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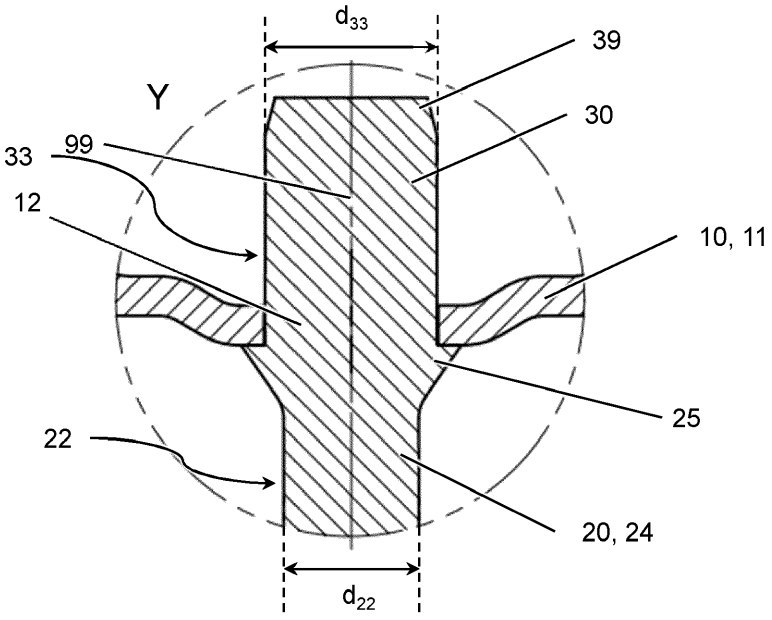
(54) METHOD FOR MANUFACTURING AN ANCHOR CHANNEL

(57) Method for manufacturing an anchor channel, comprising providing a channel body having a channel bottom and a rivet hole arranged in the channel bottom, providing a monolithic anchor body having a flange, a rivet shaft projecting from one side of the flange, and an anchor shaft projecting from an opposite other side of the flange, wherein the flange is wider than the rivet hole so as to abut against the channel body when the rivet shaft is inserted into the rivet hole, wherein the rivet shaft has, at least in a rivet shaft region located adjacent to the flange, larger cross-sectional area that has the anchor shaft, at least in an anchor shaft region located adjacent to the flange, inserting the rivet shaft into the rivet hole, after inserting the rivet shaft into the rivet hole, upsetting the rivet shaft so as to form a shop head, thereby riveting the anchor body to the channel body.

Fig. 9



EP 4 484 663 A1

Description

[0001] The invention relates to a method for manufacturing an anchor channel according to the preamble of claim 1, and to an anchor channel obtained using this method.

[0002] US4052833 A discloses a method for manufacturing an anchor channel, in which a flanged monolithic anchor body is inserted into a channel body and connected thereto by riveting.

[0003] EP0400588 A1 discloses another method for manufacturing an anchor channel. In case of EP0400588 A1, a multi-part, non-monolithic anchor body is used. The non-monolithic anchor body comprises a shank consisting of constructional steel, which shank is welded to a foot consisting of stainless steel. The foot is, in term, riveted to the channel body. The foot is oversized with respect to the shank, so that a ridge, which forms during the welding-together of shank and foot, does not radially project over the adjacent foot. According to EP0400588 A1, this is since such a radially-projecting ridge could potentially act as a concrete anchor and forming of a radially-projecting ridge could therefore potentially lead to an anchoring site at a location where no anchoring is desired, namely at a location close to the channel body, instead of deep within the concrete, where anchor performance is often highest. Having the foot of a non-monolithic anchor body oversized with respect to its shank thus prevents the forming of unwanted geometrical features during the joining process that is characteristic of a non-monolithic item.

[0004] It is an object of the invention to provide a method for manufacturing an anchor channel and an anchor channel manufactured therewith, which provide, at particularly low expenditure, particularly good anchor performance.

[0005] This object is achieved by a method according to claim 1. Dependent claims refer to preferred embodiments of the invention.

