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(54) **FASTENING DEVICE**

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(76) **Inventor: Werner Flückiger, Oberkulm (CH)**

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(57) **ABSTRACT**

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A fastening device includes a screw (1,21) with a thread part (2) and a shaft part (3,23), the shaft part (3,23) having a recess (4) at the free end for the insertion of a tool, and a sleeve (6,26) with an external thread (7) and an enlarged rim portion (8), which has means for the placement of a second tool. The screw (1,21) is formed by a rod-shaped screw blank made of hardenable steel, which has an enlarged head portion (5) at one end. The sleeve (6,26) can be mounted onto the screw blank from the other end and has a step, which can be placed on or against the head portion (5). The shaft part (3,23) is designed with a support section (16,22) for the pushed on sleeve (6,26) and the support section (16,22) can be generated by deforming the screw blank so as to hold the sleeve (6,26) on the shaft part (3,23) in such a manner that the screw (1,21) and/or the sleeve (6,26) can be rotated. The fastening device, is suitable for being screwed directly into massive materials, e.g. concrete, brick, metal and the like.

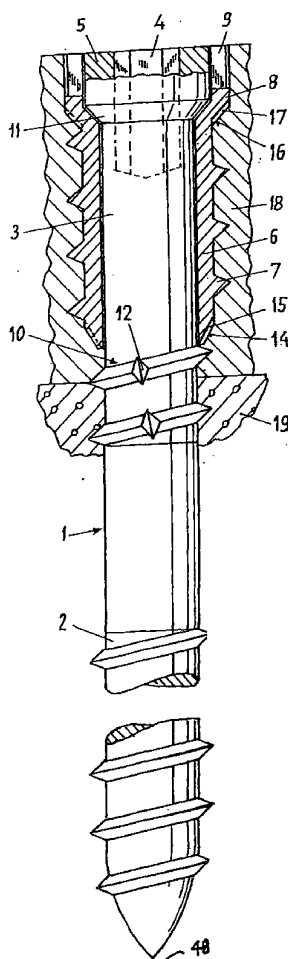


Fig. 1

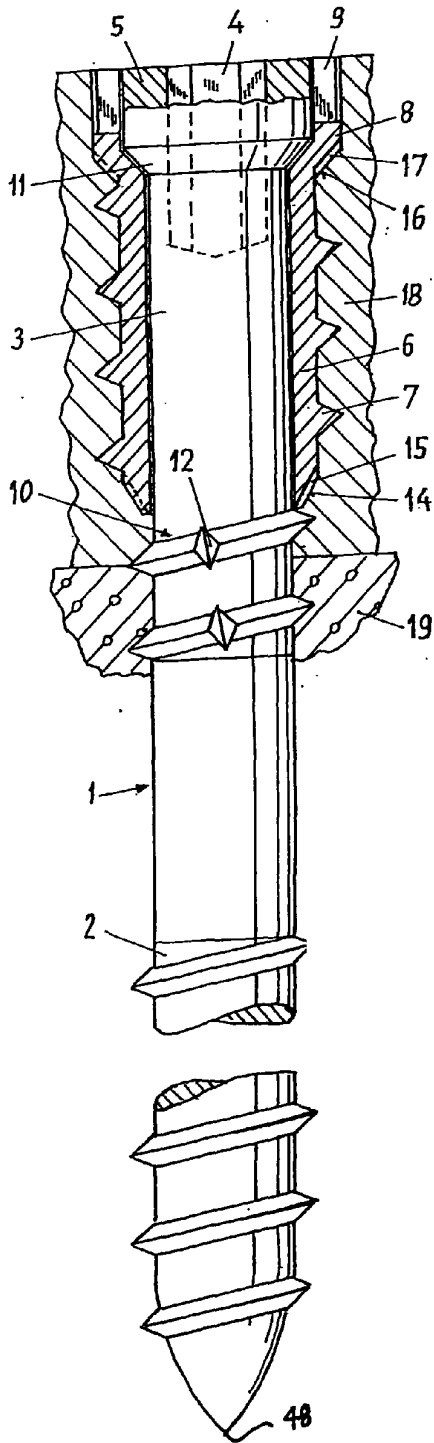


Fig. 2

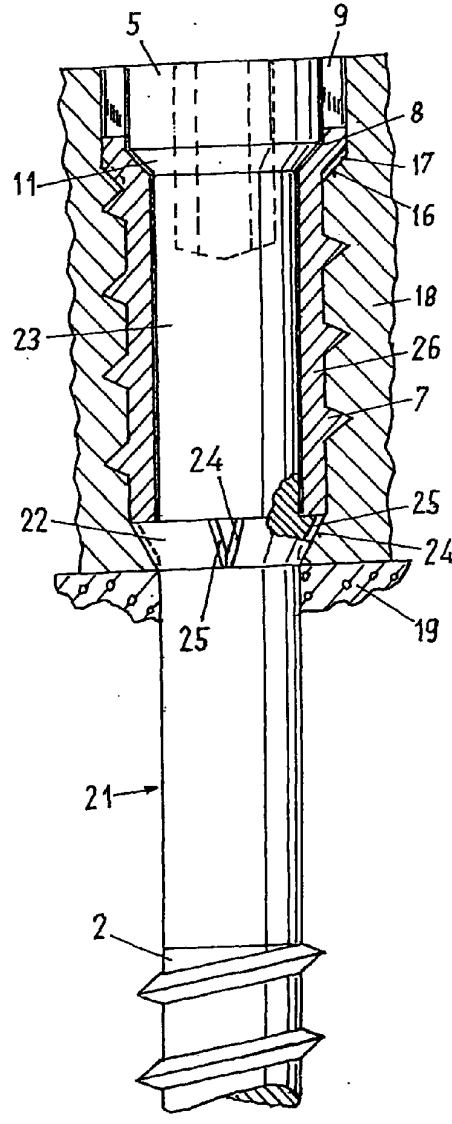


Fig. 3

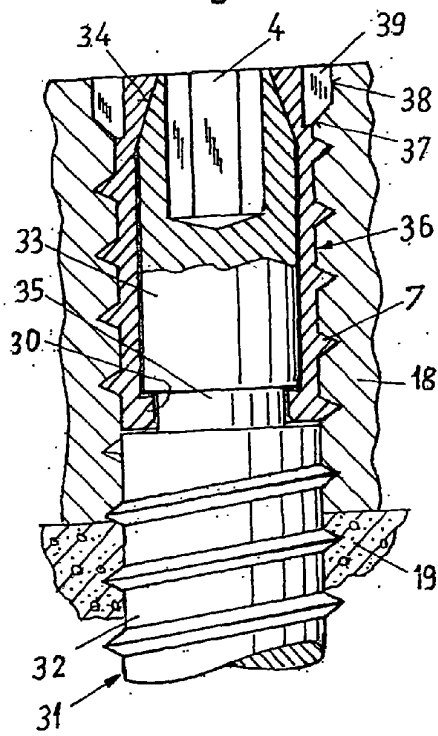


Fig. 4

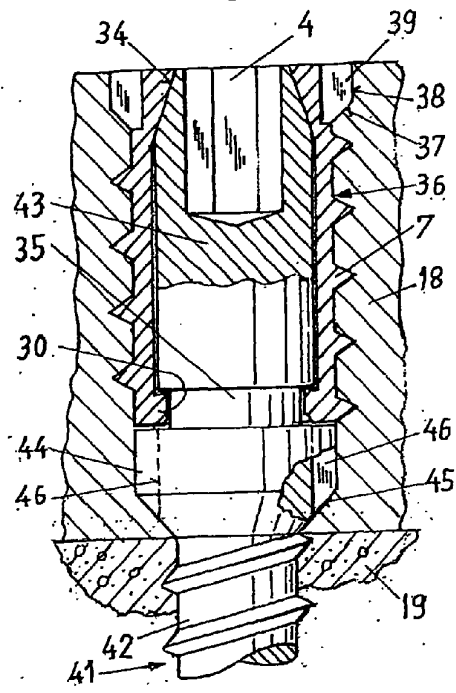


FIG. 5

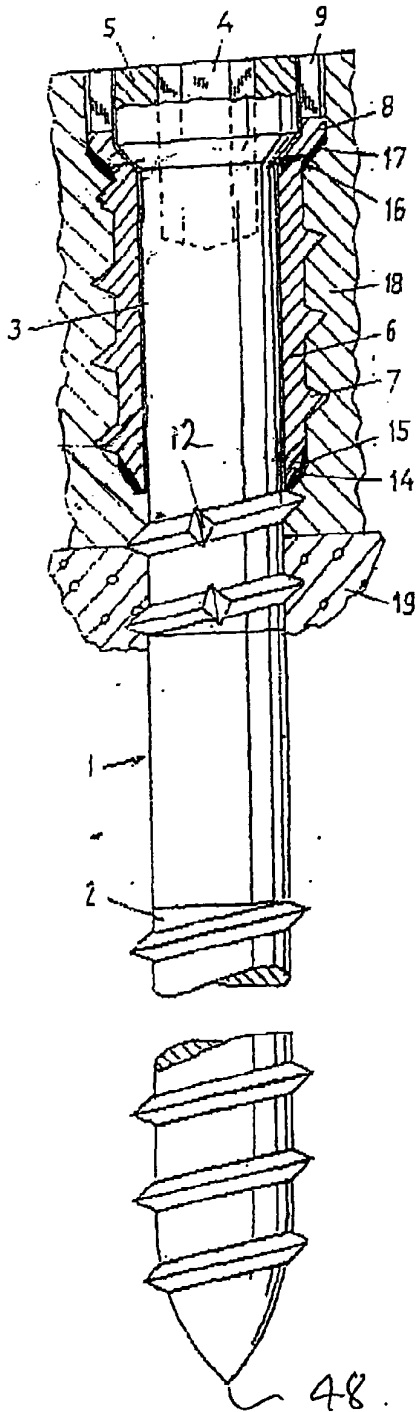
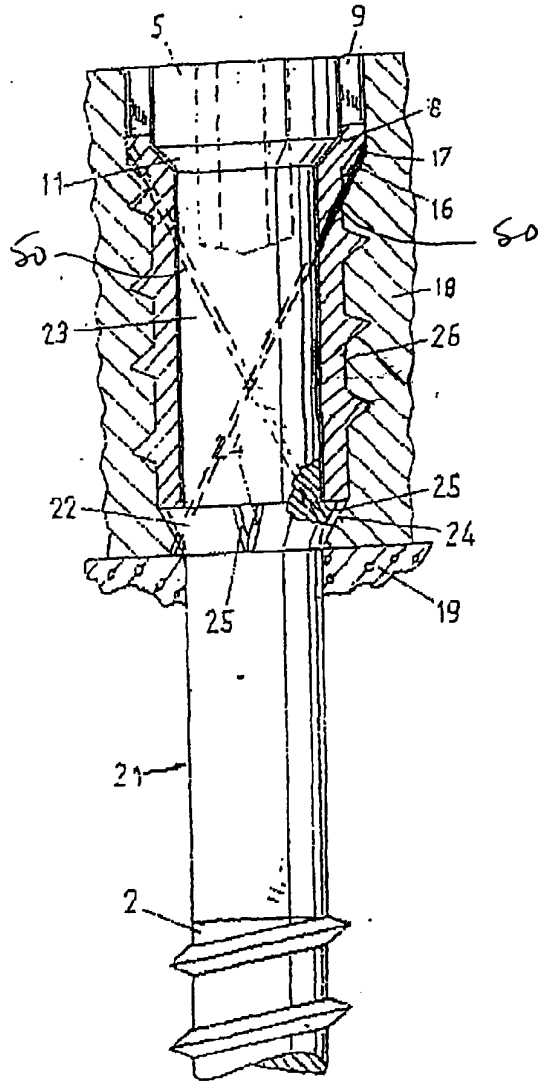


