



(11) **EP 1 332 807 B2**

(12) **NEW EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the opposition decision:
04.06.2008 Bulletin 2008/23

(51) Int Cl.:
B21C 37/29 (2006.01)

(45) Mention of the grant of the patent:
28.01.2004 Bulletin 2004/05

(21) Application number: **01660232.8**

(22) Date of filing: **04.02.2002**

(54) **Method and apparatus for making a branch collar in a pipe**

Verfahren und Vorrichtung zum Herstellen von Abzweigkragen an Rohren

Méthode et dispositif pour la fabrication des collerettes de raccordement sur des tubes

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR

(74) Representative: **LEITZINGER OY**
Tammasaarekatu 1
00180 Helsinki (FI)

(43) Date of publication of application:
06.08.2003 Bulletin 2003/32

(56) References cited:
US-A- 5 515 710

(73) Proprietor: **EFES TEX AG**
CH-6901 Lugano (CH)

- **PATENT ABSTRACTS OF JAPAN** vol. 012, no. 182 (M-702), 27 May 1988 (1988-05-27) & JP 62 292219 A (MITSUBISHI HEAVY IND LTD), 18 December 1987 (1987-12-18)
- **PATENT ABSTRACTS OF JAPAN** vol. 014, no. 003 (M-915), 8 January 1990 (1990-01-08) & JP 01 254317 A (KOKAN KAKO KK), 11 October 1989 (1989-10-11)

(72) Inventor: **Larikka, Leo**
01600 Vantaa (FI)

EP 1 332 807 B2

Description

[0001] The invention relates to a method as defined in the preamble of claim 1 (see e.g. JP-A-62 292 219) and an apparatus as defined in the preamble of claim 2 for making a branch collar or a neck in a pipe.

[0002] This type of device is prior known in a machine manufactured by Witzig & Frank GmbH (drawing E3 in the file of this patent). In this device a calibration mandrel is used for pushing back a collar forming ball and for enlarging the collar. With this device, however, it is not possible to compensate or correct the different spring back effects of the material in different directions of the collar.

[0003] When a tubular metal casing or mantle is formed with a branching, cylindrical collar or neck by stretching the casing material, its final size is determined by elasticity of the pipe and internal residual stresses of the material. As a rule, the collar size in a cross-pipe direction D_2 is less than in a lengthwise direction D_1 . Moreover, in a majority of relevant materials, for instance in a stainless steel, the collar size in a crosswise direction is less than a dimension D_2' of the tool used for forming the collar.

[0004] This problem has been addressed in a prior patent publication US-5,515,710 by giving the forming die a diameter larger than that of the pipe. This oversized forming die is delivered inside a pipe by squeezing the pipe to ellipticity, whereby its diameter increases in the over-size direction of the forming die. This arrangement is possible with large pipes and thin walls, which possess a required elasticity. With regard to smaller pipes, wherein the ratio of a diameter to a wall thickness alters the pipe elasticity in such a way that said utilization of elasticity and pipe ellipticity is not functional, the shaping and dimensioning of a neck or collar can be implemented as described in this invention.

[0005] It is an object of the invention to provide a method and an apparatus, which can be used for correcting the roundness and diametrical dimensions of a neck or collar formed by the collaring device disclosed above.

[0006] This object is accomplished by means of a method set forth in the appended claim 1 and an apparatus set forth in claim 2. The non-independent claims disclose preferred embodiments of the invention.

[0007] The invention will now be described in more detail by way of a working example with reference to the accompanying drawings, in which

fig. 1 shows an apparatus of the invention in side and plan views, respectively;

fig. 2 shows in a perspective view a collared pipe and relative dimensions of its collar and a forming tool in relation to a pipe diameter D ;

fig. 3 shows the apparatus of fig. 1 in the

initial position of a forming die, in compliance with the device disclosed in patent publication US- 5,515,710 except for the dimensioning of a forming die (a calibration mandrel of the invention is not shown);

figs. 3A and 3B illustrate the forming die and its dimensioning in various diametrical directions;

fig. 4 shows a section taken along a line IV-IV in fig. 1; and

fig. 5 shows the dimensioning of a calibration mandrel in various diametrical directions.

[0008] Referring to the illustrated embodiment, a body 1 of the apparatus comprises a cylindrical element provided with a lengthwise hole of rectangular cross-section, which is fitted with an elongated wedge 2 and its base member 5 whose end 4 can be engaged by a drive unit for operating the wedge 2 lengthwise of the body 1.

