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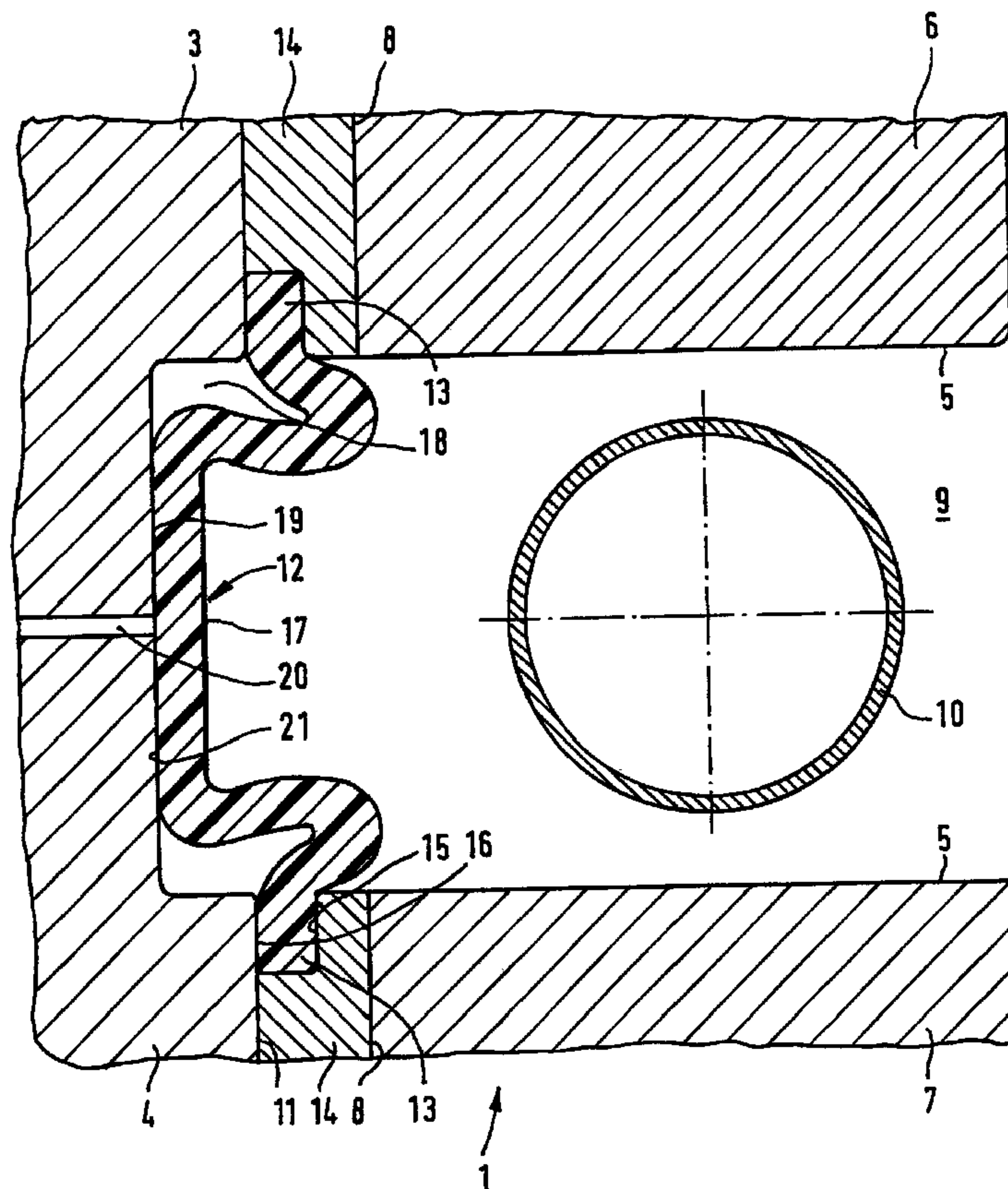
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(54) Titre : METHODE DE FABRICATION D'UN PROFILE CREUX A CIRCONFERENCE FERMEE ET DISPOSITIF
POUR SA FABRICATION

(54) Title: METHOD FOR PRODUCING A CIRCUMFERENTIALLY CLOSED HOLLOW PROFILE AND DEVICE FOR
CARRYING IT OUT



(57) Abrégé/Abstract:

The invention relates to a method and a device for producing a circumferentially closed hollow profile, a hollow-profile blank being expanded by means of fluidic internal high pressure in an internal high-pressure forming tool, after which said hollow-profile blank

(57) Abrégé(suite)/Abstract(continued):

assumes the final shape of the hollow profile. In order to make it possible in a simple way to have a production of a hollow profile in which process reliability is ensured to a sufficient extent even in the case of high expansions of the hollow profile (higher than or equal to the breaking elongation of the material), it is proposed that, during expansion, the hollow-profile blank be supported, on at least one partial circumferential region, by means of at least one diaphragm fastened to the inside, facing the blank, of the tool and capable of being acted upon by a controllable pressure acting from outside, said diaphragm shifting back elastically as expansion progresses, with the supporting pressure acting on the diaphragm being reduced at the same time.

Abstract

The invention relates to a method and a device for producing a circumferentially closed hollow profile, a hollow-profile blank being expanded by means of fluidic internal high pressure in an internal high-pressure forming tool, after which said hollow-profile blank assumes the final shape of the hollow profile. In order to make it possible in a simple way to have a production of a hollow profile in which process reliability is ensured to a sufficient extent even in the case of high expansions of the hollow profile (higher than or equal to the breaking elongation of the material), it is proposed that, during expansion, the hollow-profile blank be supported, on at least one partial circumferential region, by means of at least one diaphragm fastened to the inside, facing the blank, of the tool and capable of being acted upon by a controllable pressure acting from outside, said diaphragm shifting back elastically as expansion progresses, with the supporting pressure acting on the diaphragm being reduced at the same time.