FIG. 6



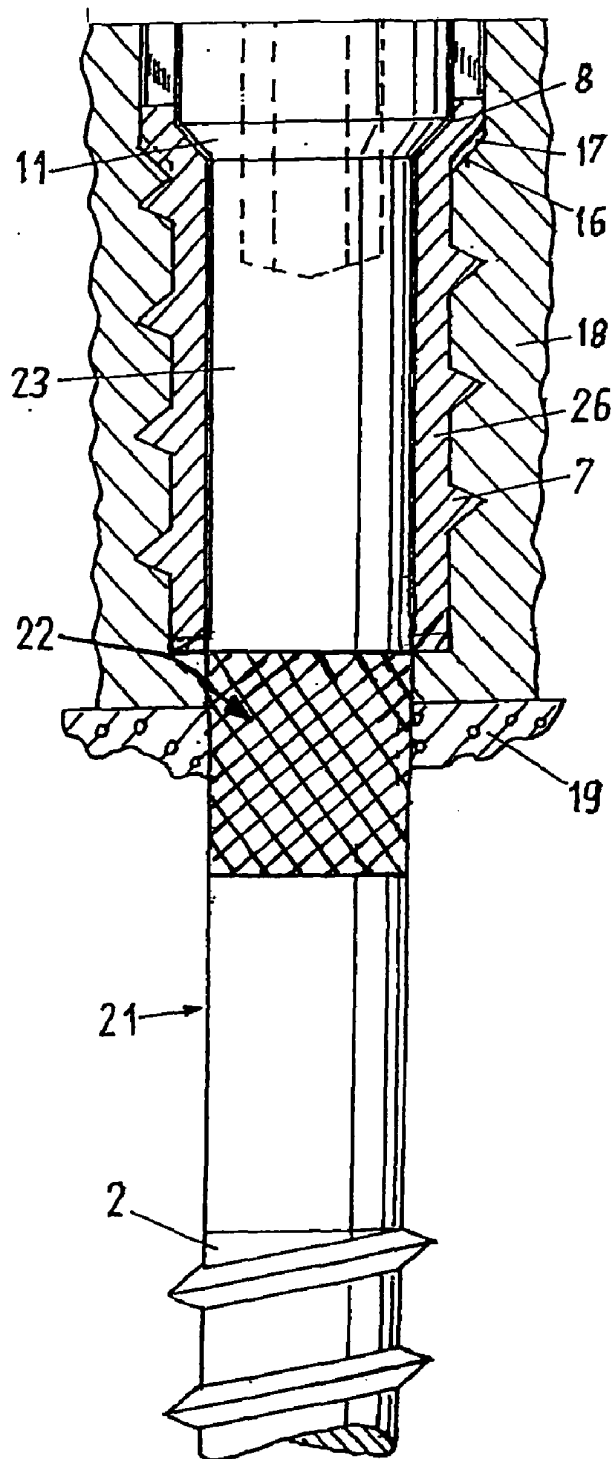


Fig. 7

FASTENING DEVICE

[0001] 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.

[0002] 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.

[0003] 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.

[0004] 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 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.

[0005] 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.

[0006] Further developments and/or advantageous embodiments of the fastening device and of the method of manufacturing the same are the subject of the further claims 2 to 12.

[0007] The invention will be explained in the following with reference to the accompanying drawings, in which:

[0008] FIG. 1 shows a longitudinal section of a first embodiment of the fastening device;

[0009] FIG. 2 shows a longitudinal section of a second embodiment of the fastening device;

[0010] FIG. 3 shows a longitudinal section of a third embodiment of the fastening device;

[0011] FIG. 4 shows a longitudinal section of a fourth embodiment of the fastening device;

[0012] FIG. 5 a diagram similar to FIG. 1 but showing an alternative design of the pre-cutting edges and

[0013] FIG. 6 a diagram similar to FIG. 2 but showing an alternative design of the pre-cutting edges.

[0014] FIG. 7 a diagram similar to FIG. 2 but showing an alternative design of the support section.

[0015] The embodiment illustrated in FIG. 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 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.

[0016] The sleeve 6 has an external thread 7, the pitch of which is the same as 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.

[0017] 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 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.

[0018] 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 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.

[0019] At the end of the sleeve 6, which is located opposite the rim portion 8 at least two first pre-cutting edges 14, in the illustrated example four pre-cutting 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 pre-cutting edges 14 lie on the surface of a cone in axial planes containing the longitudinal axis of the screw 1. Alternatively they could be generally helically disposed on or skewed relative to the surface of said cone.

[0020] The sleeve 6 is furthermore provided with at least two second pre-cutting edges 16, in the illustrated example four pre-cutting edges 16, which face 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 pre-cutting 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 pre-cutting edges 16 preferably lie on the surface of a cone in axial planes contain-

ing the longitudinal axis of the screw **1** or are, alternatively, generally helically disposed on or skewed relative to the surface of said cone.

[0021] When such a helical or skewed position is selected the front or leading ends of the first or second pre-cutting 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 pre-cutting 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 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**.

[0022] As is illustrated in FIG. 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.

[0023] 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**, 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 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 pre-cutting edges **14** formed at the end of the sleeve **6**, in each case to 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 pre-cutting edges **14** is enlarged in response 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**.

[0024] 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:

[0025] 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 pre-bored 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.

[0026] 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.

[0027] The embodiment illustrated in FIG. 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 pre-cutting edges **24**, according to the illustration four pre-cutting 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**.

[0028] 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**.

[0029] 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.

[0030] An embodiment is also possible, in which the screw **21** is equipped with a sleeve **6** according to FIG. 1.

