

Fastening device

The invention relates to a fastening device for anchorages in massive bases or materials, e.g. concrete, brick, steel or the like, consisting of a screw, which has a thread part and a shaft part with a recess formed at the free end for the insertion of a tool and consisting of a sleeve having an external thread, said sleeve having a radially enlarged rim portion, in which means are formed for the placement of a second tool, the sleeve being able to be pushed onto the shaft part, being rotatable on the shaft part and being held in the axial direction in such a manner that the screw and/or the sleeve can be rotated.

Such a fastening device is known from EP 0 476 466. In the known embodiment, the sleeve can be mounted onto the shaft part from the free shaft end and is held on the shaft part by means of a collar on the shaft at the one end and by means of a beaded over section of the shaft at the other hand. This type of fixation of the sleeve on the shaft part by means of beading over the free shaft end in a cold process requires a certain steel alloy, which cannot be hardened. The known screw can thus not have a hardened thread with a cutting function and can thus not be used for a direct installation in hard materials, such as concrete, brick and metal.

The invention is intended to provide a solution for this problem. The invention is based on the object of providing a fastening device, which can be screwed directly into concrete, brick, steel or the like.

A first solution of this problem lies in a fastening device of the initially named kind which is characterized in that the screw is formed by means of a rod-shaped screw blank made of steel, which can be hardened and

which has a radially enlarged head section formed at the free end of the shaft part, in that the sleeve can be mounted onto the screw blank from the other end and has in its rim portion a seat, which can be placed against a head section of the shaft part, in that the shaft part (3; 23) is
5 designed with a support section, which is enlarged towards the end of the mounted sleeve located opposite the rim portion by deformation of the screw blank so as to hold the sleeve on the shaft part and in that the screw is specified for hardening with the mounted sleeve.

10 A second solution of this problem lies in a fastening device, which is characterized in that the screw is made of hardened steel, in that the shaft part has a ring-shaped groove, in that the sleeve, at the end located opposite the rim portion, has an inwardly directed ring-shaped projection, which engages with the groove so as to hold the sleeve on the shaft part.

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Further developments and/or advantageous embodiments of the fastening device are the subject of the further claims 2 to 5 and a method of manufacturing a fastening device is the subject of claims 6.

20 The invention will be explained in the following with reference to the accompanying drawings, in which:

Fig. 1 shows a longitudinal section of a first embodiment of the fastening device;

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Fig. 2 shows a longitudinal section of a second embodiment of the fastening device;

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Fig. 3 shows a longitudinal section of a third embodiment of the fastening device;

Fig.4 a diagram similar to Fig. 1 but showing an alternative design
5 of the pre-cutting edges;

Fig. 5 a diagram similar to Fig. 2 but showing an alternative design of the precutting edges,

10 Fig. 6 a diagram similar to Fig. 2 but showing an alternative design of the support section.

The embodiment illustrated in Figure 1 consists of a screw 1 having a
thread part 2 and a shaft part 3, which has a recess 4 at the free end for
15 inserting a non-illustrated tool and also has a sleeve 6, which is arranged on the shaft part. As illustrated, the recess 4 can be formed as an internal hexagon or as torx recess or cross-shaped slot.

The sleeve 6 has an external thread 7, the pitch of which is the same as
20 that of the thread part 2 of the screw 1 and has at one end a radially enlarged rim portion 8 provided with slots 9, for engagement by a non-illustrated second tool. According to the illustration, the rim portion 8 can have a diameter, which substantially corresponds to the diameter of the external thread 7 of the sleeve 6.

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The screw 1 is made of steel, which can be hardened and is formed by a rod-shaped cylindrical screw blank, the diameter of which substantially corresponds to the core diameter of the thread, which is to be generated at the thread part 2 and which is designed with a radially enlarged head
30 section 5 formed at the free end of the shaft part 3 remote from the tip 48

of the screw 1. A conical support surface 11 for the sleeve 6 is formed at the head section 5. The sleeve 6 can be mounted onto the shaft part 3 over the still unprocessed thread part 2 from the other end of the screw blank. The rim portion 8 of the sleeve is designed with a conical step, which receives the head section 5 of the shaft part and which can be placed onto the support surface 11. The sleeve 6 can be made of steel, which cannot be hardened, or is not intended to be hardened, as is assumed in the illustrated example.