[0009] The body 1 has its cylindrical surface formed with a substantially radial hole or recess 9. The hole or recess 9 can also be set at a desired angle within the range of 90° - 45° with respect to the center axis of the body 1. However, the most common pipe branches are perpendicular and the most common collars or necks are perpendicular, whereby the angle is 90° . The bottom of a forming die 3 is in contact with a wedge surface 14 of the wedge 2 as the forming die 3 is positioned in the hole or recess 9. In the illustrated case, the wedge 2 is operated by pulling, but it can also be operated by pushing. It is also conceivable to employ two wedges which are movable in directions opposite to each other.

[0010] A pipe to be collared is pushed over the body 1, such that a preformed hole in the pipe sets in alignment above the hole or recess 9 and the forming die 3 present in the latter. As the wedge 2 is forced to travel with its larger or thicker end moving towards the forming die 3, said forming die 3 is driven upwards to force the pipe wall outward from around the preformed hole. The pipe wall stretches around the rim of the preformed hole and forms a branching neck or collar, having its shape and direction consistent with those of the emerging forming die 3.

[0011] The diameter of a tool depicted in fig. 3 is dimensioned for a loose fit in a pipe so as not to leave abrasion marks on the inside wall of the pipe. The forming die 3 fitted in the recess or hole 9 may not be of the size to cause marks on the inside wall of the pipe. This problem, which is about a die causing a mark or a scratch, is particularly evident when making a branch whose size is equal to the pipe itself.

[0012] This problem is resolved with a method and an apparatus of the invention by designing the collar-forming die 3 to be elliptical in such a way that its diameter D_2'

transverse to the pipe is smaller than the inner diameter of the pipe and smaller than a diameter D_1' of the forming die 3 in the longitudinal direction of the pipe.

[0013] The neck or collar produced by means of the above-described forming die 3 is elliptical or oval. The collar diameter D_2 is smaller than the inner pipe diameter D as a result of the dimension D_2' of the forming die 3, as well as smaller than the diameter D_2' of the forming die 3 as a result of internal shaping stresses and elasticity of the material.

[0014] This ellipticity of a collar can be rectified by using a special calibration mandrel 11 for finishing the collar. The calibration mandrel 11 is designed for axial movement co-directionally with the center line of the hole 9 present in the collaring tool and it can be pressed against the forming die 3 with a force sufficient for pushing the forming die 3 in front of it back into the hole 9 and stretching the collar to the dimensions of its own size.

[0015] Diameters D_3 (crosswise) and D_4 (lengthwise) of the calibration mandrel 11, as well as those D_1' (lengthwise) and D_2' (crosswise) of the forming die 3 are inter-related, depending on the dimensions and qualities (elasticity) of a pipe to be worked and a desired final result, particularly whether it is desirable to have the inner diameter D_2 of a collar comply with the inner pipe diameter or whether it is desirable to provide the collar and the pipe with equal outer diameters. If the outer diameters are to be equal, the lengthwise diameter D_1' of the forming die 3 is dimensioned to provide the collar with a diametrical size D_1 which is so large that the corresponding outer diameter of the collar is slightly oversized. In this case, the calibration mandrel 11 is dimensioned in such a way that its crosswise diameter D_3 stretches the sides of the collar to a size matching the outer pipe diameter and its lengthwise diameter D_4 supports the collar in the longitudinal direction D_1 , allowing the diameter co-directional therewith to be reduced by the extent of an oversize produced by the die 3. A reduction of size occurring co-directionally with the diameter D_1' during the calibration process facilitates essentially a lateral stretching of the crosswise diameter D_2 .

[0016] The calibration mandrel 11 has its pipe-entering end 12 designed in an arched shape for pushing its flanks 13 substantially closer to the center line of a pipe than the final position of the top end of the forming die 3. As pointed out above, the calibration mandrel 11 has a crosswise diameter D_3 which exceeds its lengthwise diameter D_4 . The mandrel 11 has an outer surface which is slightly conical.

[0017] Thus, the calibration mandrel 11 has a dual function. It pushes the forming die 3 back to the bottom of the hole or recess 9 and at the same time its crosswise measurement disparity rectifies the dimensional error of the forming die 3, which results from the fact that a forming die, which fits inside a pipe, is not capable of producing a diametrical size sufficiently large in crosswise direction.

