



OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- with amended claims (Art. 19(1))

METHOD FOR PRODUCING A BLIND RIVET, BLIND REVET AND FASTENING ARRANGEMENT

5 Field of the invention

The present invention relates to a method for producing a blind rivet, a blind rivet for connecting at least two components, a fastening arrangement comprising two components that are connected by setting a blind rivet, and a stamping tool for
10 producing a blind rivet.

Background of the invention

Blind rivets are used to permanently interconnect workpieces. The workpieces
15 usually comprise through-holes that are aligned with one another and in which the blind rivet is inserted and then fastened by means of deformation. A fastened blind rivet clamps the workpieces against one another.

In the motor vehicle industry, blind rivets are used inter alia to fasten
20 attachment parts, such as power-window motors, loudspeakers and other parts, to a unit support, such as a door module support, by means of one or more blind rivets.

In a known manner, blind rivets comprise a rivet sleeve having a sleeve head, a sleeve shank, and a rivet mandrel that is arranged in a longitudinal bore of the rivet
25 sleeve.

The connection is established by a closing head being formed when the blind rivet is set. Radial widening of the sleeve shank when the blind rivet is being set can cause the fastening bore of the component to crack. It is necessary to limit the radial
30 widening of blind rivets in the region of the sleeve shank, which shank is located in the rivet hole, in order to be able to control the bearing stress of the material to be joined. Damage must be prevented. In particular, damage must be prevented specifically in the case of plastics components and fibre composites (CRP).

Moreover, it is necessary for the closing head to be formed before the sleeve
35 shank exhibits significant radial widening.

Defined clamping regions of blind rivets can thus be guaranteed, irrespective of the hole diameter of the material to be joined on the swage-head side.

- 5 Premature collapse of the rivet shank before the closing head is formed is reduced by reinforcing part of the rivet shank (or sleeve shank) thereof.

DE102010017296 discloses a sleeve shank comprising two regions, one of the two regions being strengthened in order to reduce radial widening of the rivet sleeve
10 in the bore of the workpiece.

EP0677666A1 also describes a blind rivet comprising a work-hardened rivet sleeve.

- 15 Reinforcing the rivet sleeve causes the sleeve to thin, which in turn leads to a loss of strength. Moreover, the grip is also reduced since the sinking of the sleeve means that not enough material remains to form a closing head in the upper grip range. This has particularly serious consequences if the top sheet has a larger hole diameter, as a result of which the rivet can sink further since there is no narrow bore present that
20 slows the radial widening and thus the sinking.

In addition, according to the prior art, shank reinforcements that have a cylindrical stamping or rolling are in principle unstable. Essentially, the rivet shank may, or may not, suddenly break off radially. The sudden breaking is initiated by
25 conventional production tolerances in mass production of small iron parts of this kind. Form and positional tolerances of the rivet mandrel and the sleeve shank themselves and relative to one another when completed preferably allow the rivet sleeve to collapse at one location and in one direction.

- 30 Shank reinforcements are also implemented by geometric thickenings of the sleeve. However, said reinforcements are less stable, in part, than work-hardened reinforcements.

Shank reinforcements are also achieved in a very costly manner by induction
35 hardening of steel rivet sleeves.

The object of the present invention is therefore that of producing an improved blind rivet, it being possible for the grip range to be increased and for the blind head diameter of the finished blind rivet connection and/or the clamping force of the blind rivet connection to be increased.

Summary of the invention

The above object is achieved by a method for producing a blind rivet, comprising the steps of:

- providing a rivet sleeve comprising a sleeve head and a sleeve shank that extends along a longitudinal axis from the sleeve head as far as a tail, a longitudinal bore extending through the rivet sleeve, the sleeve shank comprising a first portion that adjoins the sleeve head and a second portion that adjoins said first portion and extends as far as the tail,
- providing a rivet mandrel, the rivet mandrel comprising a mandrel shank having a mandrel head,
- passing the rivet mandrel through the longitudinal bore of the rivet sleeve such that the mandrel head is operatively connected to the tail,
- providing a stamping tool,
- connecting the rivet mandrel to the rivet sleeve using the stamping tool, the first portion comprising an outer surface that is offset radially towards the outside, before the rivet mandrel is connected to the rivet sleeve, such that a shoulder is formed between the outer surfaces of the first and second portion, the stamping tool comprising a stamping jaw having a first stamping region and a second stamping region, the first stamping region interacting with the first portion, and the second stamping region interacting with the second portion, the first stamping region strengthening the first portion while the rivet mandrel is being connected to the rivet sleeve, such that the strength of the first portion of the rivet sleeve is increased relative to the strength of the second portion, and the shoulder between the outer surfaces of the first and second portion being maintained after strengthening.

The dual strengthening (by the stepped first portion and the strengthening of said portion by stamping) allows for very good reinforcement of the first portion. The connection of the rivet mandrel to the rivet sleeve and the strengthening by means of

stamping are carried out in a single method step, and therefore the method is particularly advantageous. No further steps or tools are required.

5 The stamping tool produces a strengthened step which has the necessary strength for strengthening the upper part of the sleeve such that no radial widening can occur during the setting process.

10 According to a further preferred embodiment, the length of the rivet sleeve remains constant before and after strengthening. In particular, the length of the sleeve shank (or of the first portion thereof) remains constant before and after strengthening. The rivet sleeve therefore does not lengthen during strengthening.

15 In a preferred embodiment, the first stamping region forms a step together with the second stamping region. The stamping jaw comprising the first stamping region and the second stamping region is formed in one piece. The shoulder of the rivet sleeve is maintained by said step.

20 The stamping design (stepped stamping) makes it possible to strengthen a stepped sleeve without lengthening the sleeve further. Prior to the connection, the first portion of the sleeve shank has a larger external diameter than the second portion. After the connection, the external diameter of the first portion remains larger than the external diameter of the second portion.

25 In a further preferred embodiment, the second stamping region has a stamping contour that has a shape that is curved outwards in the manner of a barrel in order to produce a shape of the second region that is curved outwards in the manner of a barrel.

In a particularly preferred embodiment, the longitudinal bore has a constant diameter prior to the connection.

