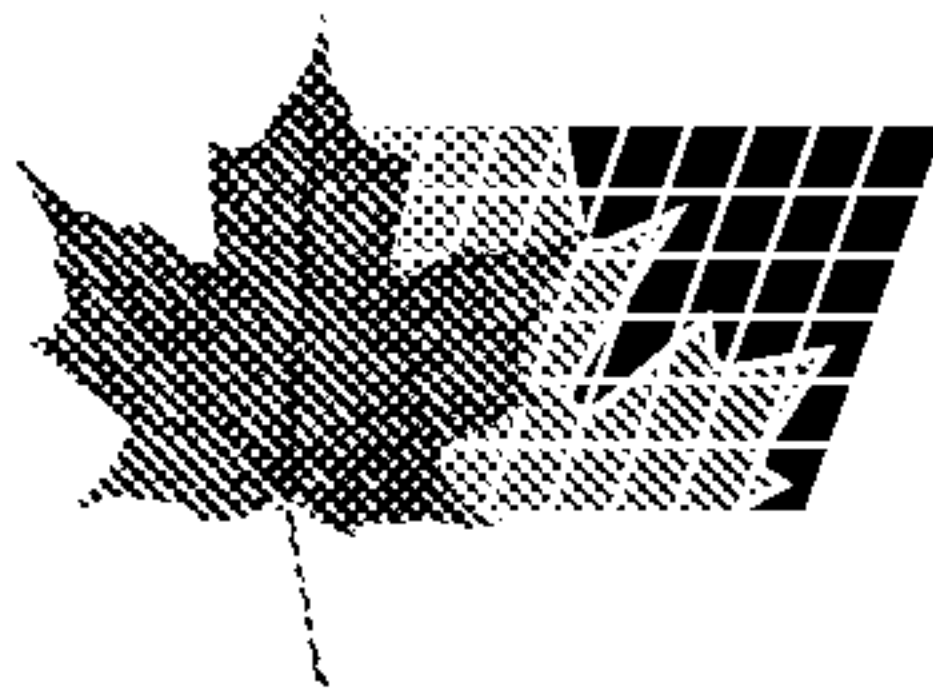




(72) SANDSTROM, ROGER, SE

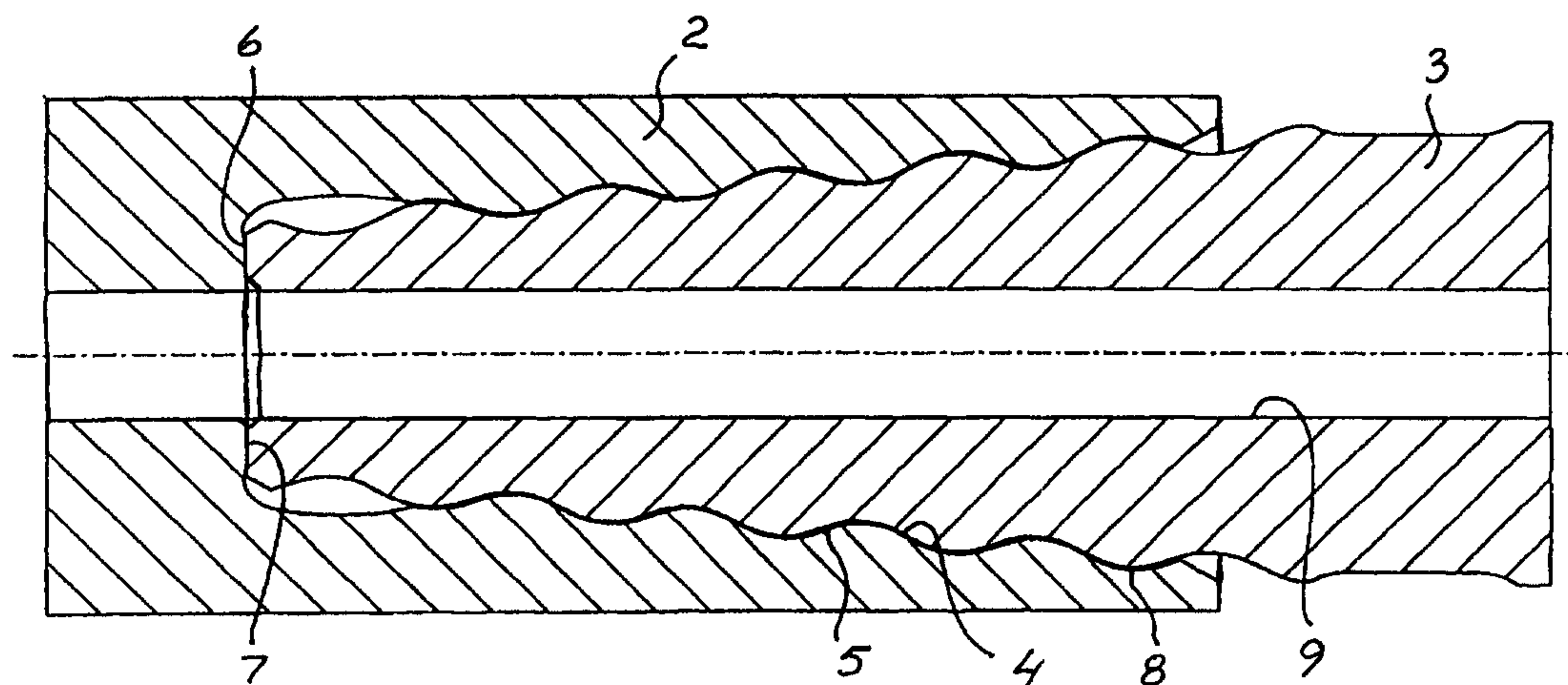
(71) UNIROC AB, SE

(51) Int.Cl.<sup>7</sup> E21B 17/042

(30) 1998/09/28 (9803267-5) SE

(54) **TRAIN DE TIGES A RACCORDS FILETES POUR PERCAGE A  
PERCUSSION DANS LA ROCHE**

(54) **THREAD COUPLING FOR A DRILL STRING FOR PERCUSSIVE  
ROCK DRILLING**



(57) Thread coupling for a drill string for percussive drilling. The thread coupling is provided with a male thread (5) and a female thread (4) cooperating therewith. The male thread is arranged on a first drill string element (3) provided with a first impact surface (6). The female thread is arranged on a second drill string element (2) which is provided with a second impact surface (7). The threads are conical. Furthermore the crests (8) of the male thread (5) have a radius of curvature which is more than 30 % of the pitch of the thread.

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

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

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>(51) International Patent Classification <sup>7</sup> :</b><br><br><b>E21B 17/042</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>A1</b> | <b>(11) International Publication Number:</b> <b>WO 00/19056</b><br><br><b>(43) International Publication Date:</b> 6 April 2000 (06.04.00)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>(21) International Application Number:</b> PCT/SE99/01652<br><br><b>(22) International Filing Date:</b> 22 September 1999 (22.09.99)<br><br><b>(30) Priority Data:</b><br>9803267-5                      28 September 1998 (28.09.98)      SE<br><br><b>(71) Applicant (for all designated States except US):</b> UNIROC AB<br>[SE/SE]; P.O. Box 521, S-737 25 Fagersta (SE).