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(11) **EP 1 433 546 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
02.08.2006 Bulletin 2006/31

(51) Int Cl.:
B21D 22/21 (2006.01) B21D 53/88 (2006.01)

(21) Application number: **03104931.5**

(22) Date of filing: **22.12.2003**

(54) **Production method and device for producing an annular container for an electric winding for assembly to a pulley of a motor vehicle air conditioning system**

Verfahren und Vorrichtung zur Herstellung von einem ringförmigen Behälter einer elektrischen Wicklung zum Zusammenbauen mit einer Riemenscheibe einer Fahrzeugklimaanlage

Procédé et dispositif pour la fabrication d'un conteneur annulaire d'un enroulement électrique pour assemblage avec une poulie d'un système de climatisation pour véhicules

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**

(30) Priority: **23.12.2002 IT TO20021116**

(43) Date of publication of application:
30.06.2004 Bulletin 2004/27

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- **PATENT ABSTRACTS OF JAPAN** vol. 012, no. 213 (C-505), 17 June 1988 (1988-06-17) -& JP 63 012626 A (SHIN MEIWA IND CO LTD), 20 January 1988 (1988-01-20)

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Description

[0001] The present invention relates to a production method and device for producing an annular container for an electric winding for assembly to a pulley of a motor vehicle air conditioning system in accordance with the preamble of the independent claims (see in particular US-A-4 669 295 and also GB-A-1 429 226 for a device suitable for producing such a container).

[0002] As is known, the compressor of a motor vehicle air conditioning system is powered by the vehicle engine via a normal belt and pulley type drive assembly.

[0003] As is also known, as a result of stricter regulations governing exhaust gas emissions by motor vehicles, vehicles have been designed in which the engine turns itself off whenever the vehicle stops temporarily, e.g. at a traffic light or in a queue, and is turned back on automatically when a specific command is imparted to the vehicle, e.g. when the clutch pedal is pressed.

[0004] In this type of vehicle, in which the engine is stopped more frequently than in conventional vehicles, to ensure continuous operation of the air conditioning system when the engine is temporarily turned off, the air conditioning system is powered by an auxiliary electric motor powered by the vehicle battery.

[0005] Selective connection of the air conditioning system compressor to the vehicle engine or auxiliary motor is made by means of an electromagnetic clutch controlled by the electronic central control unit on the vehicle according to whether the vehicle engine is on or off.

[0006] The electromagnetic clutch comprises, among other things, an electric winding for generating the electromagnetic field required to perform the above selective connection function, and which is normally housed inside an annular container fitted to the hub of the drive assembly pulley connected to the air conditioning system compressor.

[0007] At present, the annular container is stamped from a flat washer in a series of successive forming operations, by which the flat washer gradually assumes the desired final shape of the annular container.

[0008] To prevent breakage of the annular container during production, the forming operations are normally performed at intervals sufficient to allow the material to stabilize between one operation and the next, so that current production methods involve a good deal of time and work.

[0009] It is an object of the present invention to provide a production method and device for producing a container of the type described in less time than that required by known production methods.

[0010] According to the present invention, there is provided a production method and device for producing an annular container for an electric winding for assembly to a motor vehicle air conditioning system pulley, as claimed in Claims 1 and 4 respectively.

[0011] A preferred, non-limiting embodiment of the present invention will be described by way of example

with reference to the accompanying drawings, in which:

Figure 1 shows a die for producing a container for an electric winding for assembly to a motor vehicle air conditioning system pulley in accordance with the present invention and in a first operating configuration;

Figure 2 shows the Figure 1 die in a second operating configuration;

Figure 3 shows a cross section of an annular forming cavity of the Figure 1 and 2 die in accordance with a preferred embodiment of the invention.

[0012] Number 1 in Figures 1 and 2 indicates as a whole a die in accordance with the present invention for producing an annular container for an electric winding for assembly to a pulley of a motor vehicle air conditioning system (not shown). More specifically, Figures 1 and 2 only show the parts of the die pertinent to a clear understanding of the present invention.

