HU000032994T2

(19) **HU**

(11) Lajstromszám: **E 032 994**

(13) **T2**

MAGYARORSZÁG
Szellemi Tulajdon Nemzeti Hivatala

EURÓPAI SZABADALOM
SZÖVEGÉNEK FORDÍTÁSA

(21) Magyar ügyszám: **E 12 717670**
(22) A bejelentés napja: **2012. 04. 25.**

(96) Az európai bejelentés bejelentési száma:
EP 20120717670
(97) Az európai bejelentés közzétételi adatai:
EP 2701862 A1 **2012. 11. 01.**
(97) Az európai szabadalom megadásának meghirdetési adatai:
EP 2701862 B1 **2017. 03. 29.**

(51) Int. Cl.: ***B21D 22/20*** *(2006.01)*
B21D 37/08 *(2006.01)*
B21D 24/16 *(2006.01)*

(86) A nemzetközi (PCT) bejelentési szám:
PCT/EP 12/057527
(87) A nemzetközi közzétételi szám:
WO 12146602

(30) Elsőbbségi adatok:
102011050002 **2011. 04. 29.** **DE**

(72) Feltaláló(k):
FLEHMIG, Thomas, 40885 Ratingen (DE)

(73) Jogosult(ak):
ThyssenKrupp Steel Europe AG, 47166 Duisburg (DE)

(74) Képviselő:
Danubia Szabadalmi és Jogi Iroda Kft., Budapest

(54) **Eljárás és berendezés peremes húzott alkatrészek gyártására egyidejű trimmeléssel**

METHOD AND DEVICE FOR PRODUCING FLANGED DRAWN PARTS WITH SIMULTANEOUS TRIMMING

Description

The invention relates to a method and a device for producing drawn parts having flanges from a flat and/or pre-formed metal blank using a drawing punch with at least one cutting edge, using a blank holder and using a drawing die, the drawing die having a wall region, a flange region and a supporting region for the blank, the blank being placed onto the supporting region of the drawing die and formed into the drawn part by moving the drawing punch into the drawing die and at the same time cut at the flange region. In addition, the invention relates to a device for producing drawn parts having flanges, having a drawing punch, which has at least one cutting edge, having at least one blank holder and having a drawing die, which has a flange region, in which the flange is formed, a wall region and a bottom region, in which the wall region and bottom region are formed, and a supporting region for the blank before the drawing process.

The prior art discloses methods and devices for producing drawn parts having flanges, with which drawn parts can be produced from a flat blank by deep drawing and cutting in one working stroke. Thus, the textbook "Schnitt-, Stanz- und Ziehwerkzeuge [Cutting, stamping and drawing tools]", Ohler und Kaiser, 8th edition (2001) discloses designing the drawing die, which comprises the bottom region, wall region and flange region of the drawn part to be produced, so as to be height-displaceable in order, after the drawing process has been carried out, to cut the finished drawn part on the flange such that, as a result, the desired drawn part having a flange can be manufactured in one working stroke of the drawing punch. A corresponding drawing die is illustrated in the textbook referred to on page 429. However, because of the height-displaceable drawing die, the construction of the cutting and drawing tool known from the prior art is relatively complex. Furthermore, the prior art already includes methods and corresponding devices for producing drawn parts with integrated cutting, which, in order to avoid scraping of the flange region against the cutting edge of the drawing punch, carry out the cutting process in a stretch drawing step of the blank, and therefore, during the cutting process, the material is under heavy tensile loading and the flange region accordingly continues to move after the cutting. Due to the relatively uncontrolled continuing of the flange region to move, drawn parts produced in such a manner cannot highly reliably be manufactured with precise dimensions. Finally, there is a further problem in that the flange region additionally has to run obliquely with respect to the wall region in order to avoid scraping against the sharp cutting edge. A frequently desired right angled profile of the flange region with respect to the wall region cannot be produced in one method step.

Deep-drawing presses do not have highly precise tool guidance, and therefore cutting operations are not possible in such presses or can be carried out only with very great difficulty and complexity.