Method for producing a circumferentially closed hollow
profile and device for carrying it out

5 FIELD OF THE INVENTION

The invention relates to a method and device for
producing a circumferentially closed hollow profile.

10 BACKGROUND ART

A generic method and a generic device are known from
EP 0 913 277 A1. A wishbone of a wheel suspension may
be gathered from this, said wishbone being manufactured
from a tube by means of internal high-pressure forming.
15 The wishbone has various cross-sectional shapes, one of
these being a flattened rectangle. In order to produce
this shape, the circular-cylindrical prebent tube is
introduced into an internal high-pressure forming tool
divided into two and, during the closing operation, is
20 squeezed together by the two die parts. Subsequently,
with the tool closed, the tube is expanded by means of
internal high pressure, until it is to come to bear
exactly to contour against the die impression, and
therefore the desired flat rectangular final shape is
25 to be obtained. During squeezing actions of this type,
which cause folds, in conjunction with volume-enlarging
expansions by means of internal high pressure, however,
a failure of the material often occurs, this being due
to an appreciable extent to the strain-hardening of the
30 material achieved after the squeezing operation or to
the excessive partial ironings of material in the
regions which have not yet come to bear. The failure of
the material is manifested, in this case, by the
tearing or breaking of the tube or hollow profile. The
35 generally known counterstays cannot be used in this
case in order to eliminate this defect, since, on the

one hand, the solid counterstays cannot become correspondingly narrower during the squeezing of the tube. On the other hand, the contour of the supporting surface of the plunger is invariable, so that the bearing contact of the tube, whether during the squeezing operation or during the expansion phase, is at no time equally distributed, thus leading to a non-uniform support of the tube and therefore contributing to the failure of the tube at this supported point or in the regions adjacent to the counterstay.

Even a straightforward expansion of a tube of circular cross section with high degrees of expansion, in which the cross-sectional shape is maintained, does not proceed, when free of support, in a reliable way in terms of the process, since the rate of expansion increases and the tube material would fail when it reached its breaking elongation. In order to counteract this, the known solid counterstays are used, by means of which controlled expansion is possible, but limits are also placed on it, since, of course, the tube material comes to bear against the counterstay and experiences there appreciable friction which is detrimental to expansion. Moreover, all-round support by the known counterstays is virtually impossible during the entire expansion process, thus leading, as mentioned above, to the failure of the tube material in the regions adjacent to the respective counterstay.

30 SUMMARY OF THE INVENTION

The object on which the invention is based is to develop a generic method and corresponding generic device, to the effect that it becomes possible in the simple way to carry out a production of a hollow profile in which, even in the case of high expansions of the hollow profile (higher than or equal to the breaking elongation of the material), process reliability is ensured to a sufficient extent.

- 3 -

According to an aspect of the present invention, there is provided a method for producing a circumferentially closed hollow profile, a hollow-profile blank being expanded by means of fluidic internal high pressure in an internal
5 high-pressure forming tool, after which the hollow-profile blank assumes a final shape of the hollow profile, wherein, during expansion, the hollow-profile blank is supported, on at least one partial circumferential region, by means of at least one diaphragm fastened to an inside facing the
10 hollow-profile blank of the tool and capable of being acted upon by a controllable pressure acting from outside, the diaphragm shifting back elastically as expansion progresses, with a supporting pressure acting on the diaphragm being reduced at the same time.

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According to another aspect of the invention, there is provided a device for producing, a circumferentially closed hollow profile, with an internal high-pressure forming tool, in which a hollow-profile blank is capable of being
20 expanded by means of fluidic internal high pressure, wherein the tool inside has fastened to it at least one elastic diaphragm which runs laterally of a zone of engagement of a plunger and which covers, tight to high pressure, a pressure-medium feed which is connected to a
25 pressure generator located outside the tool and which runs as a duct through the tool and issues on the inside of the latter towards a cavity, on which the diaphragm, having pressure applied to it via the pressure-medium feed, is capable of coming to bear against the hollow-profile blank
30 to be formed, on at least one partial circumferential region.

According to the invention, by means of the diaphragm a flexible counterstay is formed, which, during expansion
35 forming and also in other forming processes, can adapt to any shape of the hollow-profile blank exactly to contour and in a large area over a relatively large partial circumferential region of the hollow-profile blank. The

- 4 -

contour-matching expansion and supporting force of the diaphragm, achieved by the external application of pressure, can be adjusted very accurately to the forming progress by means of the simple-to-handle pressure control parameters. Overall, that is to say, owing to the large-area bearing contact - circumferentially complete bearing contact if a plurality of diaphragms distributed in the circumferential direction are used - , during each forming phase and as a result of accurate metering of the supporting force, the hollow-profile blank to be formed always receives the appropriate uniform supporting force which prevents a failure of the blank material during expansion. The process reliability of the forming process is thereby ensured, even in the case of very high expansions. What is to be meant here by high expansion is an expansion higher than or equal to the breaking elongation of the material. A diaphragm resistant to high pressure is simple to produce and to fasten and, overall, constitutes only a very low outlay in terms of apparatus. Furthermore, existing forming tools can readily be retrofitted with the diaphragm. On account of the elasticity of the diaphragm, during the interaction of the two oppositely directed pressures of the constant or increasing internal high pressure in the hollow-profile blank and of the pressure decreasing during expansion, of the external application of pressure to the diaphragm, the latter is withdrawn from the cavity, while maintaining bearing contact which is exact to contour. As a result, as regards the entire forming process, the production of a flattened final shape can thus also take place reliably in terms of the process.