30 The above object is furthermore achieved by a blind rivet for connecting at least two components, said rivet comprising:

- a rivet sleeve comprising a sleeve head and a sleeve shank that extends along a longitudinal axis from the sleeve head as far as a tail, a longitudinal bore extending through the rivet sleeve, the sleeve shank comprising a first portion

that adjoins the sleeve head and a second portion that adjoins said first portion and extends as far as the tail,

- a rivet mandrel, the rivet mandrel comprising a mandrel shank having a mandrel head, the mandrel head being operatively connected to the tail of the rivet body, the mandrel shank being arranged in the longitudinal bore of the rivet sleeve, the second portion being designed to deform to a blind head at least in part during a setting process,

and the first portion comprising an outer surface that is offset radially towards the outside, such that a shoulder is formed between the outer surfaces of the first and second portion, and the first portion being plastically deformed at the outer periphery of the sleeve shank in order to increase the strength of said first portion.

The strength of the first portion is thus increased relative to the strength of the second portion by means of plastic deformation and geometric reinforcement.

The invention permits a wide range of application for bulbing blind rivets. The reinforcement in the upper region of the rivet sleeve makes it possible for the blind rivet to be used in applications having a through-hole and in applications having a large hole diameter (for example in the top sheet). The same grip range applies for both application structures. This means that this is also of interest for composite applications. Said blind rivet can also be used in applications involving plastics material. The fact that a radial widening does not occur also means that there is no risk of the plastics parts being cracked thereby.

In a particularly preferred embodiment, the longitudinal bore is formed by a continuous inside wall without any break in the geometry. In other words, the longitudinal bore (or the longitudinal bore diameter) is substantially constant along the longitudinal axis.

In a particularly preferred embodiment, the first portion of the rivet sleeve has a larger external diameter than the second portion.

According to a further preferred embodiment, the second portion has a shape that is curved outwards in the manner of a barrel.

In a particularly preferred embodiment, the rivet mandrel has a drawing end that can be separated from the mandrel shank.

5 In a particularly preferred embodiment, the mandrel shank and the drawing end are connected by a constricted separating portion that is positioned in the longitudinal bore.

10 The above object is furthermore achieved by a fastening arrangement comprising two components, a first component of which is arranged so as to be accessible and a second component of which is arranged behind the first component and so as to be inaccessible, the two components comprising mutually aligned bores that are penetrated by the blind rivet, the sleeve head of the blind rivet resting on the first component, the rivet shank of said rivet extending through the bores of the first and second component, and a part of the second portion of the rivet shank of said rivet
15 forming a rivet head that rests on the rear of the second component, such that the two components are interconnected.

20 In a particularly preferred embodiment, the bore of the first component has a smaller diameter than the bore of the second component.

In a particularly preferred embodiment, the shoulder is supported on the second component such that the two components are assembled so as to have a defined spacing.

25 In a particularly preferred embodiment, the second component is mechanically deformed in the surroundings of the bore thereof, such that the spacing between the two components is independent of the length of the second component along the longitudinal axis.

30 The "surroundings" is to be understood as a region that is located close to the bore. Said region can extend, for example, over a distance of up to four times the bore diameter.

35 Nowadays, according to the application, it is possible to have a variable spacing that is also intended to be retained after the joining process. When using just a

conventional blind rivet, the following problem arises: the spacing between the two components cannot be kept constant, and this is due to the constant step length. The consequence is that: when the spacing is too large, the force of the rivet causes deformation of the first or second component, and when the spacing is too small, no clamping force is generated. The above issues are resolved using the blind rivet described above by means of mechanical deformation (for example beading) of at least one of the members to be joined.

In a particularly preferred embodiment, the material of the first component is different from the material of the second component.

In a particularly preferred embodiment, the first component and/or the second component consists of plastics material.

Finally, the above object is achieved by a stamping tool for producing a blind rivet, the stamping tool comprising a stamping jaw having a first stamping region and a second stamping region, the first stamping region being suitable for interacting with the first portion, and the second stamping region being suitable for interacting with the second portion, and the first stamping region forming a step relative to the second stamping region.

Of course, the features that are mentioned above and that will be explained in the following can be used not only in the combination specified in each case, but rather also in other combinations or in isolation, without departing from the scope of the present invention.

Description of the accompanying drawings

Embodiments of the invention are shown in the drawings and will be explained in greater detail in the following description. In the drawings:

Fig. 1a is a schematic view of a rivet sleeve of a blind rivet according to the invention;

Fig. 1b is a schematic view of a rivet mandrel of a blind rivet according to the invention;

Fig. 1c is a schematic view of the rivet mandrel from Fig. 1b and of the rivet sleeve from Fig. 1a together;

Fig. 1d is a schematic view of stamping the blind rivet from Fig. 1c;

Fig. 1e is a schematic view of the blind rivet from Fig. 1d after stamping with a stepped rivet sleeve;

Fig. 2 is a schematic cross section of a stamping tool according to an embodiment;

Fig. 3 is an embodiment of a blind rivet arrangement;

Fig. 4 is a second embodiment of a blind rivet arrangement;

Fig. 5 is a third embodiment of a blind rivet arrangement.

Detailed description of preferred embodiments of the present invention

Fig. 1a shows a first embodiment of a rivet sleeve 10. The rivet sleeve 10 comprises an elongate sleeve shank 12 having a longitudinal bore 14 or longitudinal recess that is continuous in the axial direction. A sleeve head 16 is formed at one end of the sleeve shank, which head is in the shape of an annular disc and is intended to rest on a workpiece 18. The sleeve head 16 is arranged around a longitudinal axis X for example. The longitudinal bore 14 extends along the longitudinal axis X. The longitudinal bore 14 is centred in the rivet sleeve 10 for example. The side of the sleeve head 16 remote from the sleeve shank 12 can be provided with a planar support surface 20 which can be used to support the front end of a riveting tool. The end of the sleeve shank 12 opposite the sleeve head 16 forms a tail 22.

The sleeve shank 12 comprises a first portion 24 that is adjacent to the sleeve head 16, and a second portion 26 that adjoins said first portion and extends as far as the tail 22.

5 The sleeve shank 12 forms a step, as shown in Fig. 1a. The first portion 24 comprises an outer surface that is offset radially towards the outside, relative to the second portion. In other words, a shoulder 28 is formed between the outer surfaces of the first and second portion 24, 26. The shoulder 28 forms a break in the geometry between the first and second portion 24, 26.

10

The first and second portion 24, 26 preferably have a circular cross section. The first portion 24 has a larger external diameter than the second portion 26.

In conjunction with a rivet mandrel 30, the rivet sleeve 10 forms a blind rivet 32.

15

Fig. 1b shows a rivet mandrel 30 comprising a mandrel shank 34 that has a mandrel head 36 at one end and an elongate drawing end 38 at the other end.

20 The mandrel head 36 has a larger diameter than the mandrel shank 34 and comprises planar contact surfaces 40 for the tail 22 of the sleeve shank 12 on the lower face that faces the mandrel shank 34.