[0013] Die 1 substantially comprises a fixed half-die 2; a movable half-die 3 facing fixed half-die 2 and cooperating, in use, with it in a mating direction indicated by arrow F; and an actuating assembly (not shown) for moving movable half-die 3, in mating direction F, between an open position (Figure 1) in which movable half-die 3 is detached from fixed half-die 2, and a closed position (Figure 2) in which movable half-die 3 cooperates with fixed half-die 2.

[0014] Fixed half-die 2 substantially comprises a base 4; and a matrix 5 projecting integrally from base 4 and defining an annular forming cavity 6 open towards both movable half-die 3 and base 4.

[0015] More specifically, annular forming cavity 6 is substantially cylindrical with an axis A coincident with mating direction F, tapers towards the end opposite the end facing movable half-die 3, and is defined laterally by smooth surfaces.

[0016] Movable half-die 3 substantially comprises a supporting wall 7; and a punch 8 projecting integrally from supporting wall 7, extending coaxially with axis A towards the matrix of fixed half-die 2, and complementary in shape to annular forming cavity 6, so as to be insertable inside annular forming cavity 6 with very little radial clearance as movable half-die 3 is moved towards fixed half-die 2 in mating direction F.

[0017] Die 1 also comprises an extractor 9 for extracting the finished annular container from matrix 5. More specifically, extractor 9 is fitted to base 4 of fixed half-die 2, on the opposite side to matrix 5, and is substantially defined by an annular punch 10 coaxial with axis A and movable, in use, in mating direction F in the opposite sense to that of punch 8 of movable half-die 3, so as to be insertable inside annular forming cavity 6, through the opening opposite that through which punch 8 of movable half-die 3 acts, to push the finished annular container out of matrix 5.

[0018] In actual use, the annular container is produced

in one forming operation, i.e. in one operation of die 1. More specifically, after placing a flat washer 11 (Figure 1) on matrix 5 of fixed half-die 2, over the opening of annular forming cavity 6 facing movable half-die 3, movable half-die 3 is operated and, as it moves towards fixed half-die 2, causes flat washer 11 to gradually assume the desired final shape of the annular container 12 (Figure 2), - in this case, a U-section annular container.

[0019] Once annular container 12 is formed, extractor 9 is operated to push annular container 12 out of annular forming cavity 6.

[0020] Figure 3 shows a different embodiment of the present invention, which has proved particularly effective in the event the specific application calls for an annular container 12 with particularly thin lateral walls.

[0021] More specifically, as shown in Figure 3, for this type of application, annular forming cavity 6 of matrix 5 of fixed half-die 2 is defined laterally by surfaces undulated in mating direction F, as opposed to smooth surfaces.

[0022] Tests have shown that, with this particular design of the lateral walls of annular forming cavity 6, the material is practically only drawn at the grooves of the undulations, whereas, at the ridges, the material undergoes a stabilizing effect, which provides for locally controlling deformation of the material when producing annular container 12, and so greatly reducing breakage of annular container 12.

[0023] The advantages of the present invention will be clear from the foregoing description.

[0024] In particular, by producing the annular container in one forming operation, and so eliminating the material stabilizing intervals between successive forming operations typical of known production methods, the annular container is produced much faster as compared with known production methods, with obvious benefits in terms of the cost of the annular container itself.

[0025] Clearly, changes may be made to the method and device as described and illustrated herein without, however, departing from the scope of the present invention as defined in the accompanying Claims.

Claims

1. A production method for producing an annular container (12) for an electric winding for assembly to a motor vehicle air conditioning system pulley; said annular container (12) being produced from a flat washer (11) in one forming operation; said production method comprising the steps of:

- providing a die (1) comprising a fixed half-die (2), and a movable half-die (3) cooperating, in use, with said fixed half-die (2) in a mating direction (F);
- forming, in said fixed half-die (2), an annular forming cavity (6) open towards said movable

half-die (3) and substantially cylindrical with an axis (A) extending in said mating direction (F); said movable half-die (3) comprising an annular punch (8) complementary in shape to the said forming cavity (6) and being insertable inside the forming cavity (6);

- placing said flat washer (11) over the opening of said annular forming cavity (6); and
- activating said movable half-die (3) so as to insert said punch (8) inside the forming cavity (6) and to form said annular container (12) in one operation;

characterized in that said forming cavity (6) tapers towards the end opposite the end facing said movable half-die (3).