US 6,038,910 A and SU 1 003 970 A1 disclose further tools for the deep-drawing of blanks, which tools can also carry out cutting.

WO 2008/025387 A1 discloses a method and a tool for the hot forming of a blank, wherein cutting elements are provided in the dies of the tool. With the cutting elements, cutting of the workpiece can be carried

out at the same time as the drawing operation.

DE 10 2006 026 805 A1 discloses a device and a method for the hot forming of a semi-finished product, with a die, a punch and a blank holder. A cutting device is provided on the punch and die and trims the semi-finished product during the forming operation.

A device for drawing components from a blank is described in DE 10 2010 000 608 B3. During the forming operation, the blank is trimmed with an entry contour and a cutting edge.

The present invention has therefore been set the object of providing a method and a device for producing drawn parts having flanges, with cutting integrated in the process, which method or which device permits a simpler construction of the tool, a self-centring system and at the same time a reliable and dimensionally precise production of drawn parts having flanges.

According to a first teaching of the present invention, the object is achieved for a method in that the supporting region is raised and stationary relative to the flange region, wherein the height difference corresponds at least to the wall thickness of the blank to be deformed, and, while the drawing punch is moved into the drawing die, the cutting edge provided on the drawing punch engages with a rounded portion provided at the transition between supporting region and flange region, so that regions of the blank that extend beyond the flange region are cut off during the rest of the drawing process.

In contrast to the method known from the prior art, according to the invention the supporting region is raised and stationary relative to the flange region, and therefore the tool can overall be constructed in a significantly simplified manner. Owing to the fact that the height difference between supporting region and flange region of the die corresponds at least to the thickness of the blank, a satisfactory cutting process can be ensured with the cutting edge of the drawing punch or of the drawing die. In addition, owing to the fact that the at least one cutting edge provided on the drawing punch engages with the rounded portion provided between the supporting region and flange region before the end of the drawing process, it is possible that, in contrast to the conventional method, the flange region is trimmed before the end of the drawing process. The method to this extent permits a particularly simple construction of the tool, which manages without height-displaceable regions, and affords great flexibility in the arrangement of the flange. Furthermore, the reduction of the blank during the drawing process can be controlled or adjusted via the height difference between supporting region and flange region and also via the flange region width.

At the same time, by means of the interaction between the cutting edge on the drawing punch and the opposite rounded portion on the drawing die, not only is there a positive effect on the cutting result but also, because of the self-centring effect, the advantage is achieved that the tool can be used in conventional deep-drawing presses which customarily do not have an exact and precise guidance of the punch and, as a result, the construction of the tool can be kept simple.

According to a first refinement of the method, the material flow can be readily controlled during the drawing process and the cutting by the fact that, during the process of drawing and cutting the region of the blank that is to be cut off, the blank holder presses the region of the blank that is to be cut off onto the supporting region of the drawing die. In particular, the tensile loading of the blank can be adjusted by this means during the cutting and therefore the cutting quality can be influenced. When a wide blank holder and a wide supporting surface of the drawing die are used, the semi-finished product can in particular be clamped and ironed in a fold-free manner.

According to a next refinement of the method, the rounded portion has a varying height of engagement with the cutting edge of the drawing punch along the cut line and the blank is cut continuously starting from the regions of the rounded portions that engage with the cutting edge of the drawing punch first while the drawing punch is moved into the drawing die. In contrast to the method known from the prior art, in which the cutting of the blank is carried out simultaneously along the entire length of the cut line after the end of the drawing process, the cutting forces and the cutting impact can be significantly reduced. The height of engagement, which varies along the cut line, with the cutting edge of the drawing punch of the rounded portion mainly ensures that the cutting edge of the drawing punch engages with the rounded portion at different times or positions of the drawing punch such that the cutting of the blank in each case first of all begins in those regions of the rounded portion which are in engagement first and then extends continuously in the direction of the further region. The cut line formed with the cutting edge through the rounded portion can then have, for example, a wavy profile or an inclined profile.