25 The mandrel shank 34 has a circular cross section for example, but other cross sections can also be provided. The mandrel shank 34 has a substantially constant cross section. In another embodiment, it is possible for the cross section of the mandrel shank not to be constant. The mandrel shank 34 usually comprises a predetermined breaking point 42 (not shown in greater detail in Fig. 1b and Fig. 1c), at which the mandrel shank 34 breaks off as soon as a specific setting force is exceeded.

30 The internal diameter of the longitudinal bore 14 is larger than the external diameter of the mandrel shank 34. The rivet mandrel 30 is arranged in the longitudinal bore 14 such that the contact surfaces 40 are arranged against the tail 22 of the sleeve shank 12, as shown in Fig. 1c.

The predetermined breaking point 42 is provided in the longitudinal bore 14. The elongate drawing end 38 is located outside the longitudinal bore 14 at least in part. In particular, as shown in Fig. 1c, the rivet mandrel 30 comprises a first mandrel region and a second mandrel region. The first mandrel region extends from the mandrel head, inside the longitudinal bore, as far as the predetermined breaking point. The second mandrel region extends from the predetermined breaking point and out of the sleeve head.

A positive or non-positive connection (or mechanical locking) is provided between the rivet mandrel 30 and the rivet sleeve 10. A profiled rolling is provided for the mechanical locking, into which rolling material of the rivet sleeve 10 is introduced by stamping.

In particular, a stamping tool 44 is provided for stamping the first and second portions 26, 28. Fig. 1d schematically shows a stamping tool by means of which the stamping is carried out. The stamping in the first and second portions 26, 28 is preferably rotationally symmetrical stamping.

The first portion 26 is strengthened while the rivet mandrel 30 is being connected to the rivet sleeve 10. The strengthening is achieved by cold forming that is carried out by the stamping tool 44. The stamping tool 44 comprises one or more stamping jaw(s) 48 having a first stamping region 50 and a second stamping region 52. The first stamping region interacts with the first portion, and the second stamping region interacts with the second portion. The first portion 26 is thus strengthened by the stamping contour 46 of the first stamping region 52.

In particular, a break in the geometry between the first and second portion is maintained after the rivet mandrel 30 and the rivet sleeve 10 have been connected, and therefore the strength of the first portion of the sleeve shank is increased relative to the strength of the second portion.

The second stamping region 52 has, for example, a stamping contour 46 that has a shape that is curved outwards in the manner of a barrel (or has an arcuate course), in order to produce a shape of the second region 28 that is curved outwards

in the manner of a barrel. Outwards means, here, the opposite direction of the longitudinal bore 14.

5 The stamping tool 44 has a break in geometry 54 between the first and the second stamping region 50, 52. A break in geometry means, here, that the first stamping region 50 and the second stamping region 52 do not have the same diameter. In particular, the first stamping region 50 has a geometric contour that is different from the geometric contour of the second stamping region 52. The geometric contour of the first stamping region is suitable for producing the work-hardening of the first portion 26.
10

As shown in Fig. 3a, the stamping jaw 48 is formed having a step 56. The stamping jaw 48 from Fig. 2 is used in particular together with the blind rivet 32 from Fig. 1c, and the shoulder 28 of the blind rivet 32 is stamped, but a shoulder 28 remains
15 between the first and the second portion 26, 28 after stamping. The first stamping region 50 has a stamping contour that forms a cylindrical external form relative to the second stamping region 52. The external diameter formed by the first stamping region 50 is smaller than that formed by the second stamping region 52.

20 The stamping jaw 48 having the geometric contour from Fig. 3a stamps the blind rivet 32 from Fig. 1c, as is shown schematically in Fig. 1d.

During stamping, the first portion 26 is work-hardened by the first stamping region, and the external diameter of the first portion remains larger than that of the second portion 28. The rivet sleeve 10 does not lengthen during stamping. In other
25 words, the stamping contour of the first stamping region does not lengthen the rivet sleeve 10 during stamping.

After stamping, as shown in Fig. 1e, the first portion 26 will have a cylindrical
30 shape having an external diameter that is larger than that of the second portion. The second portion 28 has a shape that is curved outwards in the manner of a barrel.

The stepped stamping jaw produces a strengthened step (i.e. the first portion 26) on the rivet sleeve 10. The rivet sleeve 10 is strengthened in this first portion 26.
35 This strengthening prevents radial widening of the blind rivet 32 during a setting

process on a workpiece 18. Stamping tools hitherto would crush the step of the rivet sleeve 10 prior to stamping, resulting in lengthening of the rivet sleeve 10 and not strengthening of the first portion.

5 Fig. 3, Fig. 4 and Fig. 5 show three embodiments of a fastening arrangement 68 comprising two components 58, 60 that are connected by the blind rivet 32 from Fig. 1e. The components 58, 60 have bores 62, 64. For the purpose of connection, the blind rivet 32 is inserted into the bores 62, 64 of the components 58, 60, which bores have been aligned. Using a setting tool (not shown) that is supported on the support
10 surface 20 of the blind rivet 32, a tensile force is then exerted on the drawing end 38 of the rivet mandrel 30 and the rivet sleeve 10 is deformed, the tail moving closer to the sleeve head. The first component 58 is arranged so as to be accessible and the second component 60 is arranged behind the first component and so as to be inaccessible.

15

First, the drawing end of the rivet mandrel 30 is drawn, whereupon the rivet sleeve 10 begins to deform and forms a closing head 66. The closing head 66 is formed by bulging of the second portion 28 (or a part of the second portion 28). The closing head 66 forms a flange that is positioned in a planar manner on the component. The
20 closing head 66 rests on the component 60, resulting in an increase in force. The two components 58, 60 are clamped. When the clamping force has reached a specified value, the rivet mandrel 30 is severed at the predetermined breaking point 42 provided for this purpose.

25 In Fig. 3, the two components 58, 60 are clamped against one another by the blind rivet 32. The two components are in contact with one another. Preferably, the bore of the first component has a larger diameter than the bore of the second component. In another embodiment, the diameters of the bores could be the same, or, conversely, the bore of the first component could have a smaller diameter than the
30 bore of the second component.

In Fig. 4 and Fig. 5, the two components are connected so as to have a defined spacing. In particular, the bore of the second component has a smaller diameter than the first portion. The shoulder 28 is supported on the second component 60. The two

components are connected so as to have a defined mutual spacing. The spacing is made possible by the larger diameter of the first portion.