2. A production method as claimed in Claim 1, **characterized in that** said annular forming cavity (6) is defined laterally by smooth walls.

3. A production method as claimed in Claim 1, **characterized in that** said annular forming cavity (6) is defined laterally by walls undulated in said mating direction (F).

4. A production device (1) for producing an annular container (12) for an electric winding for assembly to a motor vehicle air conditioning system pulley; said production device (1) comprising a fixed half-die (2), and a movable half-die (3) cooperating, in use, with said fixed half-die (2) in a mating direction (F); said fixed half-die (2) comprising a matrix (5) defining an annular forming cavity (6) open towards said movable half-die (3), cylindrical with an axis (A) extending in said mating direction (F), and over which a flat washer (11) is placed in use; said movable half-die (3) comprising a punch (8) complementary in shape to the said forming cavity (6) and being insertable inside the forming cavity (6); said annular container (12) being produced from said flat washer (11) in one operation of said movable half-die (3) wherein said annular punch (8) is inserted inside said forming cavity (6); **characterized in that** said forming cavity (6) tapers towards the end opposite the end facing said movable half-die (3).

5. A production device as claimed in Claim 4, **characterized in that** said annular forming cavity (6) is defined laterally by smooth walls.

6. A production device as claimed in Claim 4, **characterized in that** said annular forming cavity (6) is defined laterally by walls undulated in said mating direction (F).

Patentansprüche

1. Herstellungsverfahren zum Herstellen eines ringförmigen Behälters (12) für eine elektrische Wicklung für eine Anordnung an einer Antriebsscheibe einer Klimaanlage für ein Kraftfahrzeug, wobei der ringförmige Behälter (12) aus einer flachen Scheibe (11) in einem einzigen Formgebungsschritt hergestellt wird, wobei das Herstellungsverfahren folgende Schritte aufweist:

- Bereitstellen einer Form (1), die eine fixierte Halbform (2), und eine bewegliche Halbform (3) aufweist, die, in Verwendung, mit der fixierten Halbform (2) in einer Fügerichtung (F) zusammenwirkt;
- Ausbilden, in der fixierten Halbform (2), eines ringförmigen Formhohlraums (6), der in Richtung der beweglichen Halbform (3) offen ist und im wesentlichen zylindrisch zu einer Achse (A), die sich in Fügerichtung erstreckt, ist, wobei die bewegliche Halbform (3) einen ringförmigen Dorn (8) aufweist, dessen Form zu dem Formhohlraum (6) komplementär ist und der in den Formhohlraum (6) einführbar ist;
- Anordnen der flachen Scheibe (11) über der Öffnung des ringförmigen Formhohlraums (6); und
- Betätigen der beweglichen Halbform (3) derart, dass der Dorn (8) in den Formhohlraum (6) eingeführt wird und dadurch der ringförmige Behälter (12) in einem Formgebungsschritt geformt wird;

dadurch gekennzeichnet, dass

sich der Formhohlraum (6) in Richtung des Endes verjüngt, das dem Ende entgegengesetzt ist, das der beweglichen Halb-Form (3) gegenüberliegt.

2. Herstellungsverfahren nach Anspruch 1, wobei der ringförmige Formhohlraum (6) lateral durch glatte Wände definiert ist.
3. Herstellungsverfahren nach Anspruch 1, wobei der ringförmige Formhohlraum (6) lateral durch Wände definiert ist, die in Fügerichtung wellenförmig verlaufen.
4. Herstellungsvorrichtung (1) zum Herstellen eines ringförmigen Behälters (12) für eine elektrische Wicklung für eine Anordnung an einer Antriebsscheibe einer Klimaanlage für ein Kraftfahrzeug, wobei die Herstellungsvorrichtung (1) eine fixierte Halbform (2) und eine bewegliche Halbform (3), die, in Verwendung, mit der fixierten Halbform (2) in einer Fügerichtung (F) zusammenwirkt, aufweist, wobei die fixierte Halbform (2) eine Matrix (5) um-