The rounded portion preferably has a radius of at least 0.5 mm. In order to increase the precision of the cutting of the blank during the drawing operation, it is advantageous if a cutting edge with a maximum radius of 0.5 mm is used.

The same also applies for a next embodiment of the method according to the invention, in which a cutting clearance of 0.05 mm to a maximum of 0.2 mm is maintained between rounded portion and cutting edge of the drawing punch.

On account of the interaction of the cutting edge (sharp edge) with the rounded portion, the tool is constructed in a self-centring manner and thereby has a positive influence on the cutting quality.

The dimensional accuracy of the produced drawn parts having flanges can be further improved, according to a further refinement of the method according to the invention, in that the blank is drawn into a preform in a pre-drawing die before being drawn in the drawing die, and the preformed blank provides excess material, so that the fully formed and cut blank is calibrated when the end position of the drawing punch is reached. The excess material can preferably be provided in the bottom region and/or in the drawing radius. As a result, by means of these two working steps, namely preforming and final forming and cutting, a drawn part which has flanges and high dimensional accuracy can be provided using simple means.

Finally, the method can be further improved in that the blank is hot-formed in the drawing die. This also optionally applies, of course, to the preforming process. During the hot forming, the blanks are heated to a hardening temperature, are hot formed and rapidly cooled such that the drawn part is press-hardened. In general during the hot forming, firstly lower deforming forces are produced and secondly so too is a structure which is advantageous for the deformation and permits high degrees of deformation. In particular, the hot forming is used in the case of blanks composed of higher or highest strength steels, for example of the 22MnB5 type.

Alternatively, it is also possible, according to a further refinement of the method according to the invention, to leave material in regions along the cut line, preferably in the form of webs, i.e. to produce an interrupted cut line, as a result of which the drawn part is at least partially still connected to the cut region and can be removed at the same time from the tool (removal of scrap via webs). In a further separating process, the cut region can be cut off from the good part.

According to a further refinement of the method according to the invention, use can be made of a "slotted" semi-finished product which has at least one slot, preferably at least two slots, in the cutting region,

said slot running from an edge of the semi-finished product as far as the cut line, as a result of which, during the cutting, the cutting region disintegrates into a plurality of individual parts (fragmentation of the scrap) and, as a result, the poor part can more easily be removed from the tool, for example via scrap chutes.

According to a second teaching of the present invention, the presented object is achieved by a device in that the supporting region is raised and stationary relative to the flange region, wherein the height difference between the supporting region and the flange region of the drawing die corresponds at least to the wall thickness of the blank to be deformed, and a rounded portion is provided between the supporting region and the flange region, said rounded portion engaging with a cutting edge provided on the drawing punch and allowing the blank to be cut during the drawing process. The device according to the invention manages to this extent without a height-displaceable drawing die, and therefore the costs for producing the tool can be significantly reduced. Furthermore, the height difference between the supporting region of the blank and the flange region permits the flange of the drawn part to be formed very precisely in the flange region after the latter has been cut. In addition, the device makes it possible for greater flexibility to be obtained in respect of the alignment of the flange region in relation to the wall region. The cost-effective tool with its simple construction reduces wear and therefore also the costs for producing precise drawn parts having flanges.

If the height difference between the supporting region and the flange region of the drawing die corresponds at least to the wall thickness of the blank to be deformed, the reduction of the flange region of the drawn part can be controlled or adjusted via the height difference or via the flange region width. A greater height difference between supporting region and flange region makes it possible for more material to be able to be provided here and for the flange region to have a lower reduction. Of course, a minimum reduction has to be ensured such that the drawn part can still be removed from the tool.

In order to improve the cut quality during engagement of the rounded portion with the cutting edge and in order to achieve improved self-centring of the system on the drawing punch/drawing die, it is advantageous if the rounded portion has a minimum entry radius of 0.5 mm.

According to a further refinement of the device according to the invention, the precision of the cutting of the flange of the drawn part is improved in that the cutting edge of the drawing punch has a maximum radius of 0.5 mm.

