A bolt for fastening a component to a base material 20 has a flange 12 for supporting the component, a first pin 14 which is formed on a first side of the flange 12 and is provided with a thread, and a second pin 16 formed on a second side of the flange 12. The second pin 16 is suitable to be fitted into a bore 21 formed in the base material 20. The second pin 16 is fittable by means of a plug-in adhesive connection into the bore 21 formed in the base material 20.
Bolt, method and bolt arrangement for fastening a component to a base material

The present invention relates to a bolt, a method and a bolt arrangement for fastening a component to a base material.

A multiplicity of bolts for fastening a component to a base material are known in automobile manufacturing. If the base material is, for example, a steel or aluminum sheet, there is the possibility of using welding bolts. Such a welding bolt is placed onto a surface of the sheet and is welded to the sheet at a flange.

If the base material is formed by a carbon-fiber-reinforced plastic, there is the possibility of using adhesive bolts. The respective adhesive bolt is positioned on the base material by means of a template. The latter is placed on by hand by a user. The bolt is subsequently adhesively bonded to the base material by means of a bolt-gluing apparatus. The bolt-gluing apparatus has to be kept in position by the user during the setting time, since otherwise the bolt may swim.

Against this background, the present invention seeks to provide an improved bolt, an improved method and an improved bolt arrangement for fastening a component to a base material, said bolt, method and bolt arrangement making possible a reduced setting time per bolt, more accurate positioning of the bolt and improved load-bearing capacity of the bolt for fastening a component to a base material. An aspect of a bolt with the features of patent claim 1, by a method with the features of patent claim 7 and by a bolt arrangement with the features of patent claim 12.

An aspect of the invention accordingly provides a bolt for fastening a component to a base material. The bolt has a flange for supporting the component, a first pin which is formed on a first side of the flange and is provided with a thread, and a second pin formed on a second side of the flange. Furthermore, it is conceivable to provide alternative fastening connections, such as, for example, mushroom shapes or slotted clamps, instead of threaded connections. The second pin is suitable to be fitted into a bore formed in the base material, wherein the second pin is fittable by means of a plug-in adhesive connection into the bore formed in the base material.
In contrast to the use of a template, forming a bore in the base material permits more accurate positioning of the bolt on the base material. By means of the provision of the second pin on the second side of the flange, which pin is fittable by means of the plug-in adhesive connection into the bore formed in the base material, a setting time can be reduced. In contrast to known solutions, provision of the bore means that the bolt cannot swim during a curing operation. The setting time of the bolt is therefore limited to an application of adhesive and to an insertion or fitting of the bolt into the bore.

For example, provision is made for the second pin to have a knurled portion or a surface suitable for adhesive bonding, wherein a respective flank of the knurled portion has an angle of 20 to 40°, preferably of 25 to 35°. The acute-angle formation of the knurled portion therefore provides the second pin with a relatively large surface. As a result, during the adhesive bonding of the second pin of the bolt to the bore of the base material, a loadable, integrally bonded connection can be produced between the bolt and the base material.

According to a further preferred refinement, provision is made for the respective flank of the second pin to have a first limb formed substantially parallel to the flange and a second limb formed obliquely with respect to the flange, wherein the second pin is of cylindrical design, and the respective flank in the region of the first limb has a larger diameter than in the region of the second limb, and the second limb extends in a direction facing away from the flange.

By means of the formation of the respective flanks of the second pin with first limbs formed substantially parallel to the flange and second limbs formed obliquely with respect to the flange, it is possible, during the fitting of the bolt into the bore of the base material, for, for example, an adhesive to be transported by the flanks into an inner region of the bore.

According to a further preferred exemplary embodiment, provision is made for the flange to be of cylindrical design, and for a cylindrical section formed concentrically on the flange to be arranged on the second side of the flange, wherein the cylindrical section has a smaller diameter than the flange.

By providing the cylindrical section formed, for example, concentrically with the flange on the second side of the flange, when the flange makes contact with the base material, an adhesive gap is formed, wherein the adhesive gap is formed between a circumferential section of the cylindrical section and a circumferential section of the flange. Of course, the adhesive gap may also be realized in another
manner and, for example, depending on the manufacturing, may be realized by means of a spacer stud or a cross recess. Upon provision of the adhesive in the adhesive gap, the adhesive gap enables an integrally bonded connection to be provided between the bolt and the base material.