5 The second component 60 and/or the first component can be mechanically deformed in the surroundings of the bore 64 thereof, as shown in Fig. 4 and Fig. 5. The mechanical deformation is a beading, for example. A variable spacing between the two components can thus be achieved along the longitudinal axis X, irrespective of the length of the first region 26. In another embodiment, both components 58, 60 or just the first component 60 can be mechanically deformed. The mechanical
10 deformation can take place in both directions along the longitudinal axis X. In Fig. 4, the second component is substantially deformed at the periphery of the bore, along the longitudinal axis X and in the direction of the sleeve head. In Fig. 5, the second component 60 is deformed at the periphery of the bore, along the longitudinal axis X and in the opposite direction of the sleeve head. The blind rivet from Fig. 1e thus makes
15 it possible to reduce the number of parts in an arrangement of this kind, where the two components 58, 60 are intended to be connected so as to have a spacing. No additional spacer is necessary.

20 This fastening arrangement 68 can also be used to fasten components that consist of different materials.

The components 58, 60 can consist of different materials, such as metals or plastics material or fibre composites (CRP).

CLAIMS

1. Method for producing a blind rivet (32), comprising the steps of:
 - 5 a. providing a rivet sleeve (10) comprising a sleeve head (16) and a sleeve shank (12) that extends along a longitudinal axis (X) from the sleeve head (16) as far as a tail (22), a longitudinal bore (14) extending through the rivet sleeve (10), the sleeve shank (12) comprising a first portion (24) that adjoins the sleeve head (16) and a second portion (26) that adjoins said first portion and extends
10 as far as the tail,
 - b. providing a rivet mandrel (30), the rivet mandrel comprising a mandrel shank (34) having a mandrel head (36),
 - c. passing the rivet mandrel (30) through the longitudinal bore of the rivet sleeve such that the mandrel head (36) is operatively connected to the tail,
 - 15 d. providing a stamping tool (44),
 - e. connecting the rivet mandrel (30) to the rivet sleeve (10) using the stamping tool,
characterised in that
before the rivet mandrel (30) is connected to the rivet sleeve (10), the first
20 portion (24) comprises an outer surface that is offset radially towards the outside, relative to the second portion (26), such that a shoulder (28) is formed between the outer surfaces of the first and second portion (24, 26), and in that the stamping tool (44) comprises a stamping jaw having a first stamping region (50) and a second stamping region (52),
25 the first stamping region (50) interacting with the first portion (24), and the second stamping region (52) interacting with the second portion (26),
the first stamping region (50) strengthening the first portion (24) while the rivet mandrel is being connected to the rivet sleeve, such that the strength of the first portion of the rivet sleeve is increased relative to the strength of the second
30 portion, and the shoulder between the outer surfaces of the first and second portion being maintained after strengthening.
2. Method according to claim 1, wherein the length of the rivet sleeve (10) remains constant before and after strengthening.

3. Method according to either claim 1 or claim 2, wherein a step (56) is formed between the first stamping region and the second stamping region.
4. Method according to any of claims 1 to 3, wherein the second stamping region
5 (52) has a stamping contour that has a shape that is curved outwards in the manner of a barrel in order to produce a shape of the second region (26) that is curved outwards in the manner of a barrel.
5. Method according to any of claims 1 to 4, wherein the longitudinal bore (14)
10 has a constant diameter prior to the connection.
6. Blind rivet (32), in particular produced by means of a method according to any of claims 1-5, for connecting at least two components, said rivet comprising:
 - a rivet sleeve (10) comprising a sleeve head and a sleeve shank that extends
15 along a longitudinal axis from the sleeve head as far as a tail, a longitudinal bore extending through the rivet sleeve, the sleeve shank comprising a first portion that adjoins the sleeve head and a second portion that adjoins said first portion and extends as far as the tail, and
 - a rivet mandrel (30), the rivet mandrel comprising a mandrel shank having a
20 mandrel head, the mandrel head being operatively connected to the tail of the rivet body, the mandrel shank being arranged in the longitudinal bore of the rivet sleeve,
the second portion being designed to deform to a blind head at least in part during a setting process,
25 characterised in that the first portion (24) comprises an outer surface that is offset radially towards the outside, relative to the second portion (26), such that a shoulder (28) is formed between the outer surfaces of the first and second portion (24, 26), and the first portion being plastically deformed at the outer periphery of the sleeve shank in order to increase the strength of said first
30 portion.
7. Blind rivet (32) according to claim 6, wherein the longitudinal bore is formed by a continuous inside wall without any break in the geometry, and wherein the first portion of the rivet sleeve has a larger external diameter than the second portion (26).

8. Blind rivet (32) according to either claim 6 or claim 7, wherein the second portion has a shape that is curved outwards in the manner of a barrel.
9. Blind rivet (32) according to any of claims 6 to 8, wherein the rivet mandrel has a drawing end that can be separated from the mandrel shank, and wherein the mandrel shank and the drawing end are connected by a constricted separating portion that is positioned in the longitudinal bore.
10. Fastening arrangement (68) comprising two components (58, 60) that are connected by means of setting using a blind rivet (32) according to any of claims 6 to 9, said arrangement comprising a first component that is arranged so as to be accessible and a second component that is arranged behind the first component and so as to be inaccessible, the two components comprising mutually aligned bores that are penetrated by the blind rivet, the sleeve head of the blind rivet resting on the first component, the rivet shank of said rivet extending through the bores of the first and second component, and a part of the second portion of the rivet shank of said rivet forming a rivet head that rests on the rear of the second component, such that the two components are interconnected.
11. Fastening arrangement (68) according to claim 10, wherein the bore of the second component has a smaller diameter than the first portion, and wherein the shoulder is supported on the second component such that the two components are connected so as to have a defined mutual spacing.
12. Fastening arrangement (68) according to either claim 10 or claim 11, wherein the second component is mechanically deformed in the surroundings of the bore thereof, such that a variable spacing between the two components can thus be implemented, independently of the length of the first region along the longitudinal axis.
13. Fastening arrangement (68) according to any of claims 10 to 12, wherein the material of the first component is different from the material of the second component.

14. Fastening arrangement (68) according to any of claims 10 to 13, wherein the first component and/or the second component consists of plastics material.

5 15. Stamping tool (44) for producing a blind rivet (32) according to any of claims 6 to 9, wherein the stamping tool comprises a stamping jaw having a first stamping region and a second stamping region, wherein the first stamping region is suitable for interacting with the first portion, and the second stamping region is suitable for interacting with the second portion, and wherein the first stamping region forms a step together with the second stamping region.