The same also applies to a next embodiment of the device according to the invention, according to which a cutting clearance of 0.05 mm to a maximum of 0.2 mm is provided between the cutting edge and the rounded portion.

In order to reduce the cutting forces, but also the cutting impact during the drawing process, according to a further embodiment of the device according to the invention the rounded portion has a varying height of engagement with the cutting edge along the cutting line, so that the cutting edge engages with the rounded portion only at some points or in some regions at the start of the cutting process.

As already explained with regard to the method, the rounded portion which, for example, varies in its height of engagement with the cutting edge, permits continuous cutting along the cutting line by movement of the drawing punch into the drawing die. As a result, the cutting forces and the cutting impact are significantly reduced during the drawing process.

Finally, the device according to the invention can be further improved by the fact that the supporting region is connected to the drawing die in a highly precise manner, for example via pinning, or is designed in one

piece with the drawing die. If the supporting region is designed in one piece with the drawing die, the drawing die can be produced particularly cost-effectively. On the other hand, significant advantages arise in the pinning of the supporting region to the drawing die in respect of maintenance. In this case, there is namely the possibility of replacing the supporting region and of possibly reworking the rounded portion or cutting edge of the drawing die in a simple manner.

The invention will now be explained in more detail with reference to exemplary embodiments in conjunction with the drawing. In the drawing

Fig. 1 shows, in a schematic sectional view, half of a first exemplary embodiment of a device according to the invention with the drawing process not yet finished,

Fig. 2 shows the exemplary embodiment from Fig. 1 when the end position of the drawing punch is reached,

Fig. 3 shows, in a schematic sectional view, half of an exemplary embodiment of a device for producing a preform in the end position of the predrawing punch,

Fig. 4 shows, in a schematic sectional view, half of a device during use of the preformed blank from Fig. 3,

Fig. 5 shows the device from Fig. 4 when the end position of the drawing punch is reached,

Fig. 6 shows, in a schematic sectional view, the profile of the rounded portion of the supporting region according to a second exemplary embodiment, and

Fig. 7 shows, in a schematic sectional view, a third exemplary embodiment of an entry contour of varying shape.

First of all, Fig. 1 shows a first exemplary embodiment of a device according to the invention for producing drawn parts having flanges, having a drawing punch 1, having a drawing die 2, which has a flange region 3, in which the flange is formed, a wall region 4 and a bottom region 5, in which the wall region and bottom region of the drawn part are formed, and a supporting region 6 for supporting the blank before the drawing process. In addition, the device has a blank holder 7 and a rounded portion 8 between supporting region 6 and the flange region 3. The rounded portion has a minimum entry radius of 0.5 mm, and therefore the material can flow unhindered from the supporting region 6 into the flange region. The supporting region 6 is raised and stationary relative to the flange region 3. The height difference between the supporting region for the blank of the drawing die 6 and the flange region 3 of the drawing die is indicated by h. In the exemplary embodiment shown, h is somewhat larger than the thickness of the blank. The directional arrows in each case indicate the direction of movement of the blank holder 7 and of the drawing punch 1.

In addition, the drawing punch 1 has a further cutting edge 9 which preferably has a radius of 0.05 mm. As illustrated in Fig. 1, during the drawing process, the blank 10 is drawn into the drawing die until the cutting edge 9 comes into engagement with the rounded portion 8. Preferably, at the beginning of the drawing process, the blank holder is moved downwards such that the latter presses the blank 10 against the supporting region 6 of the blank. By means of this measure, the flow of material during the drawing process can be additionally controlled.

If the drawing punch 1, as shown in Fig. 2, moves into the end position, because of the engagement of the cutting edge 9 of the drawing punch 1 with the rounded portion 8 of the supporting region 6, the blank is cut, and therefore parts of the blank 10 that extend beyond the flange region 3 are cut off from the blank. As can be

seen in Figs. 1 and 2, the drawing die 2 is constructed particularly simply and nevertheless permits deep drawing with simultaneous cutting of the blank. In the present exemplary embodiment, the supporting region 6 is designed in one piece with the drawing die, which corresponds to a particularly simple refinement. However, it is also conceivable to realize the supporting region 6 via an exchangeable insert which is connected to the drawing die in a highly precise manner, for example via pinning. In this case, the replacement and reworking of the rounded portion 8, which is of course subject to wear, take place in a particularly simple manner.