[0006] Accordingly, there is provided a method for manufacturing an anchor channel, comprising:

- providing a channel body having a channel bottom and at least one rivet hole that is arranged in the channel bottom,
- providing a monolithic anchor body having a flange, a rivet shaft projecting from one side of the flange, and an anchor shaft projecting from an opposite other side of the flange, wherein the flange is wider than the rivet hole so that the flange can abut against the channel body when the rivet shaft is inserted into the rivet hole,
- inserting the rivet shaft into the rivet hole, and
- after inserting the rivet shaft into the rivet hole, upsetting the rivet shaft so as to form a shop head, thereby riveting the monolithic anchor body to the channel body, characterized in that
- when the monolithic anchor body is provided, the rivet shaft has, at least in a rivet shaft region located adjacent to the flange, larger cross-sectional area that has the anchor shaft, at least in an anchor shaft region located adjacent to the flange.

[0007] The invention is based on the finding that it might be desirable to have shop heads of particularly large diameter at the rivet connection site between the monolithic anchor body and the channel body. This is since having large diameter shop heads allows large area force transfer, and thus allows reducing the wall strength of the channel body without compromising on the strength of the rivet connection. On the other hand, since the the additional mass of a large diameter shop head is merely local, the overall material expenditure can be kept particularly low. The material for forming large diameter shop heads generally originates from the deformed rivet shaft. In this context, the invention has found that it can be advantageous to provide this shop head forming material in the cross-section of the rivet shaft, instead of in the length of the rivet shaft. This advantage could be explained by a tendency of long rivet shafts to buckle during upsetting, potentially leading to inhomogeneous deformation and thus to reduced rivet load capacity. Accordingly, relatively high manufacturing effort might be necessary. In contrast, with shorter, but thicker rivet shafts (i.e. shafts with relatively large cross sectional area orthogonal to the longitudinal axis of the anchor body), the same rivet load capacity might be achieved with less manufacturing effort. On this basis, the invention proposes to provide, at least adjacent to the flange, the rivet shaft with larger cross-sectional area than the anchor shaft (with cross-sectional area in both cases measured orthogonally to the longitudinal axis of the monolithic anchor body). Thus, material is provided only where it is needed: The relatively large cross-section of the rivet shaft allows particularly low riveting effort, whereas the relatively thin anchor shaft prevents unnecessarily high material expenditure. Thus particularly good anchor performance can be achieved at particularly low expenditure, with regards to channel body wall thickness, overall anchor body mass and/or manufacturing effort.

[0008] An anchor channel can comprise a generally C-shaped channel body, and at least one anchor body, preferably a plurality of anchor bodies, protruding therefrom. If a plurality of anchor bodies is provided, it is particularly preferred that all of them are attached to the channel body by means of the described method.

[0009] The channel body and/or the monolithic anchor body consist preferably of metal, in particular steel, which might also be coated.

[0010] The flange is arranged axially (with respect to the anchor body's longitudinal axis) between the rivet shaft and the anchor shaft. The flange is intended to abut against the channel bottom in a region surrounding the rivet hole, thereby preventing the monolithic anchor body from being pushed too deeply into the channel body. Accordingly, the flange can have any shape suitably for

this purpose, e.g. a circular disc shape, a tapering shape, in particular a conical shape, or also others. In particular, the flange can have a ring shoulder facing the rivet shaft and intended to abut against the channel bottom and/or the flange can have a taper facing the anchor shaft.

[0011] The cross-sectional area of the monolithic anchor body, in particular of its rivet shaft and/or of its anchor shaft, can in particularly be measured perpendicularly to the anchor body's longitudinal axis and/or to an anchor body insertion direction, i.e. to a direction in which the rivet shaft of the monolithic anchor body is inserted into the rivet hole.

[0012] The monolithic anchor body is monolithic, i.e. it is formed from a single piece of material without joints or seams. Preferably, the monolithic anchor body can be obtained by a rolling process applied to a piece of wire.

[0013] The rivet shaft has a free end. This free end might be provided with a tapered tip, e.g. for facilitating insertion into the rivet hole. The rivet shaft is inserted into the rivet hole with the free end first. The rivet shaft is inserted into the rivet hole from outside of the channel body, so that the rivet shaft then projects into the inside of the anchor channel.