BRIEF DESCRIPTION OF THE DRAWINGS

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The invention is explained in more detail below with reference to an exemplary embodiment illustrated in the drawings in which:

- 4a -

Figure 1 shows, in cross section, a device according to the invention, with the diaphragm in a position of non-use, prior to the forming of the hollow-profile blank,

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Figure 2 shows, in cross section, the device from Figure 1, with the diaphragm in the position of use, prior to the forming of the hollow-profile blank,

10 Figure 3 shows, in cross section, the device from Figure 1, with the diaphragm in the position of use, after the expansion of the hollow-profile blank,

Figure 4 shows, in cross section, the device from Figure 1,
15 with the diaphragm in the position of use, after the flattened final shape of the hollow profile is achieved.

DETAILED DESCRIPTION OF THE INVENTION

20 The advantageousness of the invention will become particularly clear from the following exemplary embodiments which do not simply refer "only" to the generation of a hollow profile with very high expansions, but are also aimed at the production of an additionally flattened hollow
25 profile, substantially more difficult with regard to maintaining process reliability, so that a very flat, but extremely wide

- 5 -

final shape of the hollow profile is achieved.

Figure 1 illustrates a device 1 for producing a circumferentially closed flattened hollow profile 2 (Figure 4), said device consisting essentially of an internal high-pressure forming tool divided into two lateral tools, of a diaphragm 12 and of a flattening device. The lateral tools may in each case be designed in one piece, a pressure-medium feed 20 being incorporated there. However, the lateral tools may also have a multi-part design, divided into an upper side tool 3 and a lower side tool 4, in which case the pressure-medium feed 20 can run in the parting plane of the two side tools 3 and 4. To equip the forming tools with a blank 10, a manipulator is to be used, which holds the blank 10 until the two pairs of side tools 3, 4 have closed, jaw-like, around the blank 10. After forming, the ready-formed hollow profile can be removed from the forming tool in a simple way, solely by the action of gravity, when the side tools 3 and 4 are moved apart from one another. It may, however, also be envisaged, alternatively, to design the upper side tool 3 with a removable cover part, so that, with the side tools 3, 4 closed, with the exception of the cover part, the forming tool can be equipped via the orifice of the forming tool occurring in the absence of the cover part, without blank-holding manipulators being used. The forming can commence only after the cover part closes the equipment orifice. The removal of the finished hollow profile takes place by gravity in the same way as in the above-described variant of the forming tool.

Although the flattening device may simply be the pair of side tools 3 and/or the pair of side tools 4 by means of a correspondingly configured impression, in the present exemplary embodiment the flattening device comprises two mutually opposite plungers 6 and 7 which

are in alignment with one another and are guided displaceably in leadthroughs 8 of the upper pair of side tools 3 and of the lower pair of side tools 4 and which are capable, in this case, of being moved into the cavity 9 which is formed by the side tools 3 and 4 and in which the hollow-profile blank 10 initially provided with a circular-cylindrical cross section is received, said plungers being capable of exerting a squeezing action on the blank 10. The use of a single plunger may also be envisaged. The plungers 6 and 7 may be designed continuously in adaptation to the longitudinal extend of the internal high-pressure forming tool and therefore to the entire formable part of the hollow-profile blank 10 or, alternatively, be arranged only locally in order to act upon a portion of the blank 10. The plungers 6, 7 have a planar end face, so that, on the one hand, the required flat final shape of the hollow profile 2 is achieved and, on the other hand, no indentations caused by sharp-edged unevennesses of the plunger surface and detrimental to process reliability occur on the blank 10.

An elastic diaphragm 12 consisting, for example, of an elastomer or a rubber is fastened to the tool inside 11 over the length of the forming region of the hollow-profile blank 10 and so as to run laterally of the zone of engagement of the plungers 6 and 7 which may be identical to the cavity 9. The fastening of the diaphragm 12 may be carried out in many different ways, for example unreleasably by adhesive bonding, screwing, riveting and the like. In the present case, the diaphragm 12 is received advantageously, so as to be exchangeable in the event of wear, at the two flange-like ends 13 lying transversely to the longitudinal extent of the tool and parallel to the plungers 6 and 7, in each case in a holder 14.

The holder 14 is mounted releasably on the inside 11 of

- 7 -

the tool, the holder 14 having a clearance 15 which forms a receptacle, open to the inside 11, for the diaphragm 12 and between the walls of which and the opposite wall portion 16 of the tool inside 11 the
5 diaphragm flanges 13 are clamped. Although the diaphragm 12 can have a planar run between its flanges 13 in the position of non-use, that is to say in the relaxed position, the diaphragm 12 has a U-shaped design here, in order to obtain a greater reach into
10 the cavity 9 for the method explained later. As regards the shape of the diaphragm 12, a recess 18 running along the middle part 17 of the diaphragm 12 is incorporated into the inside 11 of the tool, in order to receive the diaphragm 12 to an extent such that,
15 when the diaphragm 12 is in the position of non-use and in the last forming phase of the blank 10, the cavity 9 is diaphragm-free and therefore, on the one hand, the diaphragm 12 does not cause an obstruction when the cavity 9 is being equipped with a blank 10 and, on the
20 other hand, said diaphragm can be withdrawn from the cavity 9 during the forming of the blank 10.

A duct-like pressure-medium feed 20 issues into the recess bottom 19 and is connected to a pressure
25 generator located outside the tool. The diaphragm 12 thus covers the recess 18, together with the issue of the pressure-medium feed 20, in a manner tight to high pressure, with the result that, when the pressure medium is introduced, a pressure space 22 is formed
30 between the recess bottom 19 and the outside 21, facing the latter, of the diaphragm 12. By virtue of the design of the recess 18, the pressure imparted via the pressure medium is distributed uniformly to the entire diaphragm 12, with the exception of the clamped flanges
35 13, so that local damaging elongations of the diaphragm 12 under the application of pressure are avoided and the desired bearing contact against the hollow-profile blank 10 is achieved to a sufficient extent over a

partial circumferential region of the blank 10. Although the pressure medium may be gaseous, here, however, it is a pressure fluid because of its incompressible properties which are highly advantageous
5 for support during the forming of the blank 10.