Fig. 3 now shows, in a schematic sectional view, half of a device 11 for producing a preformed blank 12 which provides excess material, for example in the bottom region. The device 11 for producing a preformed blank likewise consists of a die 13 and a drawing punch 14 and also a blank holder 15.

If, as illustrated schematically in Figs. 4 and 5, the blank 12 which is preformed in this manner is placed in a device, the preformed blank 12 cannot only be drawn into the end form but also can be simultaneously cut and calibrated. This is ensured by the material excess of the preformed blank, which is provided in the bottom region 5 of the drawing die. The difference over the device shown in Figures 1 and 2 consists in that a cutting edge 8' is provided on the drawing die 2 between supporting region 6 and flange region 3 and a rounded portion 9' is provided on the drawing punch 1.

As Fig. 4 shows, the engagement of the cutting edge with the entry contour takes place before the end of the drawing process.

Fig. 5 schematically shows a device in the end position of the drawing punch with a calibrated and preformed blank 12. The reduction of the blank in the flange region is minimal and the drawn part produced in this manner is therefore highly dimensionally accurate.

Fig. 6 schematically illustrates the rounded portion 8 between supporting region 6 and flange region 3 along its cutting line 8b. The cutting line 8b of the rounded portion 8 has a wavy profile, and therefore the cutting edge 9 of the drawing punch engages with the rounded portion 8 only at some points or in some regions at the start of the cutting process, and the blank can be continuously cut by movement of the drawing punch into the drawing die. The desired cutting contour of the rounded portion 8, which desired cutting contour corresponds to the desired size of the blank, is denoted by 8a. The illustration in Fig. 6 is not true to scale. The rounded portion can be corrected in a simple manner in one working step by a calibration, as illustrated for example in Figs. 4 and 5.

Furthermore, other profiles of the rounded portion are also possible. For example, a serrated or else a linear profile of the engagement height of the rounded portion can be used. For example, Fig. 7 shows this schematically. In Fig. 7, the rounded portion 8 has a small entry radius, for example 1 mm, on the left side. By contrast, on the right side, the entry radius is significantly larger, for example 5 mm. Accordingly, the cutting edge first of all engages first with the left side and continues its cutting to the right side by movement of the drawing punch into the die.

The cutting clearances which are provided between cutting edge 9, 8' and rounded portion 8, 9' are preferably 0.05 mm to a maximum of 0.2 mm in order to ensure particularly precise cutting of the blank. Furthermore, the cutting edge of the drawing punch preferably has a maximum radius of 0.5 mm in order likewise to ensure a particularly precise cutting operation. As a result, with the device according to the invention, particularly precise drawn parts having flanges can be provided with low capital costs for the die.

ELJÁRÁS ÉS BERENDEZÉS PEREMES HÚZOTT ALKATRÉSZEK GYÁRTÁSÁRA EGYIDEJŰ TRIMMELÉSSEL

SZABADALMI IGÉNYPONTOK

1. Eljárás peremekkel rendelkező húzott alkatrészek gyártására egy lapos és/vagy előformázott fém elődarabból (10, 12) egy legalább egy vágóéllel (9) rendelkező húzótüske (1), egy elődarabtartó (7) és egy húzószerszám (2) felhasználásával, ahol a húzószerszámnak (2) egy faltartománya (4), egy peremtartománya (3) és egy, az elődarabot (10) tartó tartománya (6) van, ahol az elődarab (10) rá van helyezve a húzószerszám (2) tartó tartományára (6) és húzott alkatrésszé van alakítva a húzótüskének (1) a húzószerszámba történő elmozdításával és le van vágva a peremtartománynál (3),
ahol a tartó tartomány (6) meg van emelve, és a peremtartományhoz (3) képest áll, ahol a tartó tartomány (6) és a peremtartomány (3) közötti magasságkülönbség (h) megfelel legalább az elődarab (10, 12) anyagvastagságának,
azzal jellemezve, hogy
miközben a húzótüskét (1) a húzószerszámba (2) mozgatjuk, a húzótüskén (1) lévő legalább egy vágóél (9) érintkezésbe kerül a tartó tartomány (6) és a peremtartomány (3) átmeneténél lévő lekerekített résszel (8) oly módon, hogy az elődarabnak (10, 12) a peremtartományon (3) túlnyúló részeit levágjuk a húzási folyamat hátralevő részében.