[0014] The shop head is a local widening of the rivet shaft, that is wide enough to prevent withdrawal of the rivet shaft out of the rivet hole. Preferably, the shop head is formed at the free end of the rivet shaft.

[0015] It is particularly preferred that, when the monolithic anchor body is provided, the monolithic anchor body further comprises an anchor head that is arranged on the anchor shaft, in particularl at an end of the anchor shaft that is remote from the flange. Accordingly, an anchor head, i.e. a widening for anchoring, is provided on the monolithic anchor body from the beginning of the manufacturing sequence. This can provide particularly good anchoring performance at particularly low manufacturing effort. The anchor head is a monolithic part of the monolithic anchor body and can, for example, be formed in a rolling process applied to the above-mentioned piece of wire.

[0016] Advantageously, when the monolithic anchor body is provided, the rivet shaft has, at least in the rivet shaft region located adjacent to the flange, generally circular cross-section with diameter d_{33}, and/or when the monolithic anchor body is provided, the anchor shaft has, at least in the anchor shaft region located adjacent to the flange, generally circular cross-section with diameter d_{22}. In both cases, the respective diameter extends preferably perpendicular to the anchor body's longitudinal axis and/or to the anchor body insertion direction. Accordingly, the rivet shaft or the anchor shaft, respectively, are generally circularly cylindrical in said regions. This can allow particularly easy manufacturing, e.g. by rolling, and particularly good force absorption.

[0017] According to another preferred embodiment of the invention, the following relation holds for the diameter d_{33} and diameter d_{22}:

$$d_{33} >= d_{22} + 0.3\ mm,$$

and/or

$$d_{33} <= d_{22} + 2.0\ mm.$$

[0018] The invention also relates to an anchor channel obtained by the described method. Features that are described here in connection with the method for manufacturing the anchor channel can also be used in connection with the anchor channel obtained with the method.

[0019] The invention is explained in greater detail below with reference to preferred exemplary embodiments, which are depicted schematically in the accompanying drawings. Individual features of the exemplary embodiments presented below can be implemented either individually or in any combination within the scope of the present invention.

Figures 1 to 4 show successive steps of a method for manufacturing an anchor channel, namely in sectional view in a first plane that extends along the channel body.

Figure 5 shows the step of figure 1, in sectional view B-B according to figure 1.

Figure 6 shows the step of figure 2, in sectional view C-C according to figure 2.

Figure 7 shows the step of figure 3, in sectional view D-D according to figure 3.

Figure 8 shows the step of figure 4, in sectional view E-E according to figure 4.

Figure 9 shows detail view Y of figure 6, i.e. figure 9 relates again to the step of figure 2.

Figure 10 shows detail view Z of figure 7, i.e. figure 10 relates again to the step of figure 3.

Figures 1 to 4, and corresponding figures 5 to 8, respectively,

[0020] The figures illustrate a method for manufacturing an anchor channel and an anchor channel obtained by means of this method.

[0021] As shown in figure 1 and in figure 5, a generally C-shaped channel body 10 and a monolithic anchor body 20 are provided as independent members. The channel body 10 includes a channel bottom 11 and at least one rivet hole 12 in the channel bottom 11. In particular, the channel body 10 can consist of metal, more preferably of steel, that can also be coated.

[0022] The monolithic anchor body 20 extends along

an anchor body's longitudinal axis 99. The monolithic anchor body 20 comprises a flange 25, a rivet shaft 30 that projects from the flange 25 and an anchor shaft 24 that projects from the flange 25. The anchor shaft 24 and the rivet shaft 30, respectively, project from opposite sides of the flange 25, i.e. the flange 25 is located axially between the anchor shaft 24 and the rivet shaft 30. The monolithic anchor body 20 further comprises an anchor head 26 that is attached to the anchor shaft 24. The anchor head 26 and the flange 25, respectively, are arranged on the anchor shaft 24 at opposite ends of the anchor shaft 24. The monolithic anchor body 20 is monolithic, i.e. the anchor shaft 24, the rivet shaft 30, the flange 25 and, if present also the anchor head 26 are a single piece. The monolithic anchor body 20 consists of metal, preferably of steel, that can also be coated.