Although only a single diaphragm is illustrated in the exemplary embodiment, a plurality of diaphragms may, however, be lined up with one another on each side
10 within the scope of the invention. This is advantageous when the blank 10 is to be formed by expansion and flattening on only a plurality of longitudinal portions spaced from one another. In this case, the blank 10 may be supported to a differing extent, depending on the
15 desired cross-sectional shape of the hollow profile, by means of pressure controls of the pressure fluid which are specific to the blank portions. By contrast, the diaphragm 12 may also extend, in a way involving a low outlay in terms of apparatus, along the entire cavity
20 of the tool, specifically even where only one of the two forming steps, expansion and flattening, or else no forming takes place. The hollow-profile blank 10 is thus supported over its entire longitudinal extent by the diaphragm 12. The pressure in the pressure space 22
25 can be controlled according to the forming progress. This may take place by a control of the pressure generator or by a control of a pressure-limiting valve.

According to the drawings, it may also be envisaged
30 that the internal high-pressure forming tool contains an upper tool and a lower tool instead of side tools 3, 4, with the result that the equipping of the cavity 14 can proceed relatively simply. Since, with the drawings interpreted as being correspondingly transposed, the
35 diaphragm 12 connects the upper tool to the lower tool, the diaphragm 12 is stretched and compressed during the opening and closing of the tool, with the result that the diaphragm 12 is exposed to increased wear. This may

be avoided, however, by means of a removable cover part located in the upper tool and covering the cavity only, the diaphragm 12 remaining unstressed during the opening and closing movement of the forming tool. In order to relieve the diaphragm 12 it may, alternatively, be advantageous to rotate the internal high pressure forming (IHF) tool arrangement consisting of the upper tool and of the lower tool through 90° anti-clockwise. In this case, the arrangement would have to be configured in such a way that a diaphragm 12 is arranged in the lower tool and a diaphragm 12 in the upper tool, the middle part 17 of the diaphragms 12 running horizontally then. In the alternative described, the pressure-medium feed 20, which then, according to the drawings, lies exactly in the parting plane of the upper tool and lower tool and can thus be formed in each case by a channel-like groove of the two tool halves, must be provided separately both in the lower tool and in the upper tool. In this version, the IHF tool can be opened and closed, without the diaphragm 12 being in any way subjected to mechanical stress, thus, on the one hand, minimizing the wear of the diaphragm and, on the other hand, optimizing access to the equipment space of the tool.

25 In order to produce the flattened hollow profile 2, first a flattening of the blank 10 may take place, the latter subsequently being expanded in the flattened state by means of internal high pressure. In order to improve process reliability, prior to flattening a pressure may be built up in the pressure space 22, which protrudes the diaphragm 12 and expands it towards the blank 10, until the diaphragm 12 bears snugly against the latter on a partial circumferential region. 30 During subsequent flattening, in which the plungers 6, 7 move towards one another and thus reduce the cavity 9, the blank 10 is squeezed and widened in the width direction towards the recess 18. In this case, the

- 10 -

pressure in the pressure space 22 must be reduced, in order to allow this widening. In this process, the elastic diaphragm 12 shifts out of the cavity 9 back into its recess 18, until it has completely left the zone of engagement of the plungers 6, 7. For the expansion of the flattened blank 10, the diaphragm 12, to which increased pressure from the pressure space 22 is applied, then stops laterally of the plungers 6, 7 and supports the blank 10 in such a way that, on the latter, a wall 24 flush with the plunger outside 23 can be formed. The flushness achieved depends on the cross-sectional shape requirement (here, rectangular cross section).

Other shape profiles of the wall 24 may, of course, also be formed, depending on the position of the diaphragm 12 in relation to the plungers 6, 7. In order to increase the process reliability by as far as possible preventing folds from occurring during flattening, it is beneficial to generate in the blank 10, during flattening, a hydraulic supporting pressure which counteracts said folding. Flattening may also take place as a result of the closing of the tool 1 itself. This presents problems, however, since the diaphragm 12, which is under pressure so as to come to bear against the blank 10, may possibly swell out of the still open tool and may be damaged when being pressed back by the tool. Although flattened hollow profiles 2 can be produced with the method variant presented, it is restricted to hollow profiles which are not to be particularly wide and flat. The underlying reason for this is that, during flattening, the blank material already comes to bear against the end faces 5 of the plungers 6, 7 at many points, so that, during expansion by means of internal high pressure, there is, even initially, a considerable friction of the blank 10 against the plunger end faces 5. This leads, in the case of a stipulation where a

very wide and flat hollow profile 2 is to be produced, to a bursting of the blank 10 during expansion. Also, as a result of the friction which seriously obstructs the flow of the blank material, the deep folds
5 occurring to an increased extent during intensified flattening can no longer be pressed out by the internal high pressure with process reliability.

In order to solve this problem and consequently achieve
10 any desired variability in the configuration of cross-sectional shapes of the hollow profile with process reliability, in a further method variant, the blank 10 is configured and placed in relation to its surroundings in the tool in such a way that there is a
15 relatively long distance from the end faces 5 of the plungers 6, 7 over the portion to be formed (Figure 1). This allows a free frictionless expansion of the blank 10, so that the circumference and diameter of the blank 10 can be increased sharply without the risk of
20 bursting. In this variant, therefore, free expansion is the first forming step of the blank 10, which is ended when the expanded blank 10 comes into contact with the plunger end faces 5.