<br><br><b>(72) Inventor; and</b><br><b>(75) Inventor/Applicant (for US only):</b> SANDSTRÖM, Roger<br>[SE/SE]; Ekallén 4, S-737 40 Fagersta (SE).<br><br><b>(74) Agent:</b> GRUNDFELT, Gunnar; Atlas Copco Rock Drills AB,<br>Patents, S-701 91 Örebro (SE). |           | <b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, 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, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).<br><br><b>Published</b><br><i>With international search report.</i><br><i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> |
| <b>(54) Title:</b> THREAD COUPLING FOR A DRILL STRING FOR PERCUSSIVE ROCK DRILLING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>(57) Abstract</b><br><br>Thread coupling for a drill string for percussive drilling. The thread coupling is provided with a male thread (5) and a female thread (4) cooperating therewith. The male thread is arranged on a first drill string element (3) provided with a first impact surface (6). The female thread is arranged on a second drill string element (2) which is provided with a second impact surface (7). The threads are conical. Furthermore the crests (8) of the male thread (5) have a radius of curvature which is more than 30 % of the pitch of the thread.                                                      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

WO 00/19056

PCT/SE99/01652

Thread coupling for a drill string for percussive rock drilling

The present invention relates to a thread coupling for a drill string for percussive rock drilling.