fasst, die einen ringförmigen Formhohlraum (6) definiert, der in Richtung der beweglichen Halbform (3) offen ist, zylindrisch zu einer Achse (A), die sich in Fügerichtung erstreckt, ausgebildet ist, und über den, in Verwendung, eine flache Scheibe angeordnet wird,

wobei die bewegliche Halbform (3) einen Dorn (8) aufweist, der in seiner Form zu dem Formhohlraum (6) komplementär ausgebildet ist und in den Formhohlraum (6) einführbar ist;

wobei der ringförmige Behälter (12) aus der flachen Scheibe in einem Formgebungsschritt der beweglichen Halbform (3) hergestellt wird, wobei der ringförmige Dorn (8) in den Formhohlraum (6) eingeführt wird;

dadurch gekennzeichnet, dass

sich der Formhohlraum (6) in Richtung des Endes verjüngt, das dem Ende entgegengesetzt ist, das der beweglichen Halbform (3) gegenüberliegt.

5. Herstellungsvorrichtung nach Anspruch 4, wobei der ringförmige Formhohlraum (6) lateral durch glatte Wände definiert ist.

6. Herstellungsvorrichtung nach Anspruch 4, wobei der ringförmige Formhohlraum (6) lateral durch Wände definiert ist, die in Fügerichtung wellenförmig verlaufen.

Revendications

1. Procédé de fabrication destiné à produire un conteneur annulaire (12) pour un enroulement électrique à assembler sur une poulie de système de climatisation de véhicule automobile ; ledit conteneur annulaire (12) étant fabriqué à partir d'une rondelle plate (11) au cours d'une seule opération de formage ; ledit procédé de fabrication comprenant les étapes consistant à :