25 Even before an internal high pressure is generated in the blank 10, the diaphragm 12 has pressure applied to it from the pressure space 22 and thereby comes to bear against a partial circumferential region of the blank 10 and against a portion of the plunger end faces 5
30 (Figure 2). By a fluidic internal high pressure being generated, the blank 10 is then expanded, during the entire expansion pressure being applied to the diaphragm 12 and the latter being pressed against the blank 10 on said partial circumferential region. The
35 diaphragm 12 supports the blank 10 there in a material-steadying and dimensionally stable manner, so that the expansion phase proceeds with full process reliability (Figure 3). At the same time, the expanding blank 10

- 12 -

forces the diaphragm 12 back towards the pressure space 22, the supporting pressure in the pressure space 22 being reduced in a continuously adapted manner with a rising degree of expansion. Although the diaphragm 12
5 bears against the blank 10 during expansion, there is no or only very slight friction over the blank material on the diaphragm 12, since the latter is not solidly firm and is deformed elastically in accompaniment. After expansion is concluded, the diameter of the blank
10 10 is approximately as large as the plunger width.

As may be seen from Figure 4, the plungers 6, 7 are moved towards one another in the direction of the arrows, with the result that the expanded blank 10 is
15 compressed. Although the blank 10 does not necessarily have to be supported by the diaphragm 12 and beyond a fluidic supporting pressure which may be lower than the expansion pressure, it is advantageous for further process reliability if this is afforded. In this case,
20 the blank 10 is pressed, free of folds, into a flattened final shape of the circumferentially closed hollow profile 2 of rectangular cross section. The blank 10 is at the same time widened even further, without damage, until it has assumed the final shape.
25 The widening induced by flattening supplements the main share of the entire widening which is provided by the expansion. According to Figure 4, the blank 10 is supported continuously and, during flattening, has pressure applied to it by the diaphragm 12 in such a
30 way that, when flushness of the flattened blank 10 with the outside 23 of the plungers 6, 7 is achieved, the final lateral contour of the hollow profile 2 is produced. The middle part 17 of the diaphragm 12 in this case bears longitudinally against the outside 23
35 of the plungers 6, 7. Even during flattening, the pressure in the pressure space 22 is reduced successively, so that the diaphragm 12 can shift back elastically until the flushness of the wall 24 carrying

- 13 -

the final contour of the hollow profile 2 with the plunger outside 23 is achieved.

It is conceivable that sharp edges are required for the final shape of the hollow profile 2. In this case, finally, the expanded and flattened hollow-profile blank 10 may be calibrated into the final shape of the hollow profile 2 by means of an internal high pressure exceeding the expansion pressure, in which case the pressure fluid in the pressure space 22 must apply the corresponding counterpressure.

Furthermore, it is conceivable to dispense completely with active flattening during the production process. In this case, to simplify the process, not only a technique of the method, but also the associated plungers 6, 7 and their control, are omitted. The internal high-pressure forming tool must then be designed in such a way that the insides 11 of the tool are planar, so as to form a box shape, with the result that the production of the flattened hollow profile 2 takes place in a single expansion, supported by the diaphragm 12, if appropriate with final calibration. On account of the early friction-inducing bearing contact of the blank material against the tool inside 11, the possibilities of shaping the hollow profile 2 in terms of height and width are, of course, restricted considerably, and therefore only low degrees of forming are possible with process reliability.

The device according to the invention makes it possible, as compared with previous method techniques, that two manufacturing steps, which differ in the shaping direction and which would normally be carried out in two manufacturing stages, can be executed in one internal high-pressure operation. Furthermore, by means of the flexible diaphragm 12, workpieces with expansions can be produced, which, by virtue of their

- 14 -

geometric configuration and the associated frictional obstruction between workpiece and tool, cannot be formed with any process reliability. For example, the workpieces mentioned may be long IHF components which
5 must have narrowly tapering expansion regions, such as the crossmember running under the windscreen in motor vehicle body construction.

- 15 -

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

1. A method for producing a circumferentially closed hollow profile, a hollow-profile blank being expanded by means of fluidic internal high pressure in an internal high-pressure forming tool, after which said hollow-profile blank assumes a final shape of the hollow profile, wherein, during expansion, the hollow-profile blank is supported, on at least one partial circumferential region, by means of at least one diaphragm fastened to an inside facing said hollow-profile blank of the tool and capable of being acted upon by a controllable pressure acting from outside, said diaphragm shifting back elastically as expansion progresses, with a supporting pressure acting on said diaphragm being reduced at the same time.

2. The method according to claim 1, wherein said hollow-profile blank is flattened in said internal high-pressure forming tool.

3. The method according to claim 1 or 2, wherein said hollow-profile blank is supported over its entire longitudinal extent by said diaphragm.

4. The method according to claim 2 or 3, wherein said hollow-profile blank is additionally supported by said diaphragm during a flattening operation.

5. The method according to any one of claims 2 to 4, wherein, a free expansion of said hollow-profile blank takes place until the latter comes into contact with a

- 16 -

flattening device of said internal high-pressure forming tool, wherein a flattening of said hollow-profile expanded blank then takes place, this being accompanied by a continuous support of said hollow-profile blank by said diaphragm.

6. The method according to claim 5, wherein pressure is applied to said hollow-profile blank, by said diaphragm in such a way that, when a flushness of the flattened hollow-profile blank with an outside of a plunger-like flattening device is achieved, a final lateral contour of said hollow profile is produced.

7. The method according to any one of claims 1 to 6, wherein, said hollow-profile blank is calibrated into the final shape of said hollow profile by means of an internal high pressure exceeding an expansion pressure.

8. The method according to claim 5 or 6, wherein in the case of an internal high pressure which supports said hollow-profile blank from inside and which is lower than the expansion pressure, flattening leads directly to the final shape of said hollow profile.