- 10 The shaft part 3 is designed with a support section 10, which can be generated by means of deforming the screw blank and which is enlarged towards the end of the mounted sleeve 6 adjacent the thread part 2 so as to hold the sleeve 6 on the shaft part 3. In accordance with the illustration, the support section 10 is formed by means of at least one thread turn
- 15 generated at the screw blank. At least two scraper grooves 12, which are associated with the sleeve 6, can be provided at the thread turn. In the illustrated example, three scraper grooves 12, which are offset from one another in the peripheral direction, are present.
- 20 At the end of the sleeve 6, which is located opposite the rim portion 8 at least two first precutting edges 14, in the illustrated example four precutting edges 14 are provided, which are directed towards the support section 10 and which are each formed at a cut-out 15. More specifically, the first precutting edges 14 lie on the surface of a cone in axial planes containing
- 25 the longitudinal axis of the screw 1. Alternatively they could be generally helically disposed on or skewed relative to the surface of said cone.

- The sleeve 6 is furthermore provided with at least two second precutting edges 16, in the illustrated example four precutting edges 16, which face
- 30 the external thread 7 and each of which is formed at a cut-out 17 on the

conical wall section of the rim portion 8. The second precutting edges 16 are designed to cut a hole in the attachment part 18 to receive the enlarged rim portion of the sleeve 6. The hole has a diameter generally corresponding to that of the enlarged core diameter of the sleeve 6. The second
 5 precutting edges 16 preferably lie on the surface of a cone in axial planes containing the longitudinal axis of the screw 1 or are, alternatively, generally helically disposed on or skewed relative to the surface of said cone.

When such a helical or skewed position is selected the front or leading
 10 ends of the first or second precutting edges, i.e. the ends nearest the tip of the thread part 2, are preferably advanced in the direction of the thread, when moving along the thread to the tip 48 of the screw, relative to the rear or trailing ends, i.e. the ends closest to the end of the fastening device engaged by the first or second tool. This preferred orientation applies to all
 15 precutting or cutting edges in all embodiments of the fastening device. The support section 10 of the shaft part 3 equipped with the sleeve 6 and the thread of the thread part 2 can be generated at the screw blank in each case in a separate rolling process or, as assumed in the illustrated embodiment, in a common rolling process. In a subsequent operation, the
 20 screw 1 produced in such a manner and equipped with the sleeve 6 is hardened. In a further operation, the screw 1 can be provided with a galvanic coating as corrosion protection at least in the region of the thread part 2 and, if required, in the region of the support part 10.

25 As is illustrated in Figure 1, the sleeve 6 is rotatably held on the shaft part 3, on the one hand by means of the support surface 11 of the shaft part 3 and, on the other hand by means of the support section 10 and is held in the axial direction in such a manner that the screw 1 and the sleeve 6 can be rotated together or individually by means of the two associated tools.

The described fastening device has the purpose of being screwed directly, i.e. without the use of a dowel, into concrete, brick, steel or the like. The illustrated embodiment serves the purpose of fastening a partially illustrated attachment part 18, which is made of wood, to a support part 19,

5 which is made of concrete and which is also illustrated partially. The screw 1, which is equipped with the sleeve 6, is screwed in this arrangement into a bore, which is introduced into the support part 19 through the attachment part 18. The diameter of the bore corresponds to the core diameter of the thread part 2. When the support section 10 of the shaft
10 part 3 strikes against the outside of the attachment part 18, the section of the hole penetrating the attachment part 18 is enlarged in response to the joint further rotation of the screw 1 and of the sleeve 6 by means of the scraper grooves 12 formed at the support section 10 and by means of the first precutting edges 14 formed at the end of the sleeve 6, in each case to
15 a diameter, which corresponds to the core diameter of the external thread 7 of the sleeve 6 and which thus makes it possible to screw the sleeve 6 into the attachment part 18 in an easier manner. When the rim portion 8 of the sleeve 6 strikes against the outside of the attachment part 18, the bore formed by means of the first precutting edges 14 is enlarged in re-
20 sponse to the further rotation of the screw 1 and of the sleeve 6 by means of the second cutting edges 17 formed at the sleeve 6, in each case to a diameter, which corresponds to the diameter of the rim portion 8 and which thus makes it possible to mount the fastening device so as to be flush with the outside of the attachment part 18.