[0023] Both the anchor shaft 24 and the rivet shaft 30 are generally circular cylindrical. In the shown embodiment, the rivet shaft 30 also comprises a tapering tip 39 at the free end of the rivet shaft 30, in order to facilitate insertion of the rivet shaft into the rivet hole 12.

[0024] The generally circular cylindrical rivet shaft 30 has generally constant diameter d_{33} in a rivet shaft region 33 that is located adjacent to the flange 25, wherein said rivet shaft region 33 with generally constant diameter d_{33} extends from the flange 25 to the tapering tip 39. The generally circular cylindrical anchor shaft 24 has generally constant diameter d_{22} in an anchor shaft region 22 that is located adjacent to the flange 25, wherein said anchor shaft region 22 with generally constant diameter d_{22} extends from the flange 25 to the anchor head 26. It is provided that d_{33} is greater than d_{22}. Since d_{33} is greater than d_{22}, the rivet shaft 30 has, at least in said rivet shaft region 33 located adjacent to the flange 25, larger cross-sectional area that has the anchor shaft 24, at least in said anchor shaft region 22 located adjacent to the flange 25, wherein cross-sectional area is measure in both cases orthogonally to the monolithic anchor body's longitudinal axis 99.

[0025] For example, values of d_{33} = 12 mm and of d_{22} = 11 mm can be provided.

[0026] The flange 25 provides a ring shoulder, namely where the flange 25 adjoins the rivet shaft region 33 that is located adjacent to the flange 25. Where the flange 25 adjoins the anchor shaft region 22 that is located adjacent to the flange 25, the flange 25 is, in the shown embodiment, provided with a conical taper, but this is an example only.

[0027] In a next step, following provision of the channel body 10 and of the monolithic anchor body 20, the monolithic anchor body 20 is inserted, with free end of the rivet shaft 30 first, into the rivet hole 12 in the channel bottom 11, preferably until the flange 25 (in particular with its ring shoulder) abuts against the channel bottom 11. The rivet shaft 30 then extends through the rivet hole 12 into the channel body 10, with the anchor shaft 24 projecting from the channel body 10 on the outside of the channel body 10. The resulting configuration is shown in figures 2, 6 and 9.

[0028] The rivet shaft 30 is subsequently upset at the free end of the rivet shaft 30 that is located within the channel body 10, wherein upsetting is preferably performed by means of an orbital riveting process using an orbital riveting die 60. In this upsetting process, a broadened shop head 35 is formed at the free end of the rivet shaft 30, which locks the rivet shaft 30 on the channel bottom 11 against being pulled out of the rivet hole 12. Accordingly, the upsetting process rivets the monolithic anchor body 20 to the channel body 10. The upsetting step is illustrated in figures 3, 7 and 10, and the final state, in which the monolithic anchor body 20 is riveted to the channel body 10, is shown in figures 4 and 8.

Claims

1. Method for manufacturing an anchor channel, comprising:

- providing a channel body (10) having a channel bottom (11) and at least one rivet hole (12) that is arranged in the channel bottom (11),
- providing a monolithic anchor body (20) having a flange (25), a rivet shaft (30) projecting from one side of the flange (25), and an anchor shaft (24) projecting from an opposite other side of the flange (25), wherein the flange (25) is wider than the rivet hole (12) so that the flange (25) can abut against the channel body (10) when the rivet shaft (30) is inserted into the rivet hole (12),
- inserting the rivet shaft (30) into the rivet hole (12), and
- after inserting the rivet shaft (30) into the rivet hole (12), upsetting the rivet shaft (30) so as to form a shop head (35), thereby riveting the monolithic anchor body (20) to the channel body (10),

characterized in that

- when the monolithic anchor body (20) is provided, the rivet shaft (30) has, at least in a rivet shaft region (33) located adjacent to the flange (25), larger cross-sectional area that has the anchor shaft (24), at least in an anchor shaft region (22) located adjacent to the flange (25).