Claims

1. A method for bending the rims of a pipe hole for a hole-enclosing collar or neck by using a forming die (3), which is movable radially relative to the pipe and which is displaced from inside the pipe outwards for shaping the collar, the rectification of a collar produced by the forming die (3) in terms of its roundness and/or diametrical sizes being effected by means of a calibration mandrel (11) movable from outside the pipe inwards, which is pressed by means of an external drive unit into a collar produced by the forming die (3), the calibration mandrel (11) stretching the collar to comply with its own size, wherein upon its penetration into the neck, the calibration mandrel (11) pushes the forming die back to its initial position for a new collaring operation, **characterized in that** the forming die (3) is used to produce a collar diameter larger than a desired final size in the lengthwise direction and a collar diameter smaller than a desired final size in the crosswise direction of a pipe, and that the dimensioning of the collar diameters is rectified by a crosswise measurement of the calibration mandrel (11), wherein the calibration mandrel (11) has a diameter which is larger in a transverse direction (D_2) than in a lengthwise direction (D_1).
2. A collaring apparatus for bending the rims of a hole for a hole-enclosing collar or neck, said apparatus comprising a body element (1) insertable inside a pipe to be collared and a forming die (3) adapted for substantially radial movement relative to the pipe and having an outer diameter which is substantially equal to a desired inner diameter for the collar, a hole or recess (9) present in the body element (1), which is dimensioned to receive the forming die (3), said forming die (3) being operable under the guidance of said hole or recess (9), as well as elements (2, 4, 5, 14) engageable with a drive unit for displacing the forming die (3) from inside the pipe outwards, the hole or recess (9) having its center line aligned with a calibration mandrel (11) movable co-directionally therewith, which is pressable by means of an external drive unit from outside the pipe inwards into a collar produced by the forming die (3), the calibration mandrel (11) in use stretching the collar to comply with its own size and, upon its penetration into the collar, the calibration mandrel (11) pushing the forming die (3) back to its initial position for a new collaring operation, **characterized in that** the forming die (3) is dimensioned to produce a collar diameter (D_1) larger than a desired final size in the lengthwise direction and a collar diameter (D_2) smaller than a desired final size in the crosswise direction of a pipe, the calibration mandrel (11) having a diameter which is larger in a transverse direction (D_2) than in a lengthwise direction (D_1) of the pipe, whereby this crosswise diameter disparity rectifies the final size

as desired.

3. An apparatus as set forth in claim 2, **characterized in that** the calibration mandrel (11) has its pipe-entering end (12) designed in an arched shape for pushing flanks (13) of the mandrel end substantially closer to the center line of a pipe than the final position of the top end of the forming die (3).

Patentansprüche

1. Verfahren zum Biegen der Ränder eines Loches in einem Rohr für einen das Loch umschließenden Kragen oder Hals durch Benutzung eines Formwerkzeugs (3), welches in radialer Richtung relativ zum Rohr beweglich ist und welches aus dem Innern des Rohres nach außen verschoben wird, um den Kragen zu formen, wobei die Korrektur eines durch das Formwerkzeug (3) erzeugten Kragens hinsichtlich seiner Rundheit und/oder Durchmessergrößen mittels eines von der Außenseite des Rohres nach innen beweglichen Kalibrierdorns (11) erfolgt, welcher mittels einer äußeren Antriebsvorrichtung in einen von dem Formwerkzeug (3) erzeugten Kragen gedrückt wird, wobei der Kalibrierdorn (11) den Kragen auf seine eigene Größe aufweitet, wobei der Kalibrierdorn (11) bei oder nach dem Eindringen in den Hals das Formwerkzeug (3) zurück in seine Anfangsposition für einen neuen Vorgang der Kragenbildung drückt, **dadurch gekennzeichnet, dass** das Formwerkzeug (3) benutzt wird, um einen Kragendurchmesser, der größer als eine gewünschte Endgröße in Längsrichtung ist, und einen Kragendurchmesser, der kleiner als eine gewünschte Endgröße in Querrichtung eines Rohres ist, zu erzeugen, und dass die Bemessung der Kragendurchmesser durch eine Quermessung des Kalibrierdorns (11) korrigiert wird, wobei der Kalibrierdorn (11) einen Durchmesser hat, der in Querrichtung (D_2) größer als in Längsrichtung (D_1) ist.
2. Aushalsvorrichtung zum Biegen der Ränder eines Loches für einen das Loch umgebenden Kragen oder Hals, die besagte Vorrichtung umfassend einen Körper (1), welcher in das Innere des auszuhalsenden Rohres einführbar ist, und ein Formwerkzeug (3), welches für eine im Wesentlichen radiale Bewegung relativ zum Rohr ausgelegt ist und einen Außendurchmesser hat, der im Wesentlichen gleich dem gewünschten Innendurchmesser des Kragens ist, wobei eine Öffnung oder Vertiefung (9) in dem Körper (1) vorhanden ist, welche so dimensioniert ist, dass sie das Formwerkzeug (3) aufnimmt, wobei das besagte Formwerkzeug (3) unter der Führung der besagten Öffnung oder Vertiefung (9) betätigbar ist, sowie Elemente (2, 4, 5, 14), die mit einer Antriebsvorrichtung koppelbar sind, um das Formwerk-