25 Generally speaking a preferred method of manufacturing the fastening device of Fig. 1, which can also be used to manufacture the fastening device of Fig. 2, is as follows:

A generally rod-shaped blank is used for a screw such as is shown in Fig. 1 (or Fig. 2) which has a thread part 2 and a shaft part 3 and is made of a hardenable material, preferably of a material hardenable to a level permitting direct thread forming action in at least one of prebored concrete, pre-bored brick and pre-bored steel. A head portion 5 including a tool receiving feature 4 is formed at the end of the shaft portion remote from the end of the screw blank which will later correspond to the tip of the thread part. The head portion is enlarged relative to the core diameter of said thread part 2. The pre-manufactured threaded sleeve 6 is subsequently placed over said the shaft part from the tip end of said blank, i.e. the end corresponding to the tip of the subsequent thread of said thread part 2. Thereafter a sleeve retaining portion 10 is subsequently formed on the screw part adjacent said front end of said sleeve, i.e. the end of the sleeve adjacent the aforementioned tip. The thread is subsequently or simultaneously formed on the thread part 2 and the screw 1 is then hardened.

In the further figures of the drawings, corresponding parts are provided, where appropriate, i.e. where the parts remain essentially unchanged, with the same reference numerals as used in the earlier figures and the same description will be understood to apply, unless something is stated to the contrary.

The embodiment illustrated in Figure 2 differs from the embodiment according to Fig. 1 by a screw 21 having a modified shaft part 23 and by a modified sleeve 26. The shaft part 23 is designed with a support section 22, which can be created by means of deforming the screw blank and which is conically enlarged towards the end of a mounted sleeve 26 opposite the rim portion 8. The support section 22 extends substantially towards the core diameter of the external thread 7 of the sleeve 26 so as to hold the sleeve 26 on the shaft part 23. On the shaft part 23 there are

provided at least two first precutting edges 24, according to the illustration four precutting edges 24, which are associated with the sleeve 26, which are adjacent the thread part 2 and which in each case are formed at a cut-out 25 of the support section 22.

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The support section 22 of the shaft part 23 equipped with the sleeve 26 and the thread of the thread part 2 can be generated at the screw blank in each case in a separate rolling process or, as provided in the illustrated embodiment, in a common rolling process. In a subsequent operation, the screw 21 with the mounted sleeve 26 produced in such a manner is hardened. In a further operation, the screw 21 can be provided with a galvanic coating as corrosion protection at least in the region of the thread part 2 and, if required, of the support section 22.

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15 When the support section 22 of the shaft part 23 strikes against the outside of the attachment part 18, when the screw 21 is screwed into the hole provided in the attachment part 18 and in the support part 19, the section of the hole which penetrates the attachment part 18 is enlarged in response to a joint further rotation of the screw 21 and of the sleeve 26 by means of the first cutting edges 24 formed on the support section 22 in each case to a diameter, which corresponds to the core diameter of the external thread 7 of the sleeve 26 and which thus makes it possible to screw the sleeve 26 into the attachment part 18 in a facilitated manner.

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25 An embodiment is also possible, in which the screw 21 is equipped with a sleeve 6 according to Fig. 1.

The embodiment illustrated in Figure 3 has a screw 41 with a shaft part 43, which has a radially enlarged end portion 44 (radially enlarged with

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respect to the outer diameter of the thread part 42 of the screw 41) bound-

ing a groove 35, with the diameter of the end portion 44 substantially corresponding to the core diameter of the external thread 7 of the sleeve 36. The thread part 42 adjoins the end section 44 and has a smaller diameter than the end section 44. At least two first precutting edges 45 facing the thread part 42 are provided on the shaft part 43, each of which is formed at a cut-out 46 axially directed in the end portion 44. The screw 41 also consists of hardened steel. The thread part 42 is designed with a pitch, which is the same as the pitch of the external thread 7 of the sleeve 36.

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In this embodiment, the screw 41, which is equipped with the sleeve 36, is screwed into a bore, which is inserted into the support part 19 through the attachment part 18. The diameter of the hole corresponds to the core diameter of the thread part 42. When the end portion 44 of the shaft part 43 strikes against the outside of the attachment part 18, the section of the bore passing through the attachment part 18 is enlarged in response to the further rotation of the screw 41 by means of the precutting edges 45 of the shaft part 43, in each case to a diameter which corresponds to the core diameter of the external thread 7 of the sleeve 36 and which thus makes it possible to screw the sleeve 36 into the attachment part 18 in a facilitated manner.