[0031] The embodiment illustrated in FIG. 3 consists of a screw **31** comprising a thread part **32** and a shaft part **33**, which has the recess **4** for the placement of a first tool as well as a ring-shaped groove **35**. The fastening device consists also of a sleeve **36**, which can be mounted onto the shaft part **33** from the free end of the shaft remote from the tip of the

threaded part 32. The sleeve 36 has an external thread 7, the pitch of which is the same as that of the thread part 32 of the screw 31, a radially enlarged rim portion 38 at one end and an inwardly directed ring-shaped projection 30 at the other end, which can be introduced into the groove 35 of the shaft part 33, e.g. by a rolling operation. The rim portion 38 is provided with slots 39 for the placement of a second tool and, in accordance with the illustration, has a diameter, which substantially corresponds to the diameter of the external thread 7 of the sleeve 36. At least two precutting edges 37, in the illustrated example four precutting edges 37, are provided adjacent the external thread 7 of the sleeve 36 at the enlarged rim portion 38. Each of the precutting edges 37 is formed at one of the slots 39.

[0032] The screw 31 is made of hardened steel. In accordance with the illustration, the thread part 32 can have a diameter, which corresponds to the diameter of the external thread 7 of the sleeve 36. The free end of the shaft part 33 at the end remote from the tip of the thread part 32 is designed with a conically tapering support surface 34 for the sleeve 36. The inner surface of the sleeve 36 is realised with a corresponding conical projection, which can be placed onto the support surface 34. The sleeve 36 can be made of unhardened steel.

[0033] As is shown in FIG. 3, the sleeve 36 is held by means of the support surface 34 of the shaft part 33 on the one hand and by means of the ring-like projection 30 engaging into the groove 35 on the other hand, so that the sleeve is rotatable on the shaft part 33 but fixed in the axial direction in such a manner that the screw 31 and the sleeve 36 can be rotated together or individually by means of the tools respectively associated with the recess 4 and the slots 39.

[0034] Actually the conical end surface 34 of the shaft part 33 and the complementary mating conical surface of the sleeve 36 can be omitted since the ring-like radially inwardly directed projection 30, which can be formed by a rolling operation and which engages into the groove 35 can serve to both axially fix the sleeve 36 to the screw 31 and to permit relative rotation of the sleeve 36 relative to the screw 31.

[0035] In this embodiment, the screw 31, which is equipped with the sleeve 36, is screwed 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 32 and of the external thread 7 of the sleeve 36, respectively.

[0036] The embodiment illustrated in FIG. 4 differs from the embodiment according to FIG. 3 in a screw 41 with a shaft part 43, which has a radially enlarged end portion 44 (radially enlarged with respect to the outer diameter of the thread part 42 of the screw 41) bounding the groove 35, with the diameter of the end portion 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.

[0037] 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.

[0038] 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.

[0039] The fastening devices of FIGS. 3 and 4 can each be made by a method as follows:

[0040] 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 in at least one of prebored concrete, pre-bored brick and pre-bored steel.

[0041] 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 part.

[0042] 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

[0043] 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 and before or after hardening of the screw 31; 41.

[0044] Turning now to FIG. 5 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. That is to say FIG. 5 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.

[0045] FIG. 6 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. 5 and also in the embodiments of FIGS. 3 and 4.

[0046] 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 pre-cutting 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.

[0047] 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.

[0048] 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.

[0049] The notches also form cutting edges which in a particularly advantageous manner facilitate the entry of the sleeve 6; 26 into the attachment part.

[0050] FIG. 7 shows a further embodiment of the fastening device. Support section 22 of the shaft part 23 of this embodiment is formed by knurling/engraving, 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.

[0051] The knurled character of support section 22 has also a rasping/precutting effect when the fastening device is screwed in support part 19.

[0052] 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.

1-16. (canceled)

17. A fastening device consisting of a screw which has a thread part and a shaft part with a recess formed at a free end for the insertion of a tool and consisting of a sleeve having an external thread, the sleeve having a 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, wherein the screw is formed using a screw blank made of steel and which has a head section formed at the free end of the shaft part, in that the sleeve has in its rim portion a seat, in that the shaft part is 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 sleeve or the screw and the sleeve is/are provided with cutting edges.

18. A fastening device for anchorage in massive bases or materials such as concrete, brick, steel or the like in accordance with claim 17, wherein the screw is made of hardened steel, the shaft part has a ring-shaped groove, and 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.

19. The fastening device in accordance with claim 17, wherein at least two first cutting edges are provided adjacent the support section at the end of the sleeve located opposite the rim portion, the cutting edges either lying on the surface of a cone in axial planes containing the longitudinal axis of the screw or being generally helically disposed on or skewed relative to the surface of the cone.