2. Method according to claim 1,
characterized in that
when the monolithic anchor body (20) is provided, the monolithic anchor body (20) further comprises an anchor head (26) that is arranged on the anchor shaft (24).

3. Method according to any of the preceding claims,
characterized in that

when the monolithic anchor body (20) is pro-

vided, the rivet shaft (30) has, at least in the rivet shaft region (33) located adjacent to the flange (25), generally circular cross-section with diameter d_{33}, and
when the monolithic anchor body (20) is provided, the anchor shaft (24) has, at least in the anchor shaft region (22) located adjacent to the flange (25), generally circular cross-section with diameter d_{22}.

4. Method according to claim 3,
characterized in that
the following relation holds for the diameter d_{33} and diameter d_{22}:

$$d_{33} >= d_{22} + 0.3\ mm,$$

$$d_{33} <= d_{22} + 2.0\ mm.$$

5. Anchor channel obtained by a method according to any of the proceeding claims.

Fig. 1

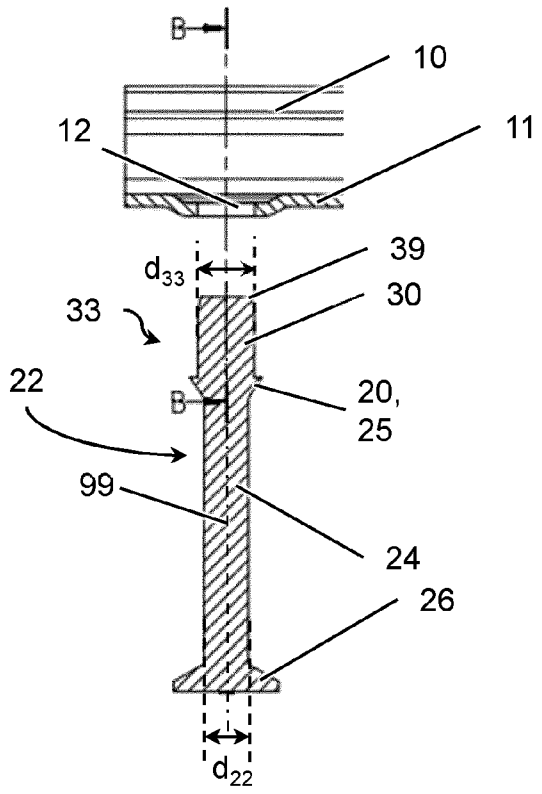
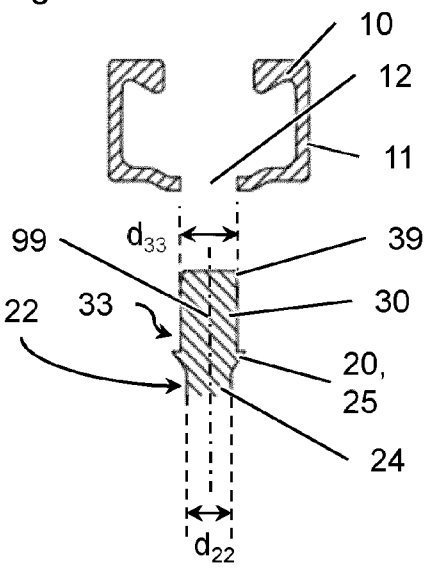