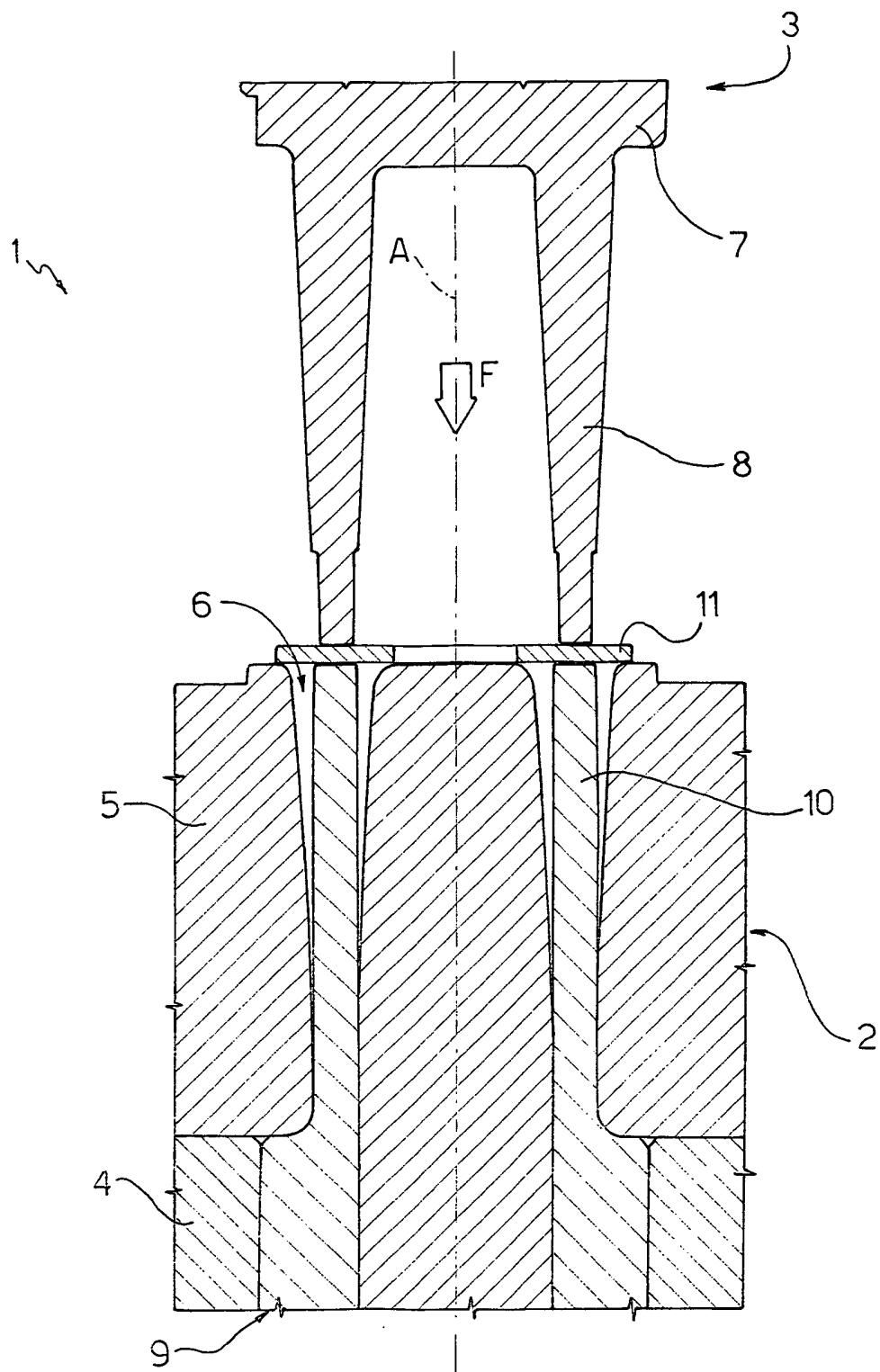
apporter un moule (1) comprenant un demi-moule fixe (2) et un demi-moule mobile (3) coopérant, pendant leur utilisation, avec ledit demi-moule fixe (2) dans une direction conjuguée (F) ; former, dans ledit demi-moule fixe (2) une cavité de formage annulaire (6) ouverte vers ledit demi-moule mobile (3) et sensiblement cylindrique, avec un axe (A) s'étendant dans ladite direction conjuguée (F) ; ledit demi-moule mobile (3) comprenant un poinçon annulaire (8) de forme complémentaire à celle de ladite cavité de formage (6) et pouvant être inséré à l'intérieur de la cavité de formage (6) ; positionner ladite rondelle plate (11) au-dessus de l'ouverture de ladite cavité de formage annulaire (6) ; et actionner ledit demi-moule mobile (3) de manière

re à insérer ledit poinçon (8) à l'intérieur de la cavité de formage (6) et à former ledit conteneur annulaire (12) en une seule opération ;

caractérisé en ce que ladite cavité de formage (6) se réduit en tronc de cône vers l'extrémité opposée à l'extrémité faisant face au dit demi-moule mobile (3). 5

2. Procédé de fabrication selon la revendication 1, **caractérisé en ce que** ladite cavité de formage annulaire (6) est définie latéralement par des parois lisses. 10
3. Procédé de fabrication selon la revendication 1, **caractérisé en ce que** ladite cavité de formage annulaire (6) est définie latéralement par des parois ondulées dans ladite direction conjuguée (F). 15