zeug (3) aus dem Innern des Rohres nach außen zu bewegen, wobei die Öffnung oder Vertiefung (9) in ihrer Mittellinie mit einem Kalibrierdorn (11) ausgerichtet ist, der mit ihr richtungsgleich verschiebbar ist und der mittels einer äußeren Antriebsvorrichtung von außerhalb des Rohres nach innen in einen von dem Formwerkzeug (3) erzeugten Kragen drückbar ist, wobei der Kalibrierdorn (11) während eines Arbeitsvorganges den Kragen auf seine eigene Größe aufweitet, und wobei der Kalibrierdorn (11) bei oder nach seinem Eindringen in den Kragen das Formwerkzeug (3) zurück in dessen Ausgangsposition für einen neuen Aushalsvorgang drückt, **dadurch gekennzeichnet, dass** das Formwerkzeug (3) so dimensioniert ist, dass es einen Kragendurchmesser (D_1) erzeugt, der größer als eine gewünschte Endgröße in der Längsrichtung ist, und einen Kragendurchmesser (D_2), der in der Querrichtung eines Rohres kleiner als eine gewünschte Endgröße ist, wobei der Kalibrierdorn (11) einen Durchmesser aufweist, der in Querrichtung (D_2) größer ist als in Längsrichtung (D_1) des Rohres, wodurch diese Abweichung der Querdurchmesser die Endgröße wie gewünscht korrigiert.

3. Vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** das in das Rohr eintretende Ende (12) des Kalibrierdorns (11) bogenförmig ausgebildet ist, um die Flanken (13) des Dornendes wesentlich dichter zur Mittellinie eines Rohres als die Endposition des oberen Endes des Formwerkzeugs (3) zu schieben.

Revendications

1. Procédé pour courber les bords d'un trou de tuyau pour une collerette ou un col renfermant le trou, en utilisant une matrice de formage (3) qui peut être déplacée radialement relativement au tuyau et qui est déplacée depuis l'intérieur du tuyau vers l'extérieur pour former la collerette, la rectification de la collerette produite par la matrice de formage (3) concernant sa rondeur et/ou ses diamètres étant réalisée au moyen d'un mandrin de calibrage (11) qui peut être déplacé depuis l'extérieur du tuyau vers l'intérieur et qui est pressé, au moyen d'une unité d'entraînement externe, dans une collerette produite par la matrice de formage (3), le mandrin de calibrage (11) étirant la collerette pour la conformer à sa propre taille, dans lequel, lorsqu'il pénètre dans le col, le mandrin de calibrage (11) repousse la matrice de formage vers l'arrière jusqu'à sa position initiale pour une nouvelle opération de formage de collerette, **caractérisé en ce que** la matrice de formage (3) est utilisée pour produire un diamètre de collerette plus grand qu'une dimension finale souhaitée dans la direction longitudinale et un diamètre de collerette