2. Az 1. igénypont szerinti eljárás, **azzal jellemezve**, hogy az elődarab (10, 12) húzási és vágási folyamata során az elődarabtartó (7) az elődarab (10, 12) levágandó tartományát rányomja a húzótüske (2) tartó tartományára (6).

3. Az 1. vagy 2. igénypont szerinti eljárás, **azzal jellemezve**, hogy a lekerekített résznek (8) a vágási vonal mentén a vágóéllel (9) érintkező magassága változó, és amíg a húzótüske (1) a húzószerszámba (2) belép, az elődarabot (10, 12) folyamatosan vágjuk a lekerekített résznek (8) azon tartományától indulva, amely először érintkezik a vágóéllel (9).

4. Az 1-3. igénypontok bármelyike szerinti eljárás, **azzal jellemezve**, hogy legfeljebb 0,5 mm sugarú vágóélet (9) használunk.

5. Az 1-4. igénypontok bármelyike szerinti eljárás, **azzal jellemezve**, hogy a lekerekített rész (8) és a vágóél (9) között egy 0,05 mm és legfeljebb 0,2 mm közötti vágási hézagot tartunk.

6. Az 1-5. igénypontok bármelyike szerinti eljárás, **azzal jellemezve**, hogy az elődarabot (10, 12) a húzótüskében (2) történő húzást megelőzően egy, a húzótüskében (11) lévő előformázóba húzzuk, és az előformázott elődarab (12) többletanyaggal rendelkezik, ezáltal a teljesen kialakított és levágott elődara-

bot (12) kalibráljuk, amikor elérjük a húzótüske (1) végpozícióját.

7. Az 1-6. igénypontok bármelyike szerinti eljárás, **azzal jellemezve,** hogy az elődarabot (10, 12) hőformázzuk a húzótüskében (2).

8. Eszköz peremekkel rendelkező húzott alkatrészek előállítására, amely eszköznek olyan húzótüskéje (1) van, amelynek legalább egy vágóéle (9) van, továbbá amely eszköz tartalmaz legalább egy elődarabtartót (7) és egy húzószerszámot (2), amelynek egy olyan peremtartománya (3) van, ahol a perem van kialakítva, továbbá amelynek faltartománya (4) és alsó tartománya (5) van, ahol a faltartomány és az alsó tartomány van kialakítva, továbbá egy tartó tartománya (6) van az elődarab (10, 12) számára a húzási folyamat előtti megtartásra, ahol a tartó tartomány (6) meg van emelve és a peremtartományhoz (3) képest áll, ahol a húzószerszám (2) tartó tartománya (6) és peremtartománya (3) közötti magasságkülönbség (h) megfelel legalább az átalakítandó elődarab (10, 12) falvastagságának,
azzal jellemezve, hogy
a tartó tartomány (6) és a peremtartomány (3) között egy lekerekített rész (8) van kialakítva, amely lekerekített rész a húzótüskén (1) lévő vágóéllel (9) érintkezik, és lehetővé teszi az elődarab (10, 12) levágását a húzási folyamat során.

9. A 8. igénypont szerinti eszköz, **azzal jellemezve,** hogy a lekerekített rész (8) bemeneti sugara minimum 0,5 mm.

10. A 8. vagy 9. igénypont szerinti eszköz, **azzal jellemezve,** hogy a vágóél (9) maximális sugara 0,5 mm.

11. A 8-10. igénypontok bármelyike szerinti eszköz, **azzal jellemezve,** hogy a vágóél (9) és a lekerekített rész (8) között egy 0,05 mm és maximum 0,2 mm közötti vágási hézag van.