9. A device for producing a circumferentially closed hollow profile, with an internal high-pressure forming tool, in which a hollow-profile blank is capable of being expanded by means of fluidic internal high pressure, wherein said tool inside has fastened to it at least one elastic diaphragm which runs laterally of a zone of engagement of a plunger and which covers, tight to high pressure, a pressure-medium feed which is connected to a pressure generator located outside said tool and which runs

- 17 -

as a duct through said tool and issues on the inside of the latter towards a cavity, on which said diaphragm, having pressure applied to it via said pressure-medium feed, is capable of coming to bear against said hollow-profile blank to be formed, on at least one partial circumferential region.

10. The device according to claim 9, wherein said device contains a flattening device which is integrated into the internal high-pressure forming tool and by means of which said hollow-profile blank is capable of being flattened.

11. The device according to claim 10, wherein said flattening device consists of at least one plunger guided displaceably in a leadthrough of said tool.

12. The device according to any one of claims 9 to 11, wherein said diaphragm extends along the entire cavity of said tool.

13. The device according to any one of claims 9 to 12, wherein said diaphragm is received, at two ends lying transversely to a longitudinal extent of said tool, in each case in a holder which is arranged on the inside of said tool.

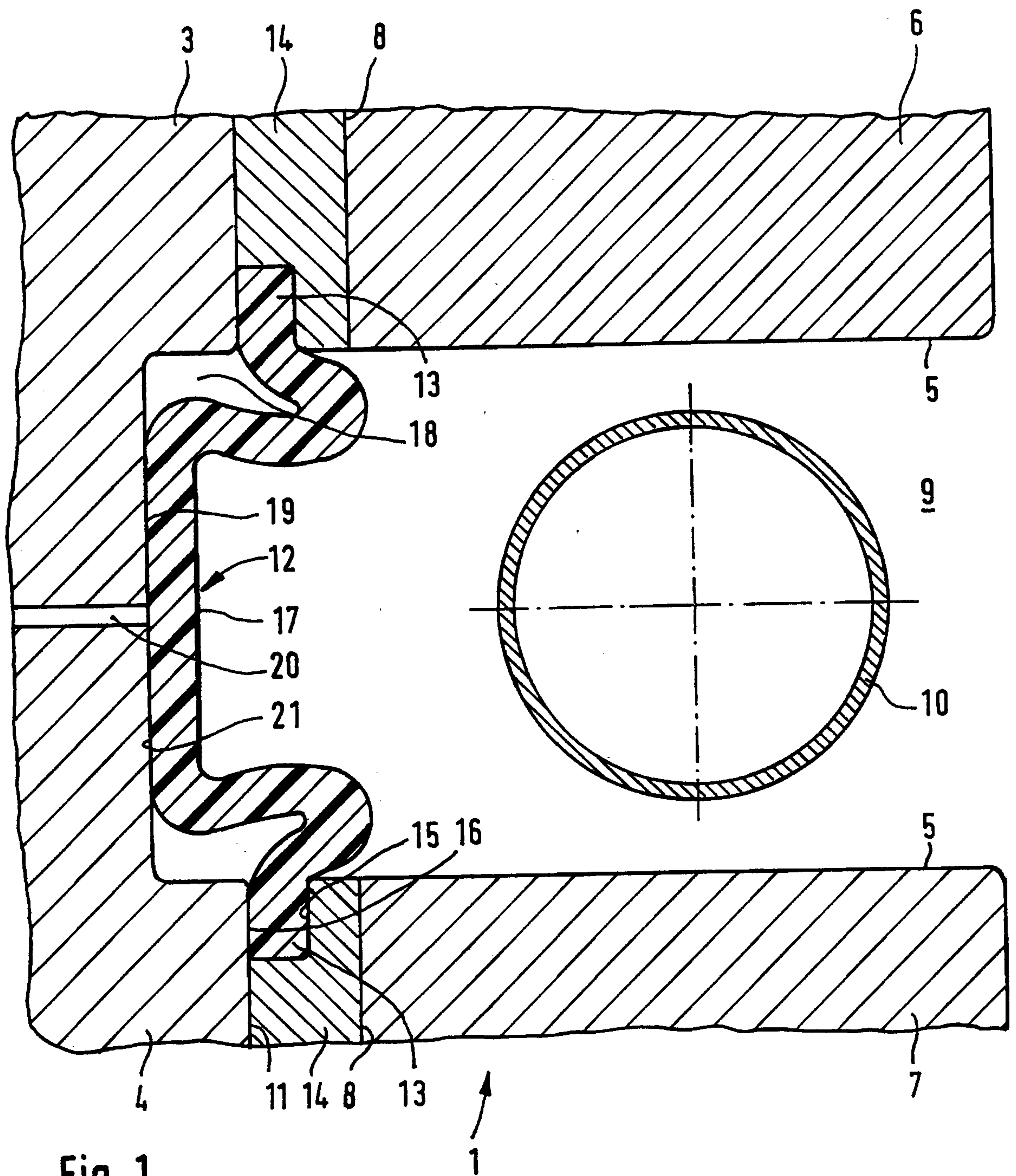
14. The device according to claim 13, wherein said diaphragm is firmly clamped between said tool inside and a wall of the holder receptacle.

- 18 -

15. The device according to any one of claims 9 to 14, wherein a pressure medium acting upon said diaphragm towards said hollow-profile blank is a pressure fluid.

16. The device according to any one of claims 11 to 15, wherein said plunger has a planar end face.

17. The device according to any one of claims 9 to 16, wherein said tool inside has incorporated into it a recess which runs along said diaphragm and is covered by said diaphragm and into which said pressure-medium feed issues, wherein a pressure space is capable of being formed between the bottom of said recess and outside, facing the latter, of said diaphragm.