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AMENDED CLAIMS

received by the International Bureau on 23 April 2018 (23.04.2018)

1. Method for producing a blind rivet (32), comprising the steps of:
 - 5 a. providing a rivet sleeve (10) comprising a sleeve head (16) and a sleeve shank (12) that extends along a longitudinal axis (X) from the sleeve head (16) as far as a tail (22), a longitudinal bore (14) extending through the rivet sleeve (10), the sleeve shank (12) comprising a first portion (24) that adjoins the sleeve head (16) and a second portion (26) that adjoins said first portion and extends
10 as far as the tail,
 - b. providing a rivet mandrel (30), the rivet mandrel comprising a mandrel shank (34) having a mandrel head (36),
 - c. passing the rivet mandrel (30) through the longitudinal bore of the rivet sleeve such that the mandrel head (36) is operatively connected to the tail,
 - 15 d. providing a stamping tool (44),
 - e. connecting the rivet mandrel (30) to the rivet sleeve (10) using the stamping tool,
characterised in that
before the rivet mandrel (30) is connected to the rivet sleeve (10), the first
20 portion (24) comprises an outer surface that is offset radially towards the outside, relative to the second portion (26), such that a shoulder (28) is formed between the outer surfaces of the first and second portion (24, 26), and in that the stamping tool (44) comprises a stamping jaw having a first stamping region (50) and a second stamping region (52),
25 the first stamping region (50) interacting with the first portion (24), and the second stamping region (52) interacting with the second portion (26),
the first stamping region (50) strengthening the first portion (24) while the rivet mandrel is being connected to the rivet sleeve, such that the strength of the first portion of the rivet sleeve is increased relative to the strength of the second
30 portion, and the shoulder between the outer surfaces of the first and second portion being maintained after strengthening.
2. Method according to claim 1, wherein the length of the rivet sleeve (10) remains constant before and after strengthening.

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3. Method according to either claim 1 or claim 2, wherein a step (56) is formed between the first stamping region and the second stamping region.
4. Method according to any of claims 1 to 3, wherein the second stamping region (52) has a stamping contour that has a shape that is curved outwards in the manner of a barrel in order to produce a shape of the second region (26) that is curved outwards in the manner of a barrel.
5. Method according to any of claims 1 to 4, wherein the longitudinal bore (14) has a constant diameter prior to the connection.
6. Blind rivet (32), in particular produced by means of a method according to any of claims 1-5, for connecting at least two components, said rivet comprising:
- a rivet sleeve (10) comprising a sleeve head and a sleeve shank that extends along a longitudinal axis from the sleeve head as far as a tail, a longitudinal bore extending through the rivet sleeve, the sleeve shank comprising a first portion that adjoins the sleeve head and a second portion that adjoins said first portion and extends as far as the tail, the first portion being plastically deformed at the outer periphery of the sleeve shank in order to increase the strength of said first portion, and
 - a rivet mandrel (30), the rivet mandrel comprising a mandrel shank having a mandrel head, the mandrel head being operatively connected to the tail of the rivet body, the mandrel shank being arranged in the longitudinal bore of the rivet sleeve,
- the second portion being designed to deform to a blind head at least in part during a setting process,
- characterised in that the first portion (24) comprises an outer surface that is offset radially towards the outside, relative to the second portion (26), such that a shoulder (28) is formed between the outer surfaces of the first and second portion (24, 26), , such that the strength of the first portion of the rivet sleeve is increased relative to the strength of the second portion.
7. Blind rivet (32) according to claim 6, wherein the longitudinal bore is formed by a continuous inside wall without any break in the geometry, and wherein the

first portion of the rivet sleeve has a larger external diameter than the second portion (26).

8. Blind rivet (32) according to either claim 6 or claim 7, wherein the second
5 portion has a shape that is curved outwards in the manner of a barrel.
9. Blind rivet (32) according to any of claims 6 to 8, wherein the rivet mandrel has
a drawing end that can be separated from the mandrel shank, and wherein the
mandrel shank and the drawing end are connected by a constricted separating
10 portion that is positioned in the longitudinal bore.
10. Fastening arrangement (68) comprising two components (58, 60) that are
connected by means of setting using a blind rivet (32) according to any of
claims 6 to 9, said arrangement comprising a first component that is arranged
15 so as to be accessible and a second component that is arranged behind the
first component and so as to be inaccessible, the two components comprising
mutually aligned bores that are penetrated by the blind rivet, the sleeve head
of the blind rivet resting on the first component, the rivet shank of said rivet
extending through the bores of the first and second component, and a part of
20 the second portion of the rivet shank of said rivet forming a rivet head that rests
on the rear of the second component, such that the two components are
interconnected.
11. Fastening arrangement (68) according to claim 10, wherein the bore of the
25 second component has a smaller diameter than the first portion, and wherein
the shoulder is supported on the second component such that the two
components are connected so as to have a defined mutual spacing.
12. Fastening arrangement (68) according to either claim 10 or claim 11, wherein
30 the second component is mechanically deformed in the surroundings of the
bore thereof, such that a variable spacing between the two components can
thus be implemented, independently of the length of the first region along the
longitudinal axis.

13. Fastening arrangement (68) according to any of claims 10 to 12, wherein the material of the first component is different from the material of the second component.
- 5 14. Fastening arrangement (68) according to any of claims 10 to 13, wherein the first component and/or the second component consists of plastics material.
- 10 15. Stamping tool (44) for producing a blind rivet (32) according to any of claims 6 to 9, wherein the stamping tool comprises a stamping jaw having a first stamping region and a second stamping region, wherein the first stamping region is suitable for interacting with the first portion, and the second stamping region is suitable for interacting with the second portion, and wherein the first stamping region forms a step together with the second stamping region.
- 15