According to a further preferred exemplary embodiment, provision is made for the cylindrical section to have a thickness of 0.2 mm to 0.4 mm, preferably of 0.25 mm to 0.35 mm. This is sufficient in order, when the adhesive is applied, to permit an integrally bonded connection between the bolt and the base material.

Furthermore, provision is preferably made for the bolt to be formed from stainless steel, a coated steel or aluminum or from a fiber-reinforced plastic. The formation of the bolt from stainless steel avoids contact corrosion between the bolt and base material. When the bolt is formed from a fiber-reinforced plastic, the bolt can advantageously be produced as an injection molded part.

The invention furthermore provides a method for fastening a bolt to a base material. The method comprises introducing a bore into the base material, applying an adhesive in the region of a border of the bore and fitting the bolt into the bore. The bolt has a flange, a first pin which is formed on a first side of the flange and is provided with a thread, and a second pin formed on a second side of the flange. The second pin of the bolt is advantageously fitted into the bore by means of a plug-in adhesive connection.

By providing the second pin on the second side of the flange, which pin is fitted by means of the plug-in adhesive connection into the bore formed in the base material, a setting time can be reduced. In contrast to known solutions, provision of the bore means that the bolt cannot swim during a curing operation. The setting time of the bolt is therefore limited to an application of adhesive and an insertion or fitting of the bolt into the bore.

Provision is furthermore preferably made for, when the bolt is fitted into the bore, a knurled portion formed on the second pin to fit at least some of the adhesive applied in the region of the border of the bore into the bore at the same time. Corresponding flanks of the knurled portion transport the adhesive from the border of the bore onto an inner region of the bore, wherein the adhesive provides an integrally bonded connection between the second pin and the bore.
According to an advantageous development of the invention, provision is made for, when the cylindrical section makes contact with the base material, at least some of the adhesive applied in the region of the border of the bore to be displaced in such a manner that the adhesive is arranged in an adhesive gap, wherein the adhesive gap is formed between a circumferential section of a cylindrical section formed concentrically on the flange on the second side of the flange and a circumferential section of the flange of cylindrical design, wherein the cylindrical section has a smaller diameter than the flange.

Upon provision of the adhesive in the adhesive gap, the adhesive gap makes it possible to provide an integrally bonded connection between the bolt and the base material.

According to a further preferred refinement, provision is made for the adhesive to be formed by a single- or two-component adhesive. A curing time of the adhesive can be reduced as a result.

According to a further preferred exemplary embodiment, provision is made for the bore to be introduced into the base material by a CNC device. This permits more accurate positioning of the bore on the base material.

The invention furthermore provides a bolt arrangement for fastening a component to a base material. The bolt arrangement has the bolt according to the invention and a base material, wherein the second pin of the bolt is fitted by means of a plug-in adhesive connection into a bore formed in the base material.

In contrast to the use of a template, by forming a bore in the base material, the bolt can be positioned more accurately on the base material. By providing the second pin on the second side of the flange, said pin being fittable by means of the plug-in adhesive connection into the bore formed in the base material, a setting time can be reduced. In contrast to known solutions, provision of the bore means that the bolt cannot swim during a curing operation. The setting time of the bolt is therefore limited to an application of adhesive and to an insertion or fitting of the bolt into the bore.

According to a further preferred exemplary embodiment, provision is made for the bolt, in particular the second pin of the bolt, to be fitted into the bore by means of an interference fit. This additional interlocking connection advantageously increases the load-bearing capacity of the bolt with respect to bending and shearing forces.
Provision is preferably furthermore made for the base material to be formed by a carbon-fiber-reinforced plastic. By providing the bolt with the second pin which is formed on the second side of the flange and is fittable into the bore of the base material, the bolt is therefore insensitive to small unevennesses, such as may occur on the unmold side of laminar components.

Provision is preferably made, according to a further exemplary embodiment, for the base material to be formed by a body component or a composite fiber component of a motor vehicle. The plug-in adhesive connection of the bolt to the base material can therefore provide a stronger connection to the base material, in particular with respect to shearing and bending forces of the bolt.