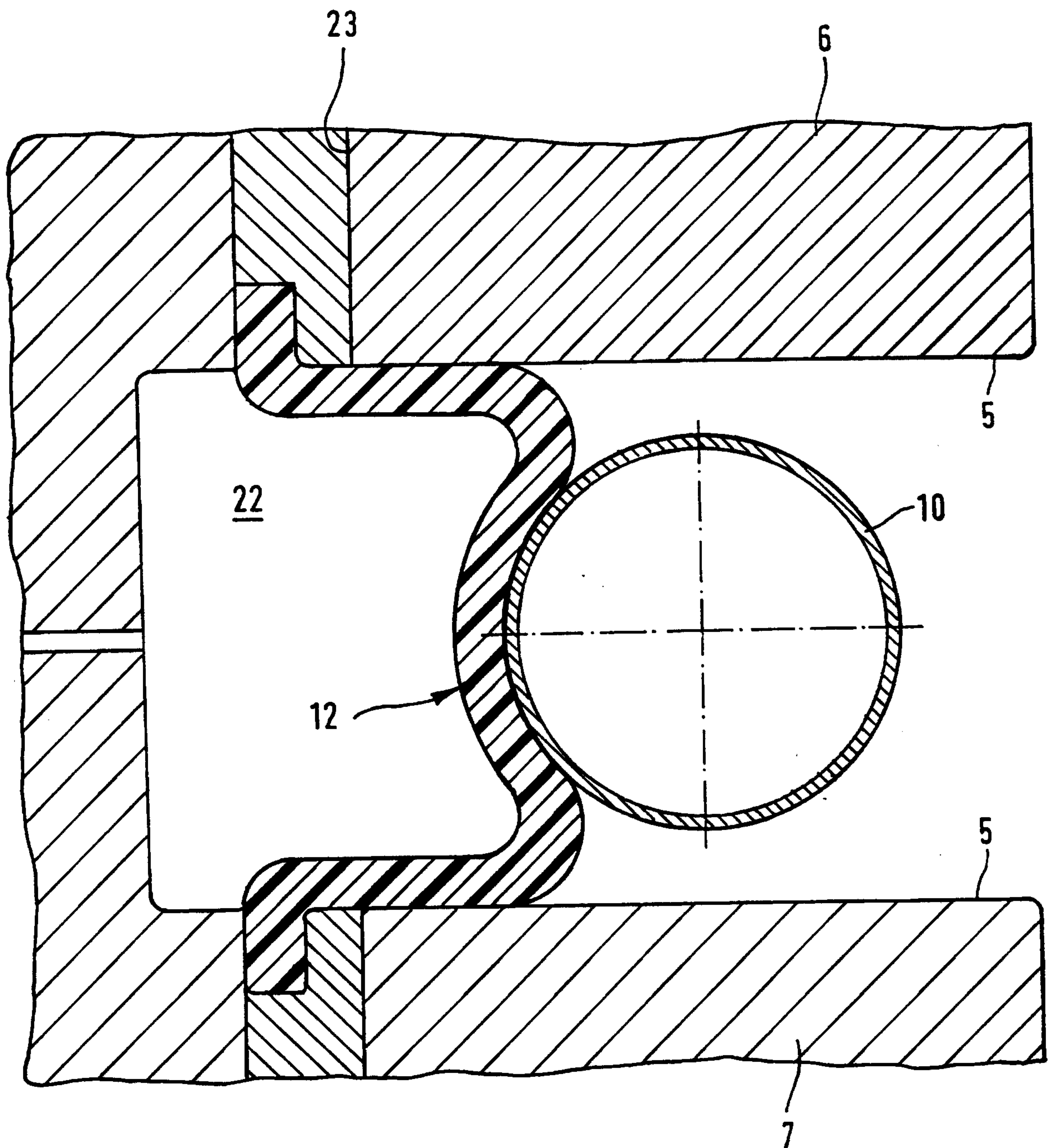


Fig. 2

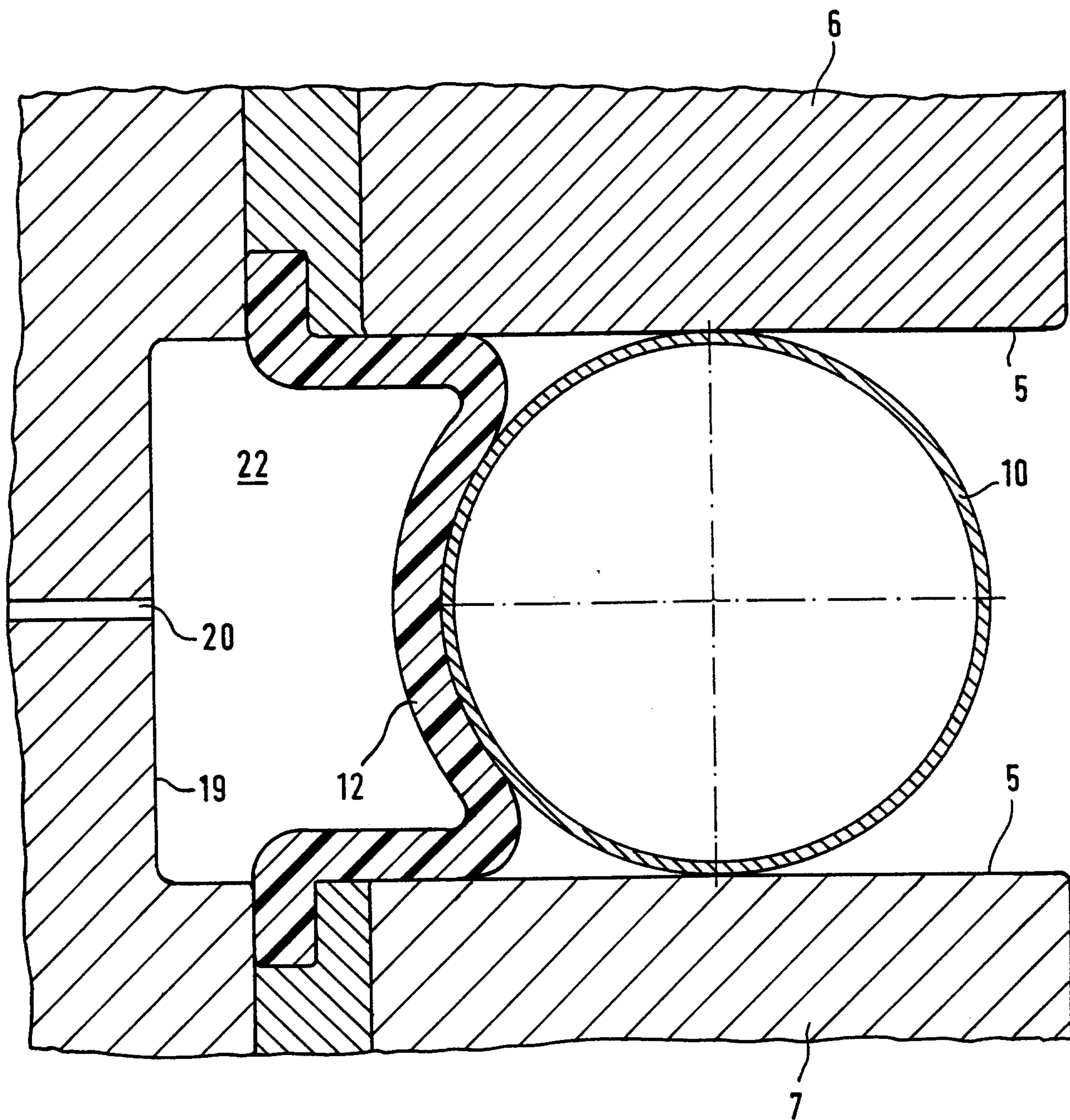