- plus petit qu'une dimension finale souhaitée dans la direction transversale d'un tuyau et **en ce que** le dimensionnement des diamètres de la collerette est rectifié par une mesure transversale du mandrin de calibrage (11), le mandrin de calibrage (11) ayant un diamètre qui est plus grand dans une direction transversale (D_2) que dans une direction longitudinale (D_1). 5
2. Appareil à courber les bords d'un trou pour une collerette ou un col renfermant le trou, ledit appareil comprenant un élément formant corps (1) qui peut être inséré à l'intérieur d'un tuyau à pourvoir d'une collerette, et une matrice de formage (3) adaptée pour effectuer un mouvement sensiblement radial relativement au tuyau et ayant un diamètre extérieur qui est sensiblement égal au diamètre intérieur souhaité de la collerette, un trou ou retrait (9), qui est dimensionné pour recevoir la matrice de formage (3), étant présent dans l'élément formant corps (1), ladite matrice de formage (3) pouvant être actionnée sous le guidage dudit trou ou retrait (9), ainsi que des éléments (2, 4, 5, 14) qui peuvent être engagés avec une unité d'entraînement pour déplacer la matrice de formage (3) depuis l'intérieur du tuyau vers l'extérieur, l'axe du trou ou retrait (9) étant aligné avec un mandrin de calibrage (11) qui peut être déplacé dans la même direction que celui-ci et qui peut être pressé au moyen d'une unité d'entraînement externe à partir de l'extérieur du tuyau vers l'intérieur dans une collerette produite par la matrice de formage (3), le mandrin de calibrage (11) étirant la collerette pendant l'utilisation pour la conformer à sa propre taille et, lorsqu'il pénètre dans la collerette, le mandrin de calibrage (11) repoussant la matrice de formage (3) vers l'arrière jusqu'à sa position initiale pour une nouvelle opération de formage de collerette, **caractérisé en ce que** la matrice de formage (3) est dimensionnée pour produire un diamètre de collerette (D_1) plus grand qu'une dimension finale souhaitée dans la direction longitudinale et un diamètre de collerette (D_2) plus petit qu'une dimension finale souhaitée dans la direction transversale d'un tuyau, le mandrin de calibrage (11) ayant un diamètre qui est plus grand dans une direction transversale (D_2) que dans une direction longitudinale (D_1) du tuyau, cette disparité de diamètre transversale rectifiant la dimension finale comme souhaité. 10
15
20
25
30
35
40
45
3. Appareil selon la revendication 2, **caractérisé en ce que** le mandrin de calibrage (11) a son extrémité d'entrée (12) dans le tuyau conçue en une forme arquée pour pousser les flancs (13) de l'extrémité du mandrin sensiblement plus près de l'axe d'un tuyau que la position finale de l'extrémité supérieure de la matrice de formage (3). 50
55