In previously known thread couplings for percussive rock drilling one sometimes obtains breakage of the drill rod adjacent to the drill bit and on the skirt of the drill bit adjacent to the inner end of the thread of the drill bit. These breakages occur in particular when the collaring conditions are bad. The cause of these breakages is that the drill rod adjacent to its end surface in contact with a bottom impact surface on the drill bit is prestressed by the deformations occurring at the shock wave passage through the thread coupling in combination with the applied torque. A corresponding prestressing is obtained in the skirt of the drill bit.

The present invention, which is defined in the subsequent claim, aims at achieving a thread coupling which avoids these breakages through forming the thread coupling such that the material thickness becomes optimal at those parts on drill rod and drill bit which are most sensitive to breakage. This is achieved by means of a combination of conical threads and a well rounded crest of the threads. It has turned out to be advantageous to have a radius of curvature at the crest of the thread on the male thread which is at least 30% of the pitch of the thread. The conical thread form means that the prestressing of the thread is moved away from the contact surface between the end surface of the drill rod and the bottom impact surface. This effect is achieved because the pitch angle of the thread is larger at smaller thread diameter than at larger thread diameter, constant pitch.

An embodiment of the invention is described below with reference to the accompanying drawing in which fig 1 shows a drill string with a thread coupling according to the invention. Fig 2 is a section through a thread coupling according to the invention.

The drill string shown in the drawing comprises a drill bit 1, a drill rod 2 and a shank adapter 3. Instead of a drill rod as shown one can have several. Drill bit, drill rod and shank adapter are drill string elements. The thread coupling shown in the drawing comprises a

male thread 5 arranged on a first drill string element 3 and a female thread 4 arranged on a second drill string element 2. The first drill string element 3 is provided with a first impact surface 6. The second drill string element 2 is provided with a second impact surface 7. In the shown example contact is obtained between the impact surfaces 6,7 at the bottom of the female thread. One can alternatively form the drill string element such that one obtains contact at the outer end of the female thread. In this case the drill string element with the male thread is provided with an impact surface at the end of the male thread which is farthest away from the end of the drill string element. The drill string elements are provided with a central flushing channel 9. The male thread 5 and the female thread 4 are conical with constant pitch. It has turned out to be advantageous to make the thread with a cone angle which is smaller than  $20^{\circ}$ . This means that the pitch angle of the threads increases when the diameter decreases. Through this the largest load on the threads is moved away from the area where known technique has had a tendency to give thread breakage. Since the crests 8 of the male threads 5 have been given a radius of curvature which is more than 30% of the pitch of the thread good transfer of shock wave energy is obtained without overloading of the thread coupling.

WO 00/19056

PCT/SE99/01652

3

## Claim:

1. Thread coupling for a drill string for percussive rock drilling comprising a male thread (5) and a female thread (4) cooperating therewith, said male thread being arranged on a first drill string element (3) and said female thread being arranged on a second drill string element (2), that said first drill string element (3) has a first impact surface (6) and that said second drill string element (2) has a second impact surface (7), said first and second impact surfaces being arranged to abut against each other, characterized in that said male thread (5) and said female thread (6) are conical and that the crests (8) of said male thread (5) have a radius of curvature which is larger than 30% of the pitch of the thread.