4. Dispositif de fabrication (1) destiné à produire un conteneur annulaire (12) pour un enroulement électrique à assembler sur une poulie de système de climatisation de véhicule automobile ; ledit dispositif de fabrication (1) comprenant un demi-moule fixe (2) et un demi-moule mobile (3) coopérant, pendant leur utilisation, avec ledit demi-moule fixe (2) dans une direction conjuguée (F) ; ledit demi-moule fixe (2) comprenant une matrice (5) définissant une cavité de formage annulaire (6) ouverte vers ledit demi-moule mobile (3), cylindrique, avec un axe (A) s'étendant dans ladite direction conjuguée (F) et sur laquelle une rondelle plate (11) est positionnée à l'usage ; ledit demi-moule mobile (3) comprenant un poinçon (8) de forme complémentaire à celle de ladite cavité de formage (6) et pouvant être inséré à l'intérieur de la cavité de formage (6) ; ledit conteneur annulaire (12) étant fabriqué à partir de ladite rondelle plate (11) au cours d'une seule opération dudit demi-moule mobile (3), dans lequel ledit poinçon annulaire (8) est inséré à l'intérieur de ladite cavité de formage (6) ; **caractérisé en ce que** ladite cavité de formage (6) se réduit en tronc de cône vers l'extrémité opposée à l'extrémité faisant face au dit demi-moule mobile (3). 20
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5. Dispositif de fabrication selon la revendication 4, **caractérisé en ce que** ladite cavité de formage annulaire (6) est définie latéralement par des parois lisses. 50
6. Dispositif de fabrication selon la revendication 4, **caractérisé en ce que** ladite cavité de formage annulaire (6) est définie latéralement par des parois ondulées dans ladite direction conjuguée (F). 55