20. The fastening device in accordance with claim 17, wherein at least two first cutting edges are provided at the support section adjacent the threaded part and designed to cut a hole in an attachment part, the hole having a diameter generally corresponding to that of the core diameter of the external thread of the sleeve, the cutting edges either lying on the surface of a cone in axial planes containing the longitudinal axis of the screw or being generally helically disposed on the surface of the cone.

21. The fastening device in accordance with claim 17, wherein the external thread of the sleeve has helically or axially extending grooves or notches extending over a major portion of the axial length of the sleeve between a front end thereof adjacent a tip of the thread part and the enlarged rim portion thereof.

22. The fastening device in accordance with claim 21, wherein second cutting edges are provided at a front portion of a radially enlarged rim of the sleeve.

23. The fastening device in accordance with claim 22, wherein the second cutting edges are formed by extensions of the helically or axially extending grooves.

24. The fastening device in accordance with claim 22, wherein the helically or axially extending grooves of the thread part of the sleeve are aligned with and form continuations of first cutting edges formed on the sleeve adjacent the support section or on the support section.

25. The fastening device in accordance with claim 18, wherein the shaft part has a portion enlarged relative to the thread part and bounding the groove in front of the front end of the threaded sleeve adjacent the tip of the screw, the diameter of the enlarged portion corresponding to the core diameter of the external thread of the sleeve and in that the thread part of the screw has a smaller diameter than the end portion.

26. The fastening device in accordance with claim 25, wherein at least two first cutting edges are provided at the enlarged portion adjacent to the thread part and designed to cut a hole in an attachment part, the hole having a diameter generally corresponding to that of the core diameter of the external thread of the sleeve, the first cutting edges either lying in axial planes containing the longitudinal axis of the screw or being generally helically disposed on the surface of the enlarged part.

27. The fastening device in accordance with claim 17, wherein at least two second cutting edges facing the external thread are provided at the rim portion of the sleeve and designed to cut a hole in an attachment part to receive an enlarged rim portion of the sleeve, the hole having a diameter

generally corresponding to that of the enlarged rim portion, the second cutting edges either lying on the surface of a cone in axial planes containing the longitudinal axis of the screw or being generally helically disposed on or skewed relative to the surface of the cone.

28. The fastening device in accordance with claim 17, further comprising at least one of first cutting edges, second cutting edges and further cutting edges, any of the first, second, and further cutting edges being defined by the radially outer extremities of respective flutes or grooves formed in the respective ones of the front end of the threaded sleeve, the support section, the enlarged rim portion and along the threaded sleeve.

29. The fastening device in accordance with claim 17, wherein a knurled or engrailed region is provided on the shaft adjacent a front end of the sleeve to retain the sleeve on the shaft, the knurled or engrailed region having a rasping or cutting effect.

30. The fastening device in accordance with claim 17, wherein the shaft is made of a material hardened to a level permitting direct thread forming action in at least one of pre-bored concrete, pre-bored brick and pre-bored steel.

31. A method of forming a fastening device, comprising the steps of:

taking a blank for a screw having a thread part and a shaft part and made of a material hardenable to a level permitting direct thread forming action in at least one of pre-bored concrete, pre-bored brick and pre-bored steel, forming a head portion including a tool receiving feature, the head portion being enlarged relative to a core diameter of the thread part,

subsequently placing a pre-manufactured threaded sleeve over the shaft part from a tip end of the blank, i.e. an end corresponding to the tip of the subsequent thread of the thread part,

subsequently forming a sleeve retaining portion on the screw part adjacent the free end of the sleeve, subsequently or simultaneously forming a thread on the thread part, and thereafter hardening the screw.

32. A method of forming a fastening device comprising the steps of:

taking a blank for a screw having a thread part and a shaft part and made of a material hardenable to a level permitting direct thread forming action in at least one of pre-bored concrete, pre-bored brick and pre-bored steel, forming a head portion including a tool receiving feature on the blank,

forming a groove between the thread part and the shaft part or in the shaft part,

subsequently or simultaneously forming a thread on the thread part and

thereafter hardening the screw,

wherein the method further comprises the step of placing a pre-manufactured threaded sleeve over the shaft part and subsequently deforming a portion of the sleeve into the groove, the sleeve placement step taking place before or after forming a thread on the thread part and before or after hardening of the screw.

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