Fig. 5



B-B

Fig. 2

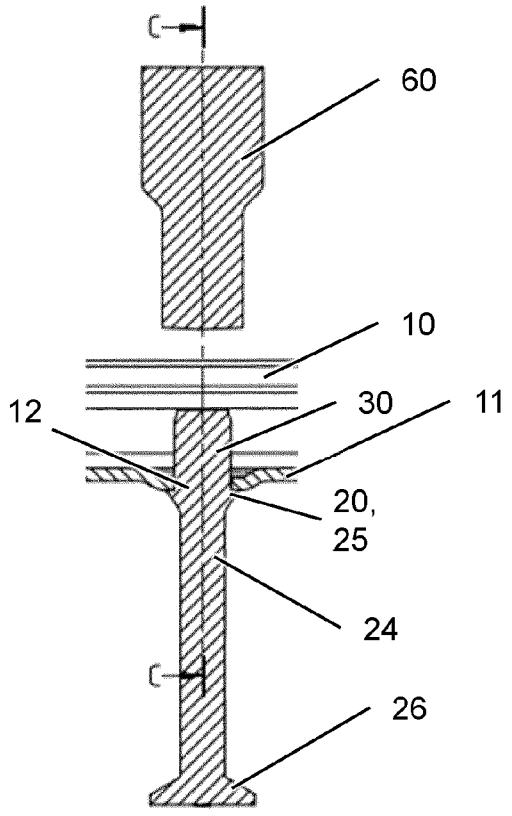
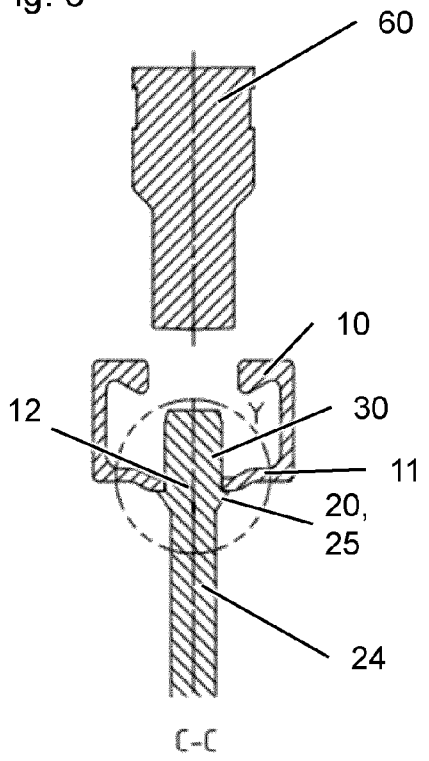