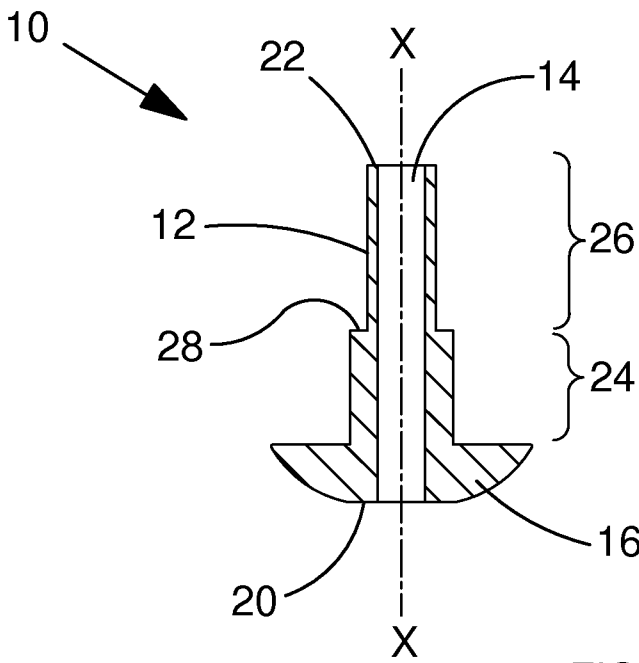


FIG. 1a

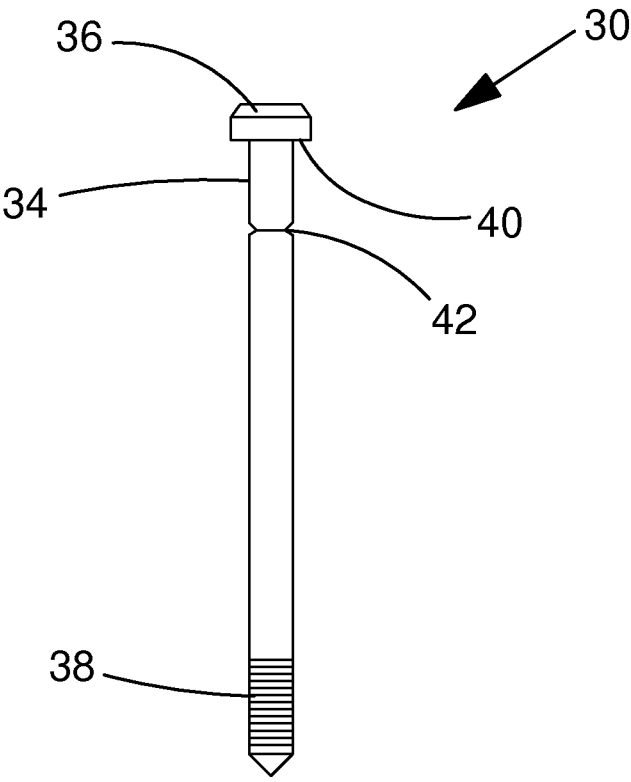
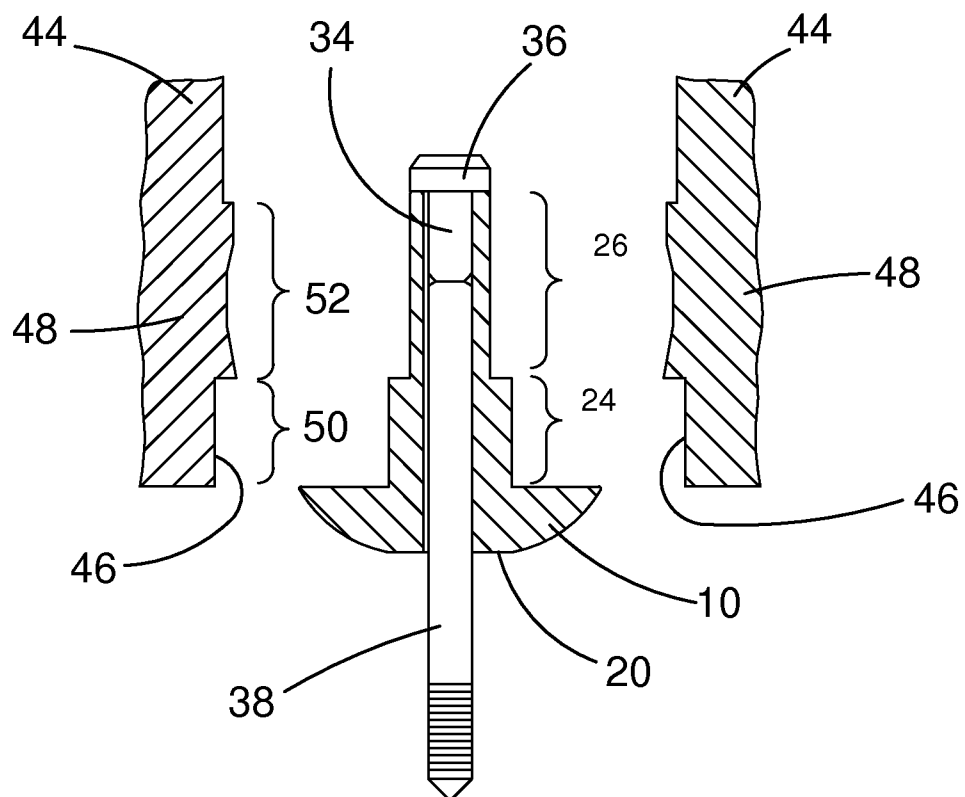