Exemplary embodiments of the invention are illustrated in the figures of the drawings and are explained in more detail in the description below, in which:

fig. 1 shows a schematic illustration of a bolt for fastening a component to a base material according to a preferred exemplary embodiment; and

fig. 2 shows a schematic illustration of a bolt arrangement for fastening a component to a base material according to a preferred exemplary embodiment.

Fig. 1 shows a schematic illustration of a bolt for fastening a component to a base material according to a preferred exemplary embodiment.

The bolt 10 has a flange 12, a first pin 14 and a second pin 16.

The flange is preferably of cylindrical design and serves to support the component which is to be fastened to the bolt. The first pin 14 is formed on a first side of the flange 12. The first pin 14 is formed in particular perpendicularly to the flange 12 and is provided with a thread. In the present exemplary embodiment, the thread is formed by a coarse thread.

Alternatively, the use of other suitable threads, for example a symmetrical thread or a pine-tree thread, is likewise possible.
The second pin 16 is formed on a second side of the flange 12. The second pin 16 is formed in particular perpendicularly to the flange 12. The second pin 16 furthermore has a knurled portion 16a. A respective flank 17 of the knurled portion 16a preferably has an angle of 30°. However, the angle of the respective flank may alternatively likewise be formed within a range of 20° to 40°.

The respective flank 17 of the second pin 16 has a first limb 17a formed substantially parallel to the flange and a second limb 17b formed obliquely with respect to the flange 12, wherein the second pin 16 is of cylindrical design, and the respective flank has a larger diameter in the region of the first limb 17a than in the region of the second limb 17b, and the second limb 17b extends in a direction facing away into the flange.

Furthermore, a cylindrical section 18 formed concentrically with the flange is arranged on the second side of the flange 12. The cylindrical section 18 has a smaller diameter than the flange 12. As a result, upon the bolt 10, in particular the flange 12 of the bolt 10, making contact with the base material 20, an adhesive gap is provided.

The cylindrical section 18 and the adhesive gap provided by means of the cylindrical section 18 has a thickness of 0.3 mm. Alternatively, the cylindrical section 18 can likewise have a thickness within the range of 0.2 mm to 0.4 mm. The bolt is preferably formed from stainless steel or a fiber-reinforced plastic.

Fig. 2 shows a bolt arrangement for fastening a component to a base material 20 according to a preferred exemplary embodiment.

The bolt arrangement comprises the bolt 10 and the base material 20. According to the illustration of fig. 2, the bolt 10, in particular the second pin 16 of the bolt 10, is fitted by means of a plug-in adhesive connection into a bore 21 formed in the base material 20.

The bolt 10, in particular the second pin 16 of the bolt 10, is fitted into the bore 21 by means of an interference fit. The base material 20 is formed by a carbon-fiber-reinforced plastic. The base material 20 is preferably formed by a body component or a composite fiber component of a motor vehicle.

The fastening of the bolt 10 to the base material 20 preferably comprises introducing the bore 21 into the base material 20, applying an adhesive 22 to the base material in the region of a border of the bore,
and inserting a bolt into the bore 21, wherein the second pin 16 of the bolt is fitted into the bore 21, and the cylindrical section 18 forms contact with the base material 20.

When the bolt 10 is fitted into the bore 21, the second pin 16 is designed in such a manner that the knurled portion 16a formed on the second pin 16 fits at least some of the adhesive 22 applied in the region of the border of the bore 21 into the bore 21 at the same time.

Furthermore, after the bolt 10 is fitted into the bore 21, in particular when a cylindrical section 18 of the bolt 10 makes contact with the base material 20, the adhesive 22 applied in the region of the border of the bore 21 is displaced in such a manner that the adhesive 22 is arranged in an adhesive gap, wherein the adhesive gap is formed between a circumferential section 18a of the cylindrical section 18 formed concentrically on the flange 12 on the second side of the flange 12 and a circumferential section 12a of the flange 12 of cylindrical design, wherein the cylindrical section 18 has a smaller diameter than the flange 12. The adhesive 22 is preferably formed by a two-component adhesive. The bore 21 is introduced into the base material 20 in an advantageous manner by a CNC device.