Fig. 3

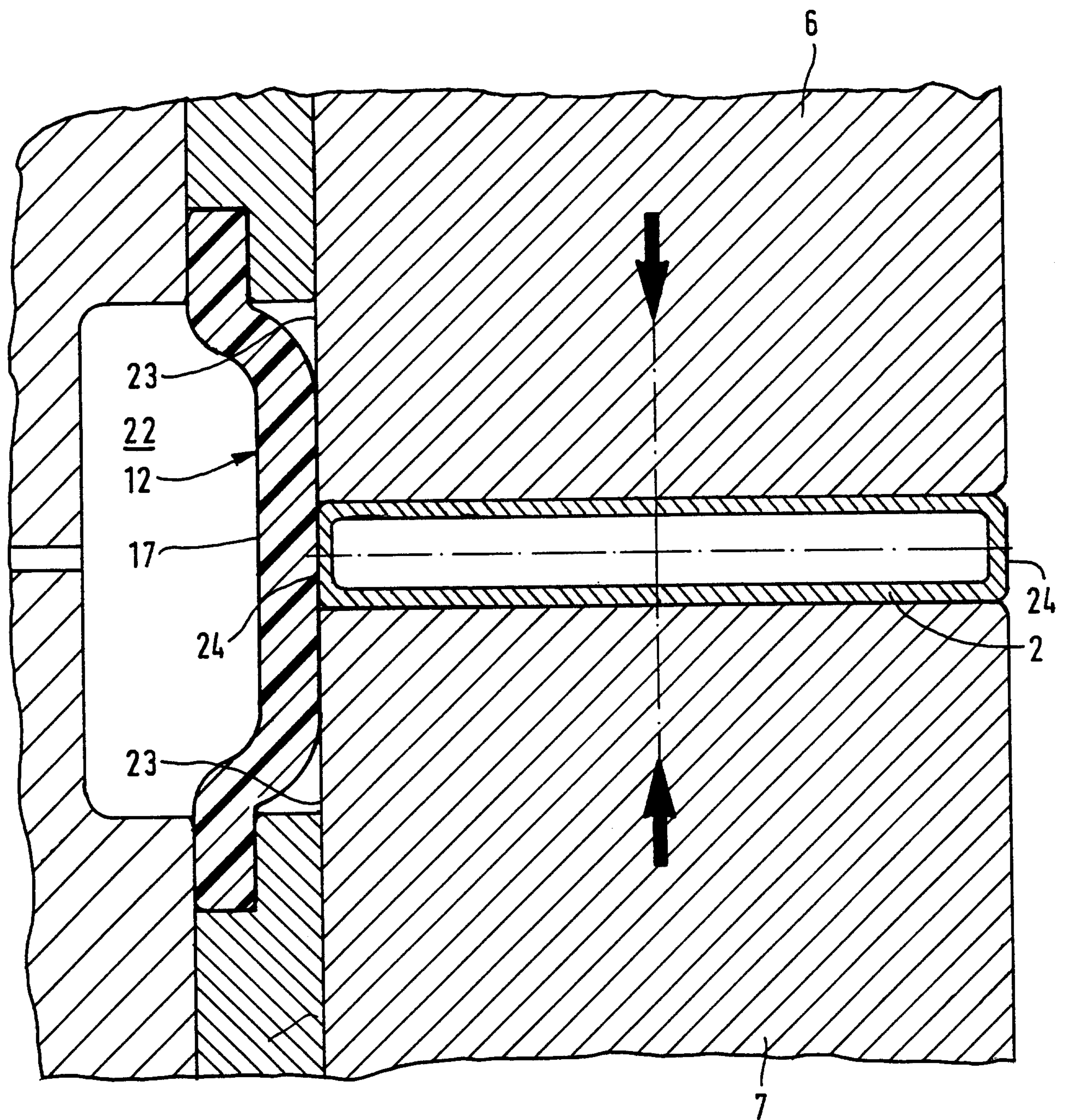


Fig. 4