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The afore-described embodiments each make it possible,, in particular without using a stud, to attain a direct, stress-free installation of the fastening device in hard materials, such as concrete, brick, steel or the like in an advantageously simple manner and to thus attain a reliable and permanent connection between the attachment part 18 and the support part 19.

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30 The fastening device of Fig. 3 can be made by a method as follows:

First of all a blank for a screw is taken which is preferably of rod shaped (cylindrical) form, the blank is made of a hardenable material, preferably of a material hardenable to a level permitting direct thread forming action
 5 in at least one of prebored concrete, pre-bored brick and pre-bored steel.

A head portion including a tool receiving feature 4 is then formed on said blank, e.g. by a cold heading process, and the groove 35 is formed between the thread part 32; 42 and the shaft part 33; 43 or in said shaft
 10 part.

The thread is subsequently or simultaneously formed on said thread part 32; 42, e.g. by a rolling process, and the screw 31, 41 is thereafter hardened
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The method comprises the further step of placing the pre-manufactured threaded sleeve 36 over said shaft part and subsequently deforming the portion 30 of said sleeve into the groove 35. This sleeve placement step can take place before or after forming a thread on said thread part 32;42
 20 and before or after hardening of the screw 31; 41.

Turning now to Fig. 4 there can be seen a modified version of the fastening device of Fig. 1 in which the first and second precutting edges 14 and 16 are helically disposed rather than lying in axial planes as shown in Fig. 1.
 25 That is to say Fig. 4 shows the helical or skewed position of the first and second precutting edges 14 and 16 referred to above as an alternative in connection with Fig. 1 and also the corresponding helical or skewed position of the grooves 15 and 17 defining the precutting edges at the intersections of the respective grooves at the surface of the sleeve 6.

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Fig. 5 shows a modified version of the fastening device of Fig. 2 in which the external thread 7 of said sleeve 26 has helically or axially extending grooves 50 extending over a major portion of the axial length of the sleeve between a front end thereof adjacent a tip of said thread part 2 and the enlarged rim portion thereof. Indeed the grooves 50 can essentially form axial extensions of the first precutting edges 24 and run out into second precutting edges 16. A similar arrangement of axially or helically extending grooves 50 can also be provided in the embodiment of Fig. 3.

Thus the second precutting edges 17 can be provided at a front portion of said enlarged rim of said sleeve 6; 26 and can be generally formed by extensions of the helically or axially extending grooves 50 and, optionally, the helically or axially extending grooves 50 of the thread part 7 of said sleeve 6; 26 can be aligned with and form continuations of the first precutting edges 14; 24 formed on said sleeve 6 adjacent said support section 10 or on said support section 22. The grooves 50 thus form continuous cutting edges at their intersections with the surface of the sleeve 6; 26. The grooves 50 also function to ensure the waste material cut from the installation part 18 is led away better. The grooves 50 can in particular be formed in the manner described in EP-B-0870118 of the present applicant.

More specifically the grooves or notches 50 are formed in the threads 7 of the sleeve 6; 26 and lie generally on a straight line which extends at a preferred angle of about 15° relative to the longitudinal axis of the screw 1; 21. If the precutting edges 14; 24 or 16 are inclined helically then they are also preferably inclined at the same angle. Four grooves or rows of notches are preferably provided and are uniformly distributed around the periphery of the sleeve with the same alignment at the periphery of the sleeve. If the grooves only intersect the threads 7 of the sleeve then they

can be thought of as discrete notches, they can however be made deeper than the core diameter of the thread 7 and then form continuous grooves. If the grooves are designed so that discrete notches are formed then these are generally triangular and have an apex (deepest point) at the core diameter of the thread 7 with the one side surface extending radially and the other generally tangentially.

The notches also form cutting edges which in a particularly advantageous manner facilitate the entry of the sleeve 6; 26 into the attachment part.

Fig. 6 shows a further embodiment of the fastening device. Support section 22 of the shaft part 23 of this embodiment is formed by knurling/engrailing, particularly cross-knurling. The knurling operation is performed after sleeve 26 has been placed over shaft part 23 of the fastening device. This operation leads to an increase of the diameter of the knurled section thereby preventing that sleeve 26 can slip off the shaft part 23. After forming the cross-knurled support section 22, the fastening device can be exposed to a hardening process to harden the materials of the device.