The invention is not restricted to the above exemplary embodiment. Within the scope of protection, the bolt according to the invention, the method according to the invention and the bolt arrangement according to the invention for fastening a component to a base material may rather also take on a different embodiment to the one specifically described above. For example, different types of flange shapes are conceivable, for example a flange provided with a curvature, in order, when the flange is fastened to a base material formed with a curvature, to provide a supporting surface of the flange on the base material.
Patent claims

1. A bolt for fastening a component to a base material, comprising:
a flange for supporting the component;
a first pin which is formed on a first side of the flange and is provided with a thread; and
a second pin which is formed on a second side of the flange and is suitable to be fitted into a
bore formed in the base material, wherein the second pin is fittable by means of a plug-in
adhesive connection into the bore formed in the base material.

2. A bolt as claimed in claim 1, wherein the second pin has a knurled portion, wherein a
respective flank of the knurled portion has an angle of 20° to 40°, preferably of 25° to 35°.

3. A bolt as claimed in claim 2, wherein the respective flank of the second pin has a first limb
formed substantially parallel to the flange and a second limb formed obliquely with respect to
the flange, wherein the second pin is of cylindrical design, and the respective flank in the region
of the first limb has a larger diameter than in the region of the second limb, and the second limb
extends in a direction facing away from the flange.

4. A bolt as claimed in one of the preceding claims, wherein the flange is of cylindrical design, and
a cylindrical section formed concentrically with the flange on the flange is arranged on the
second side of the flange, wherein the cylindrical section has a smaller diameter than the
flange.

5. A bolt as claimed in claim 4, wherein the cylindrical section has a thickness of 0.2 mm to
0.4 mm, preferably of 0.25 mm to 0.35 mm.

6. A bolt as claimed in one of the preceding claims, wherein the bolt is formed from stainless steel
or from a fiber-reinforced plastic.

7. A method for fastening a bolt to a base material, comprising the following steps:
introducing a bore into the base material;
applying an adhesive in the region of a border of the bore;
fitting the bolt into the bore, wherein the bolt has a flange, a first pin which is formed on a first side of the flange and is provided with a thread, and a second pin formed on a second side of the flange, and wherein the second pin of the bolt is fitted into the bore by means of a plug-in adhesive connection.

8. A method as claimed in claim 7, wherein, when the bolt is fitted into the bore, a knurled portion formed on the second pin fits at least some of the adhesive applied in the region of the border of the bore into the bore at the same time.

9. A method as claimed in claim 7 or 8, wherein, when a cylindrical section makes contact with the base material, at least some of the adhesive applied in the region of the border of the bore is displaced in such a manner that the adhesive is arranged in an adhesive gap, wherein the adhesive gap is formed between a circumferential section of the cylindrical section formed concentrically on the flange on the second side of the flange and a circumferential section of the flange of cylindrical design, and wherein the cylindrical section has a smaller diameter than the flange.

10. A method as claimed in one of claims 7 to 9, wherein the adhesive is formed by a two-component adhesive.

11. A method as claimed in one of claims 7 to 10, wherein the bore is introduced into the base material by a CNC device.

12. A bolt arrangement for fastening a component to a base material, comprising:

   a bolt according to one of claims 1 to 6; and

   a base material, wherein the second pin is fitted by means of a plug-in adhesive connection into a bore formed in the base material.

13. A bolt arrangement as claimed in claim 12, wherein the bolt, in particular the second pin of the bolt, is fitted into the bore by means of an interference fit.

14. A bolt arrangement as claimed in claim 12 or 13, wherein the base material is formed by a carbon-fiber-reinforced plastic.
15. A bolt arrangement as claimed in one of claims 12 to 14, wherein the base material is formed by a body component or a composite fiber component of a motor vehicle.

16. A bolt, substantially as hereinbefore described with reference to any of one of the accompanying drawings.

17. A method for fastening a bolt to a base material, substantially as hereinbefore described with reference to any one of the accompanying drawings.

18. A bolt arrangement, substantially as hereinbefore described with reference to any one of the accompanying drawings.
**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

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<th>Category</th>
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| X        | 1, 12, 13         | GB 1494364 A  
(ILLINOIS TOOL WORKS) whole document relevant |
| X        | 1, 12, 13         | GB 1382655 A  
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**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC XD:

- Worldwide search of patent documents classified in the following areas of the IPC
- F16B

The following online and other databases have been used in the preparation of this search report:

- WPI, EPDOC

**International Classification:**

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