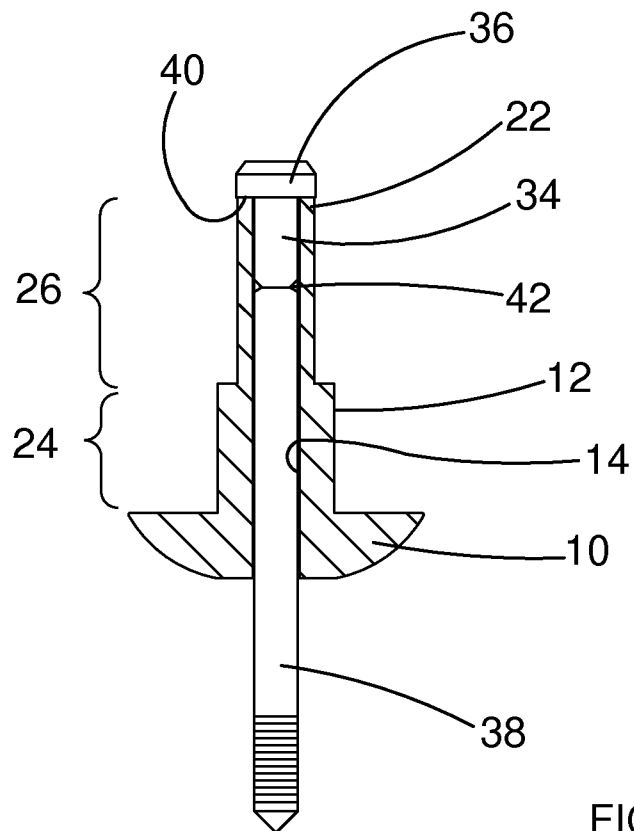
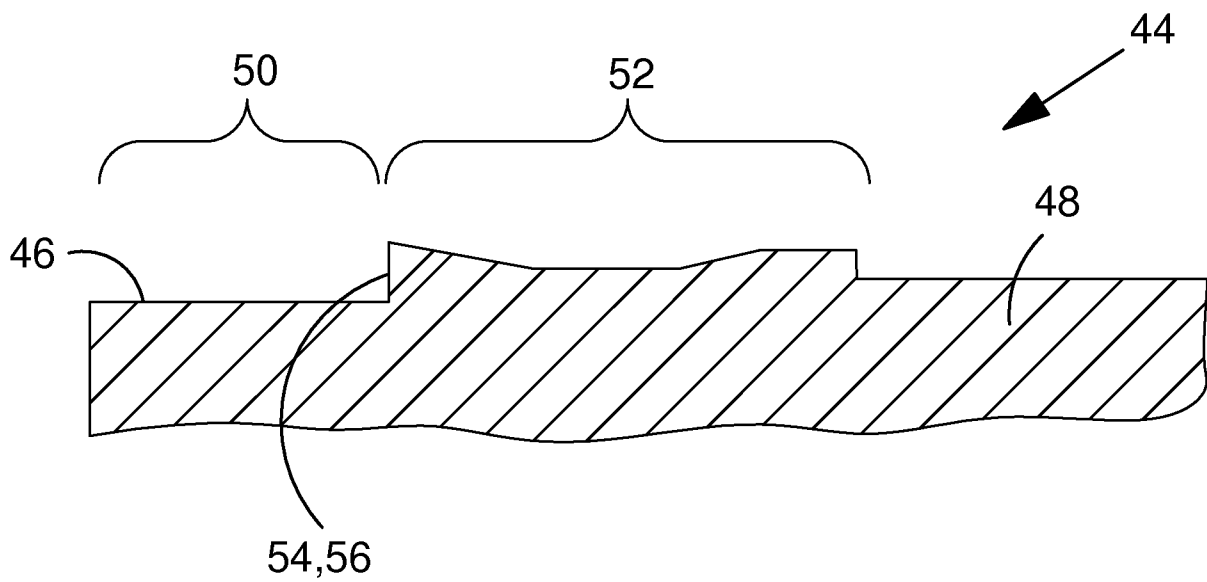
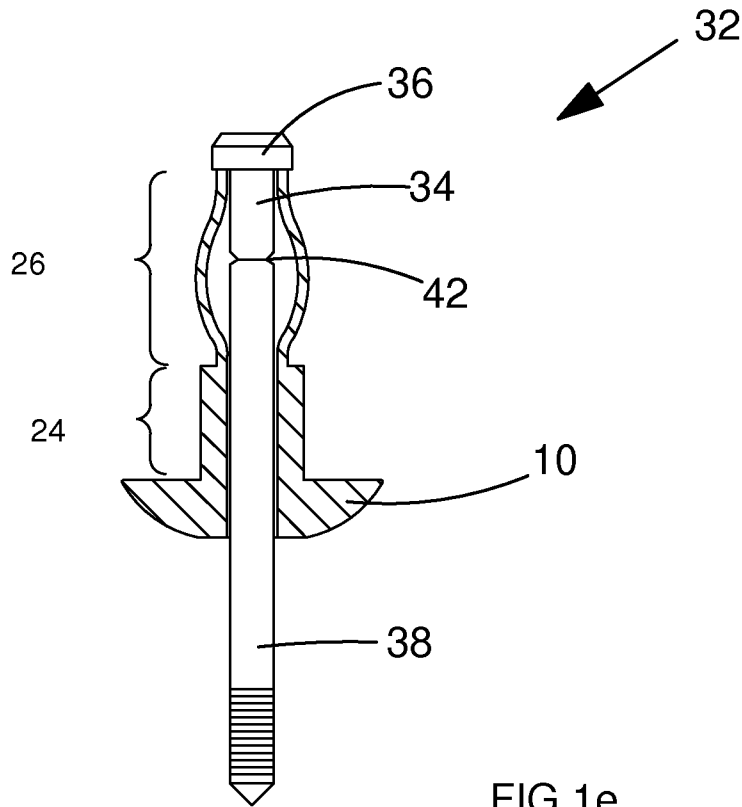