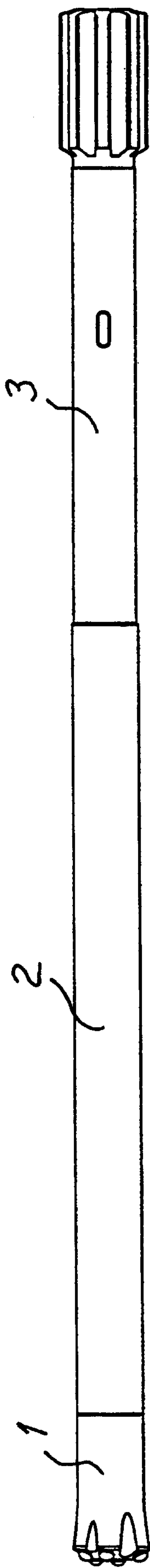


Fig. 1

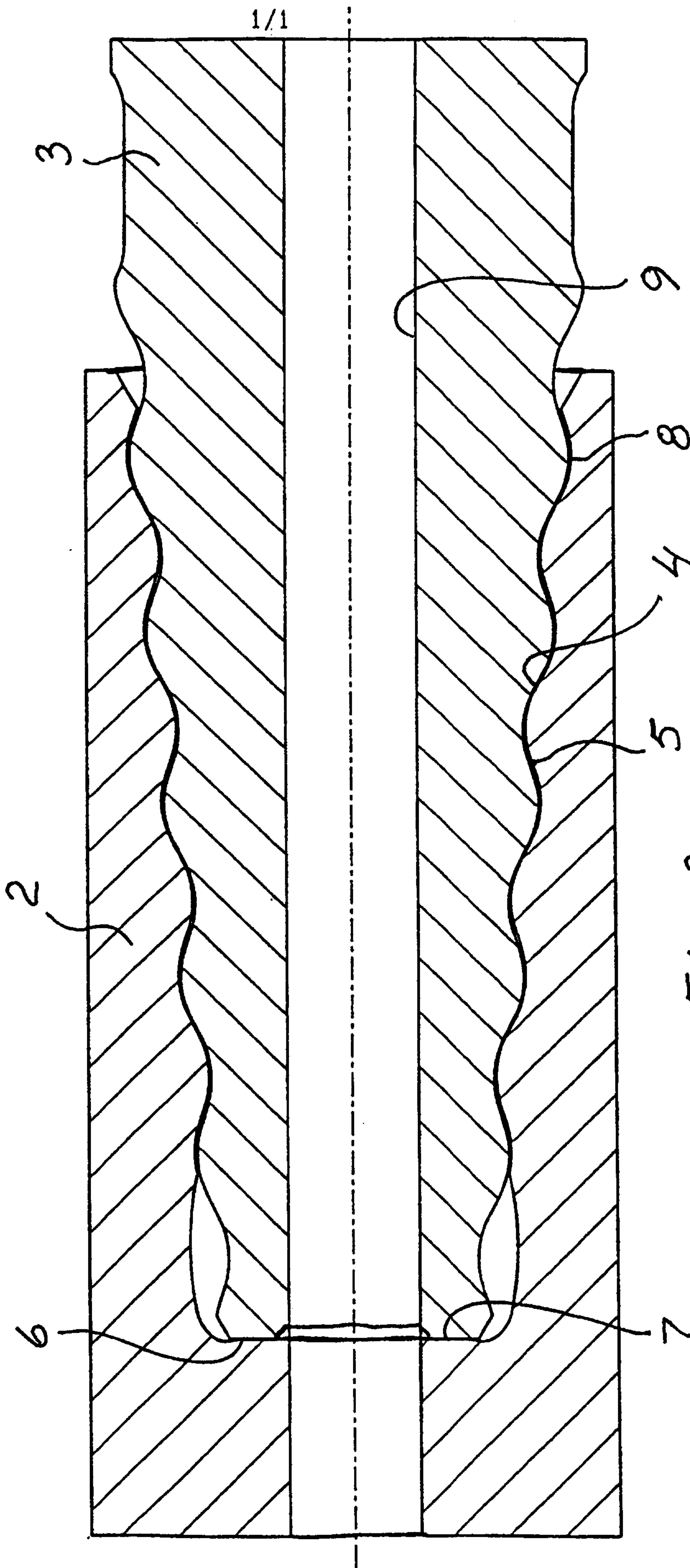


Fig. 2