Fig.1



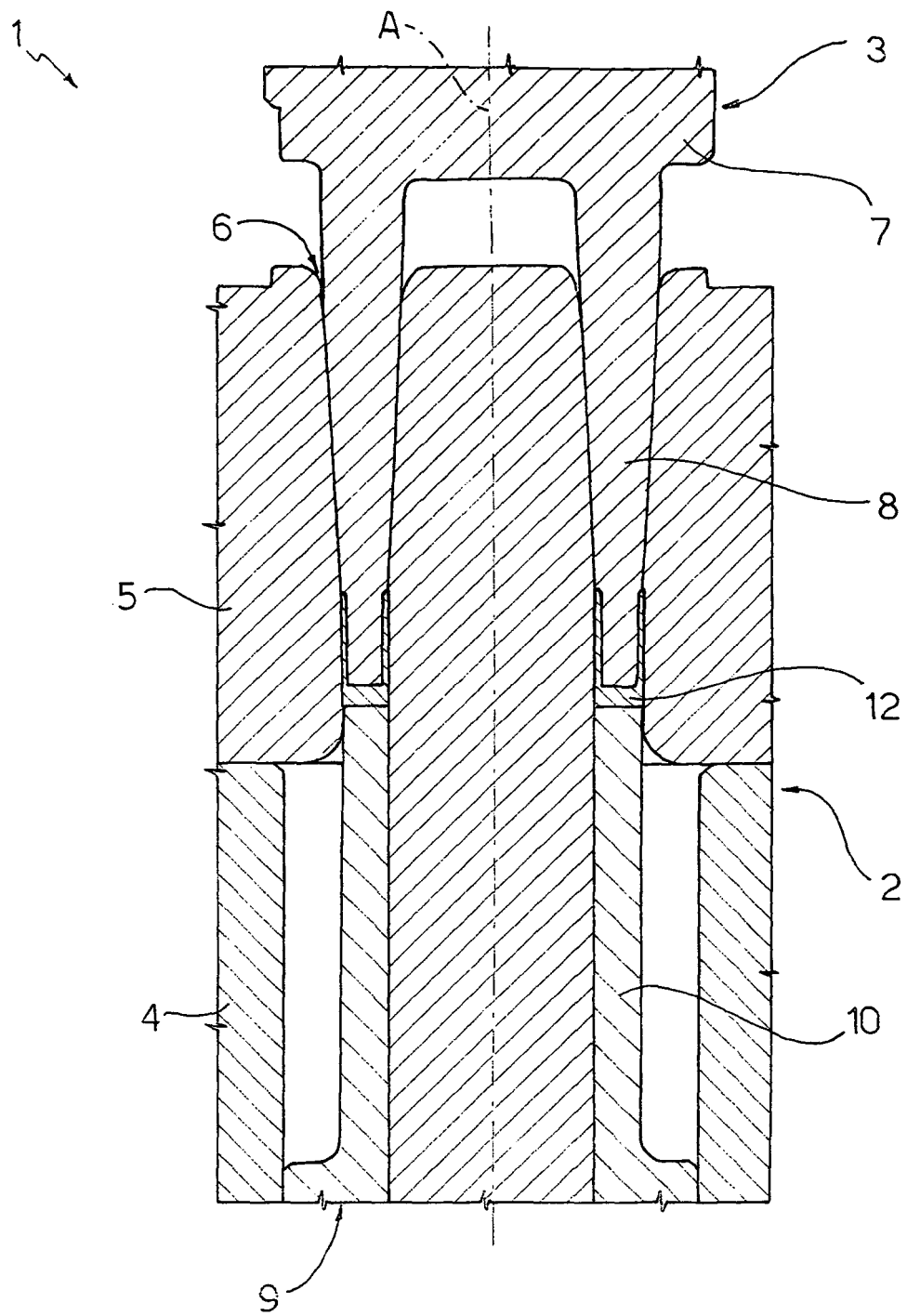


Fig.2

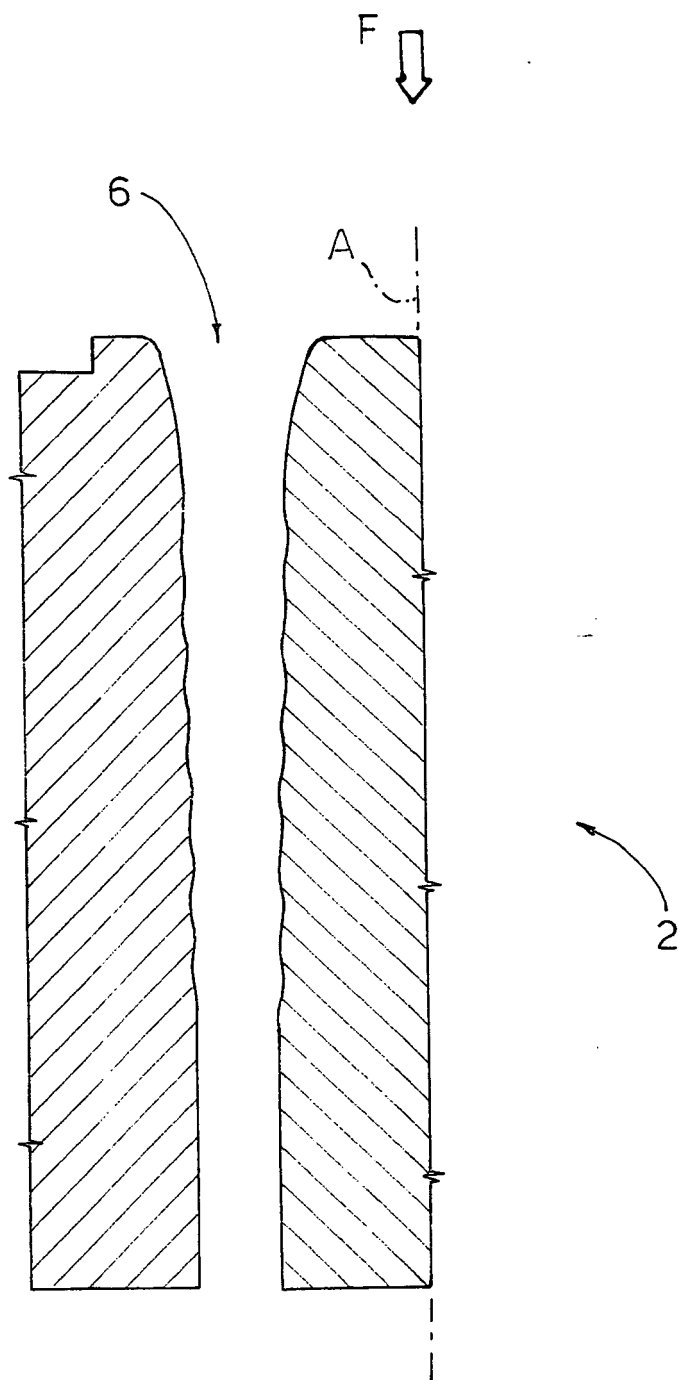


Fig. 3