The knurled character of support section 22 has also a rasping/precutting effect when the fastening device is screwed in support part 19.

It should be mentioned that all described fastening devices are suitable for anchorage in any massive base or material as concrete, brick, metal, in particular steel, or the like. Wood and plastic are also massive materials in that sense. The attachment part can also be made of any material, particularly of any of the materials mentioned above.

PATENT CLAIMS

1. A fastening device for anchorage in massive bases or materials such as concrete, brick, steel or the like, consisting of a screw (1; 21; 41) of steel, which has a thread part (2; 42), a shaft part (3; 23; 43) having a head section (5) at a free end of the shaft part, with a recess (4) formed at the head section (5) for the insertion of a tool and consisting of a sleeve (6; 26) having an external thread (7), said sleeve having a radially enlarged rim portion (8; 38), in which means (9; 39) are formed for the placement of a second tool, the sleeve being able to be pushed onto the shaft part (3; 23; 43), being rotatable on the shaft part and being held in the axial direction in such a manner that the screw and/or the sleeve can be rotated, wherein the sleeve (6; 26; 36) can be mounted axially onto the screw blank and has in its rim portion (8) a seat, which can be placed against the head section (5) of the shaft part (3; 23; 43), wherein the shaft part (3; 23; 43) is designed with a support section (10; 22; 44), which is enlarged towards the end of the mounted sleeve (6; 26; 36) located opposite the rim portion (8) by deformation of the screw blank so as to hold the sleeve (6; 26; 36) on the shaft part (3; 23; 43); characterized in that the screw (1; 21; 41) is formed using a screw blank made of a steel which can be hardened; in that at least two first precutting edges (12; 24; 45) are provided at the support section (10; 22; 44) adjacent the thread part (2; 42) and are designed to cut a hole in an attachment part, said hole having a diameter corresponding to that of the core diameter of the external thread (7) of the sleeve (6; 26; 36).

2. A fastening device in accordance with claim 1, characterized second precutting edges (16, 17; 37) are provided lying on the surface of a cone in axial planes containing the longitudinal axis of the screw (1; 21; 41) or being helically disposed on the surface of said cone.
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3. A fastening device in accordance with either one of the preceding claims, characterized in that said external thread (7) of said sleeve (26) has helically or axially extending grooves (50) or notches extending over a major portion of the axial length of the sleeve (26) between a front end thereof adjacent a tip of said thread part (2) and said enlarged rim portion (8) thereof.
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4. A fastening device in accordance with claim 3, characterized in that second precutting edges (16, 17) are provided at a front portion of said enlarged rim of said sleeve (6; 26). and are formed by extensions of said helically or axially extending grooves (50).
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5. A fastening device in accordance with claim 1 or 2, characterized in that at least two second precutting edges (16, 17; 37) facing the external thread (7) are provided at the rim portion (8; 38) of the sleeve (6; 26; 36) and designed to cut a hole in an attachment part to receive said enlarged rim portion of said sleeve (6; 26; 36), said hole having a diameter corresponding to that of said enlarged rim portion of said sleeve (6; 26; 36), said second precutting edges (16, 17; 37) preferably lying on the surface of a cone in axial planes containing the longitudinal axis of the screw (1) or being helically disposed on or skewed relative to the surface of said cone.
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6. A method of forming a fastening device in accordance with any one of the preceding claims comprising the steps of taking a blank for a
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screw having a thread part (2; 42) and a shaft part (3; 23; 43) and made of a material hardenable to a level permitting direct thread forming action in at least one of prebored concrete, pre-bored brick and pre-bored steel, forming a head portion (5) including a tool receiving feature (4) at one end of said blank, said head portion being enlarged relative to a core diameter of said thread part (2; 42) to form a seat, subsequently placing a pre-manufactured threaded sleeve (6; 26) over said shaft part from a tip end of said blank, i.e. an end corresponding to the tip of the thread of said thread part (2; 42), and bringing it into position at said seat, subsequently forming a sleeve retaining portion (10; 22) on said screw part adjacent a free end of said sleeve, said sleeve retaining portion having first precutting edges (24) designed to cut a hole in an attachment part, said hole having a diameter corresponding to that of the core diameter of the external thread (7) of the sleeve (6; 26) and subsequently or simultaneously forming a thread on said thread part (2; 42) and thereafter hardening said screw.