Fig. 6



C-C

Fig. 3

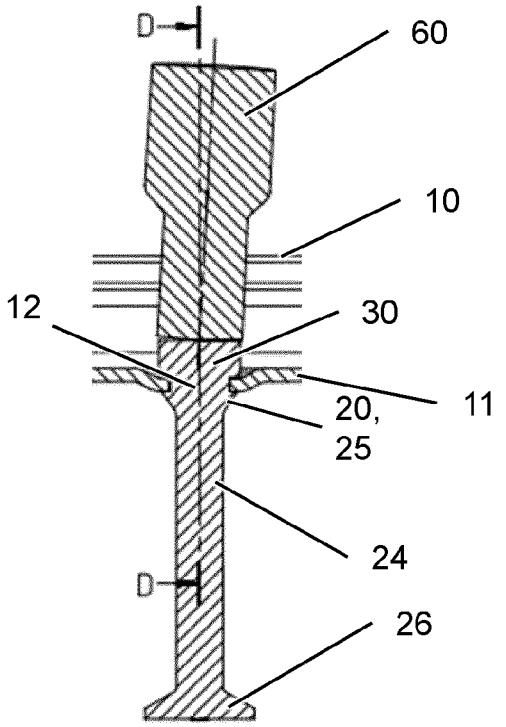


Fig. 7

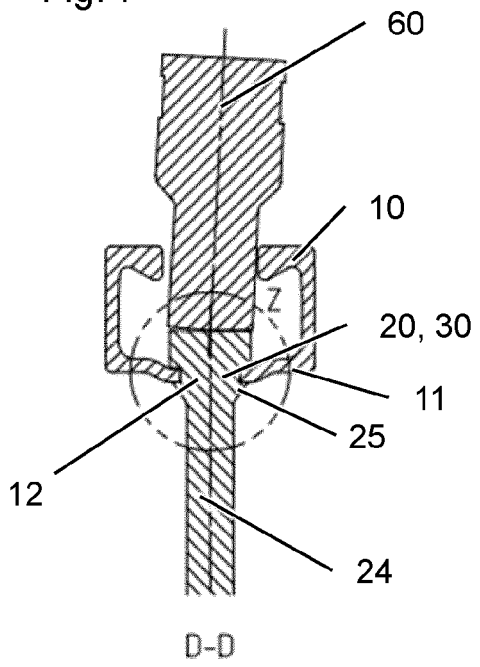


Fig. 4

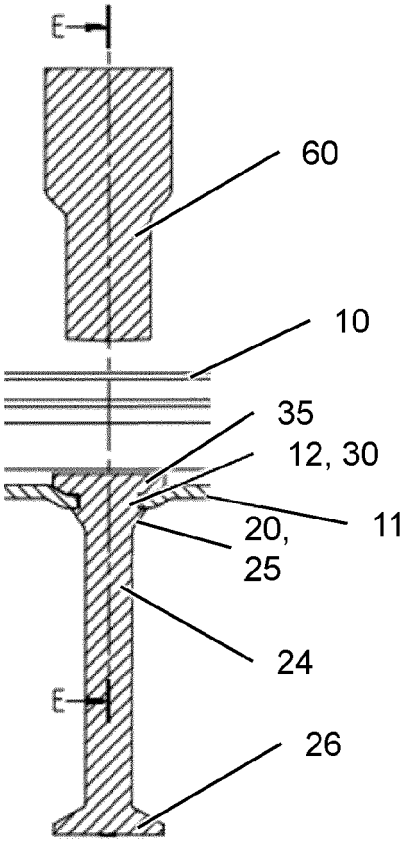


Fig. 8

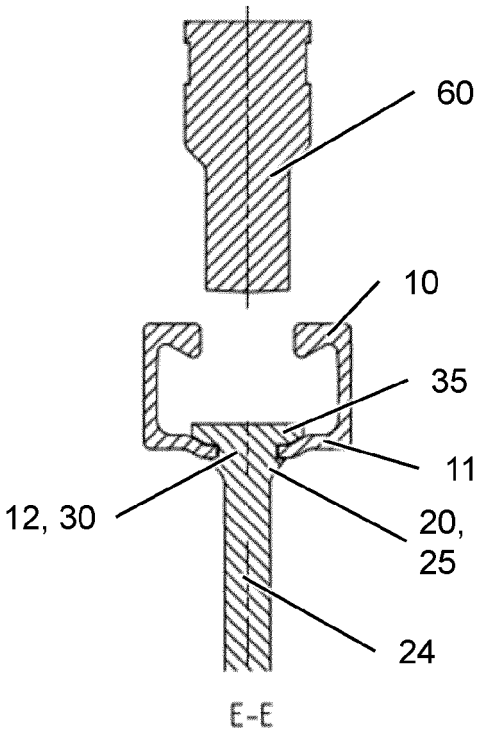


Fig. 9

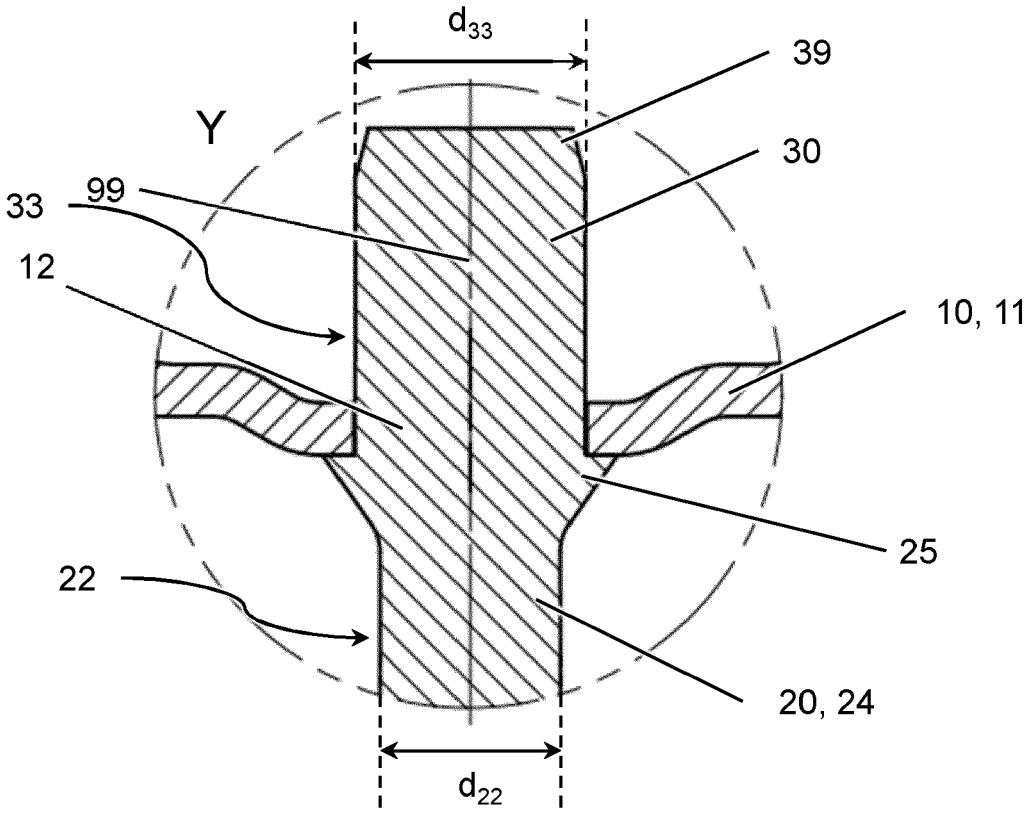
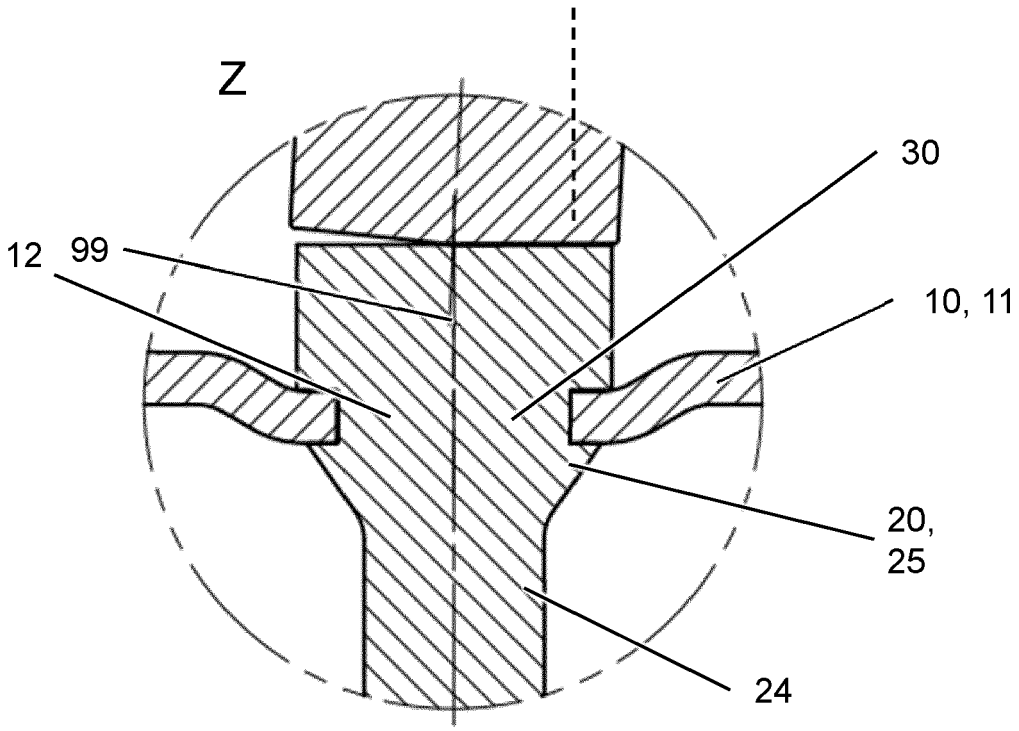


Fig. 10



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EUROPEAN SEARCH REPORT

Application Number
EP 23 18 1686

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 729 951 A (FROEHLICH KLAUS [DE]) 24 March 1998 (1998-03-24)	5	INV. E04B1/41
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TECHNICAL FIELDS SEARCHED (IPC)

E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 December 2023	Pirog, Pawel

CATEGORY OF CITED DOCUMENTS

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