FIG. 1b

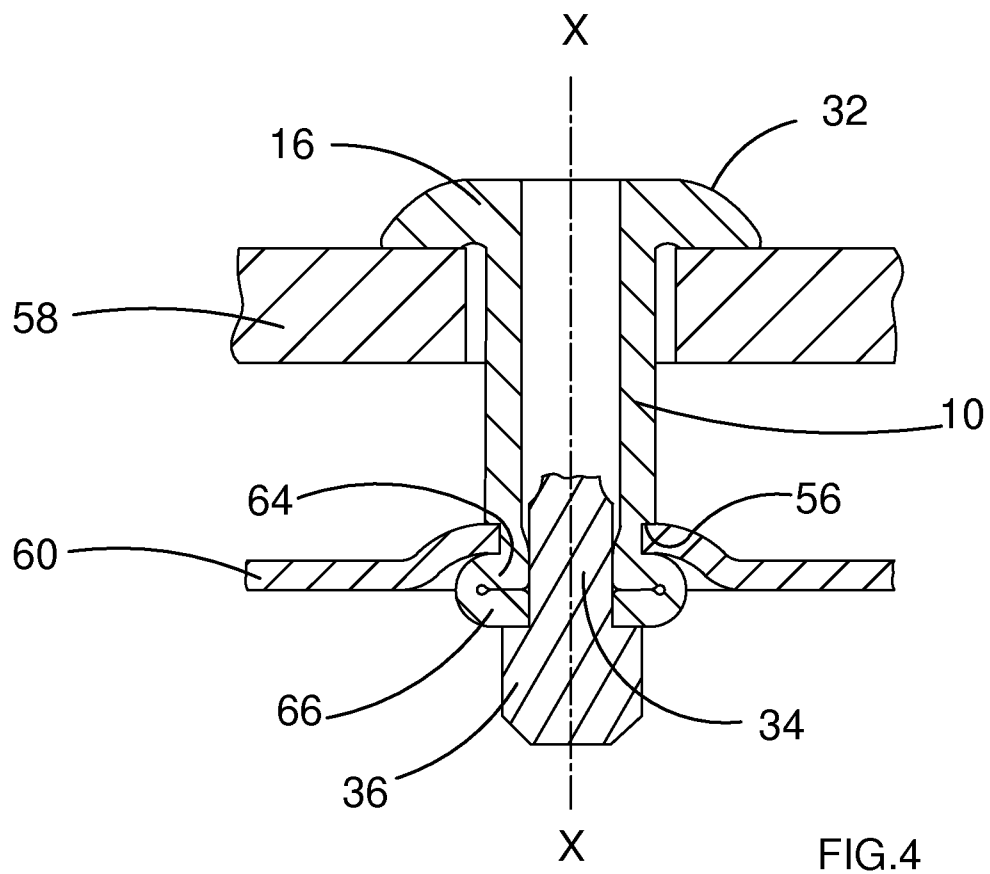
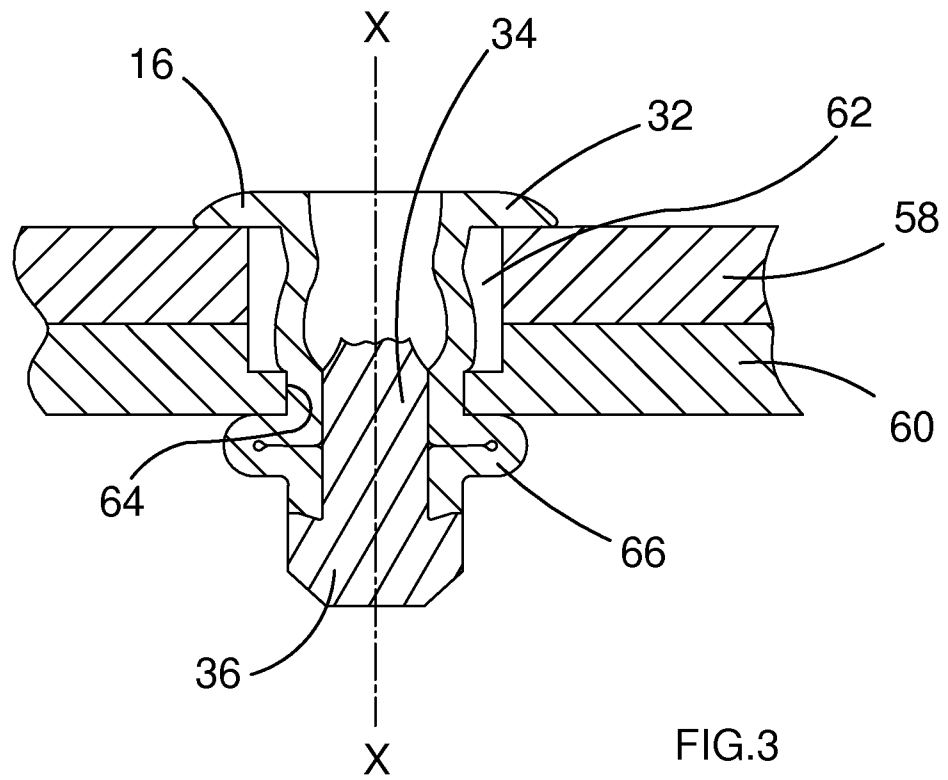
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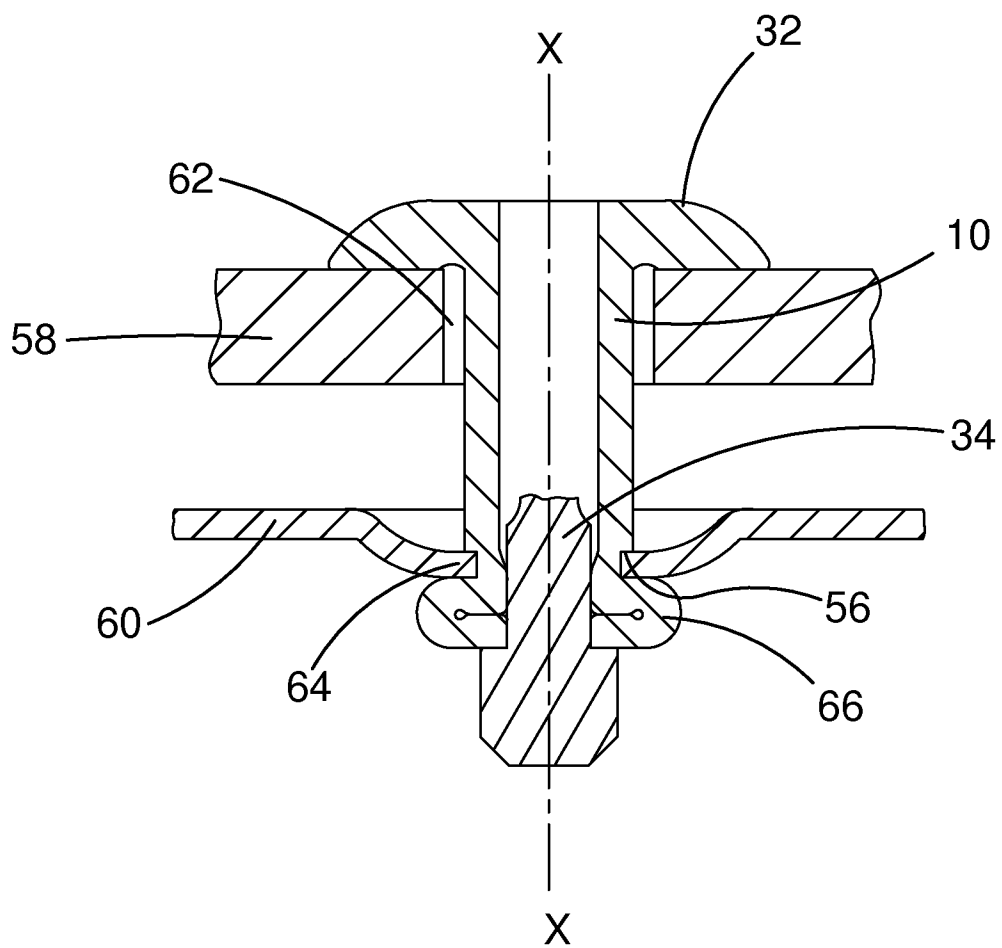


FIG.5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/052800

A. CLASSIFICATION OF SUBJECT MATTER
INV. B21K1/60 F16B19/10
ADD. B21J15/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B21K F16B B21J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 00/68583 A1 (BERGNER VERBINDUNGSTECHNIK GMB [DE]; DEHLKE KLAUS [DE]) 16 November 2000 (2000-11-16) page 3, line 7 - line 10 page 4, line 29 - page 6, line 25 page 8, line 20 - page 10, line 22; claims 1,8,12; figures 1-4 ----- -/-	1,6,10



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

27 March 2018

Date of mailing of the international search report

06/04/2018

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/052800

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Information on patent family members

International application No

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