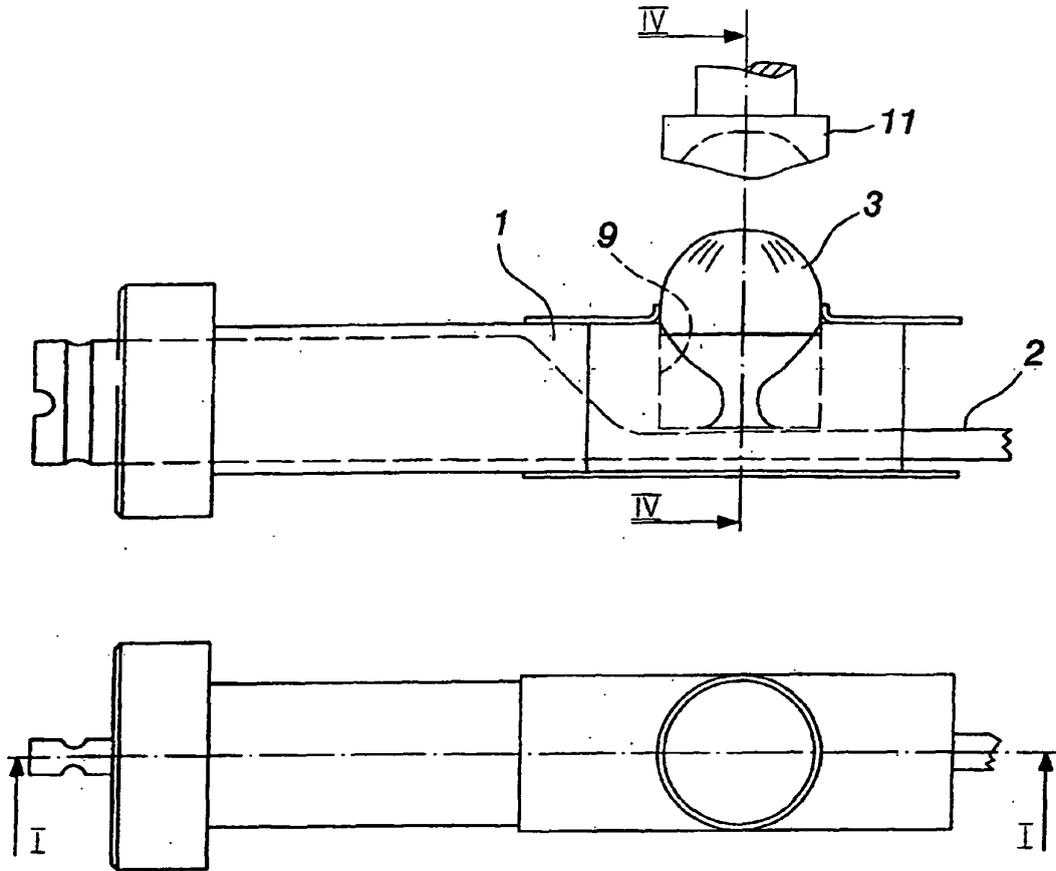


Fig.1

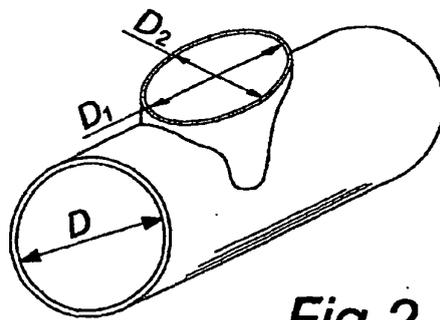


Fig.2

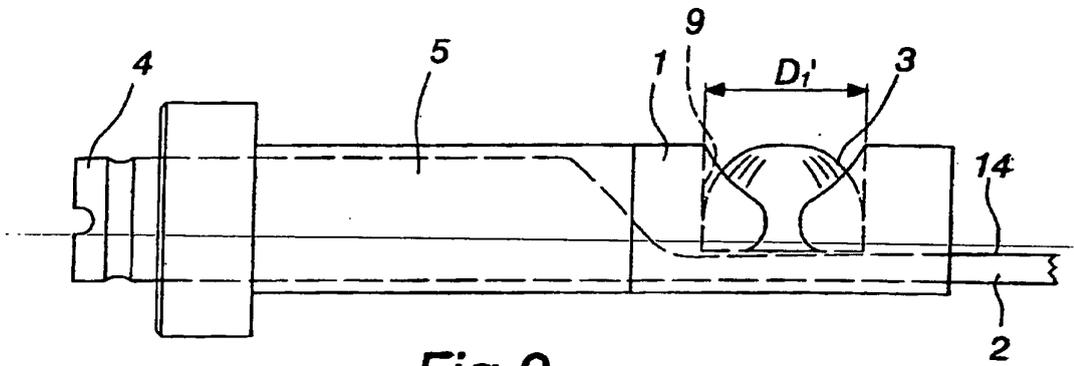


Fig.3

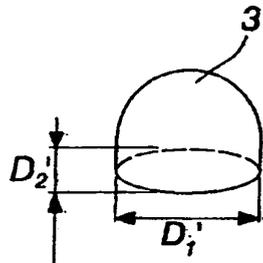


Fig.3A

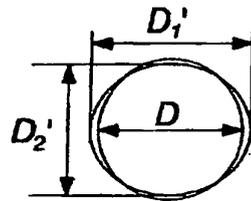


Fig.3B

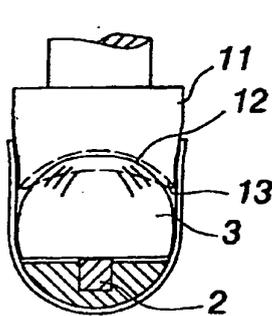


Fig.4

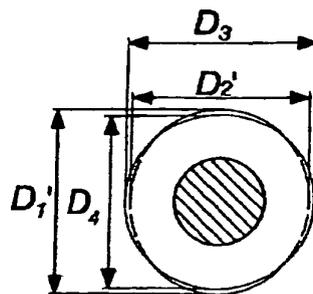


Fig.5

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 62292219 A [0001]
- US 5515710 A [0004] [0007]