12. A 8-10. igénypontok bármelyike szerinti eszköz, **azzal jellemezve,** hogy a lekerekített résznek (8) a vágási vonal mentén a vágóéllel (9) érintkező magassága oly módon változik, hogy a vágóél (9) csak néhány ponton vagy néhány tartományban lép érintkezésbe a lekerekített résszel (8) a vágási folyamat elején.

13. A 8-10. igénypontok bármelyike szerinti eszköz, **azzal jellemezve,** hogy a tartó tartomány (6) rendkívül pontosan csatlakozik a húzószerszámhoz (1) vagy a húzószerszámmal (2) egy egységként van kialakítva.

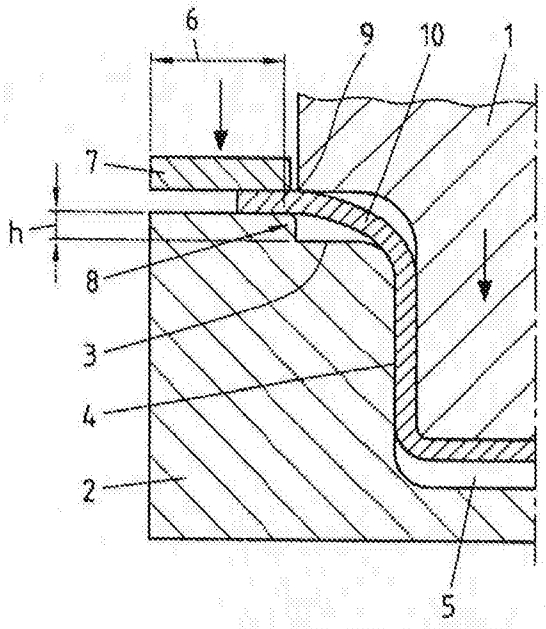

Fig.1

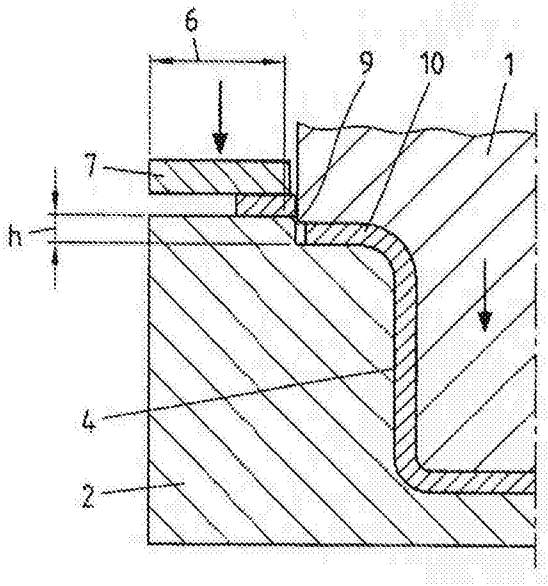

Fig.2

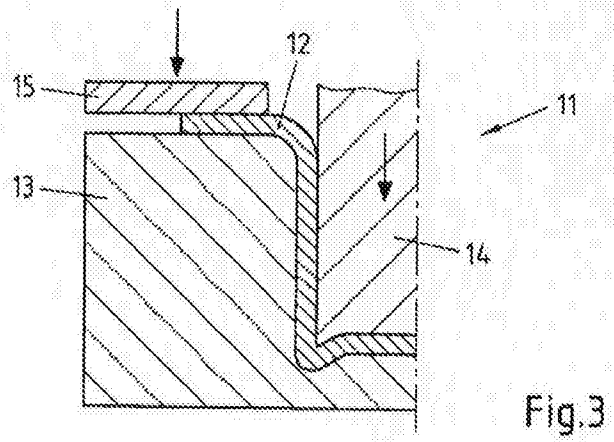

Fig.3

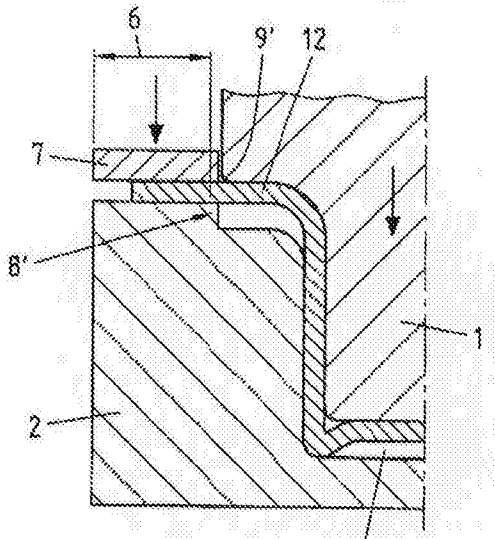

Fig.4

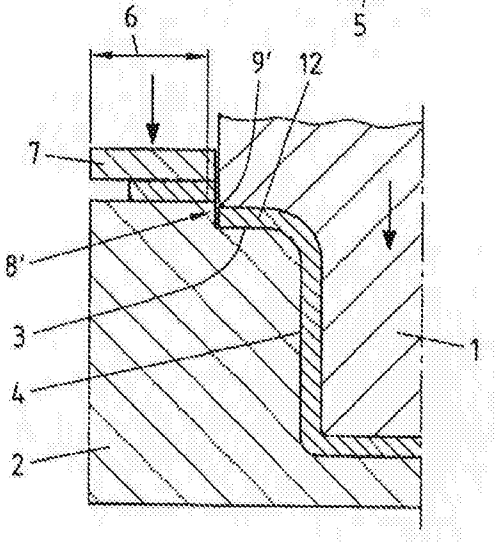

Fig.5

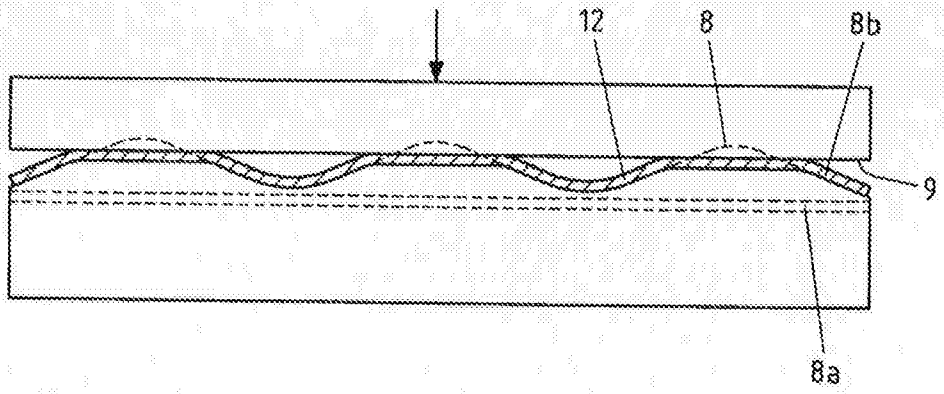

Fig.6

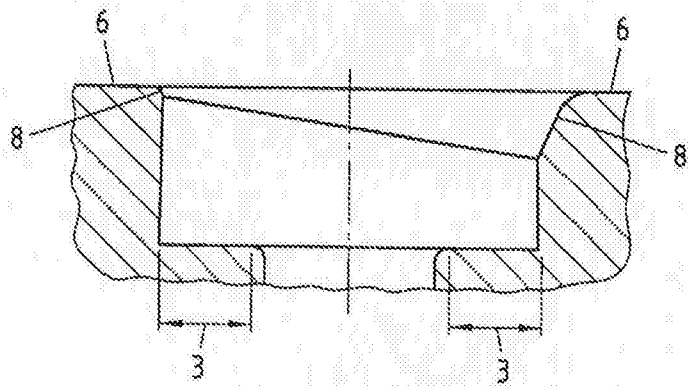

Fig.7