

The invention relates to an anchor bar for structural engineering, with raised areas on the back of the bar, in which are provided openings through which pass the shanks of anchor bolts, the bolt with a countersunk head fitting snugly in the raised area.

An anchor bar of this kind is known from the DE-C-3 407 801, in which the anchor bolt is constructed as a bolt with a countersunk head, with an external thread extending over the whole shank. In this case the raised area for the countersunk head continues into an upwardly directed neck onto which is screwed the countersunk head. This design lacks adequate stability because the junction between the countersunk head and the shank is liable to fracture. It is very difficult in shaping technology to produce a neck with sufficient material thickness.

Also known from the DE-B-2 631 396 is a design in which the anchor element is approximately double T-shaped. A conically shaped end for insertion, extending from the supporting arm of the anchor element facing towards the back of the bar, passes through the opening and is then upset. At the same time the front end is deformed in rivet fashion to form a head which is basically countersunk in the raised area. It cannot however be avoided that after the riveting process there is a certain degree of reverse deformation, which reduces the stability of attachment of the anchor bolt to the anchor bar.

The subject of the invention has the object of designing an anchor bar of the kind in question in a manner allowing ease of manufacture and in such a way that in addition to extremely stable fixing of the anchor bolts to the anchor bar, no fracture zone reducing the load carrying capacity occurs in the region of the junction between the inclined surface of the countersunk head and the shank.

This object is achieved by the characterising part of claim 1.

The subsidiary claims constitute advantageous developments.

As a result of such a design there is provided an anchor bar of the kind mentioned hereinbefore, which is distinguished by high durability and stability. The form locking obtained between anchor bolt and anchor bar by the instruction according to the invention is optimal, so that maximum stresses are absorbed without damage. For the first time an intermediate section extending from a countersunk head is clinched in such a way that during this process the wedge-shaped gap between the inner surface of the opening and the intermediate section is completely filled. In particular this can be done by cold upsetting, the intermediate section adjoining the countersunk head leading to uniform higher strength in the region of the junction between inclined surface of countersunk head and intermediate section, which reliably excludes the possibility of a zone liable to fracture there. The corresponding cross-sectional shape of the opening results in the fact that there is no reverse deformation which would promote possible loosening of the anchor bolt. The upsetting pressure is continued into the raised area, achieving close abutment of the raised area against the inclined surface of the countersunk head. This connection is even liquid-tight. Hairline cracks which would allow penetration of moisture cannot occur. In order to obtain the corresponding frustoconical orientation of the inner surface of the opening, it is possible to punch or drill the hole in the back of the bar first. Due to subsequent pressing of the raised area, the inner surface of the opening acquires its frustoconical orientation. This results in facilitation of manufacture, connected with reduced production costs. Due to correspondingly greater stretching of the material on the outside of the raised area, the hole breaks open frustoconically when punched. The opening may also be punched between the raised area. It is recommended that each raised area be composed of several angularly adjoining individual sections. The central section serves to receive the inclined surface of the countersunk head, while the adjoining section or sections result in stiffening of the back of the bar, for the purpose of increasing the stability under load and reducing any deformation under load. In particular this is aided by the measure of providing on both sides of the countersunk head receiving space a raised area section which is arched like a bridge towards the interior of the bar. In order to ensure inter alia stable fixing of the anchor bolt in position

during the thread rolling process, in the region of its free end it is provided with two threaded sections leaving a thread-free bolt section between them. This achieves a dual function. Firstly, the threaded sections can be manufactured better. Secondly, these threaded sections serve to hold a nut which is locked on the two threaded sections and thereby prevented from rotating. Another advantage lies in that the core diameter is smaller in the threaded region than in the region of the intermediate section. This results in facilitation of manufacture. Lastly, it is also an advantage with regard to stress technology if the inner surface of the opening is approximately perpendicular to the frustoconical peripheral surface of the countersunk head, i.e., the inclined surface of the countersunk head. The outer threaded section needs to be only slightly larger than the height of a corresponding nut. If necessary, it can even be longer than the height thereof.

Two practical examples of the invention are shown in the drawings. These show:

- Fig. 1 a perspective view of the anchor bar with the anchor bolts fixed to it, relating to the first embodiment,
- Fig. 2 the section through line II-II in Fig. 1,
- Fig. 3 a view corresponding to Fig. 2, in which the anchor bolt is inserted but not yet clinched,
- Fig. 4 a perspective view of the anchor bar according to the
- Fig. 4a a variant of the same, second embodiment,
- Fig. 5 the section through line V-V in Fig. 4, and
- Fig. 6 a view corresponding to Fig. 5, but with the anchor bolt inserted in the opening prior to upsetting.

The anchor bar 1 has a C-profile in cross-section. In detail, the anchor bar consists of the back 2 of the bar, the arms 3 of the C which extend at right angles therefrom and which are adjoined by inturned end sections 4 pointing towards each other. Between the latter is left a longitudinal slot 5 for introduction of fastening elements, not shown.

Anchor bolts 6 spaced a preset distance apart from each other extend from the back 2 of the bar. Each anchor bolt 6 forms a countersunk head 7. The latter is adjoined by an intermediate section 8 which continues into a shank 9 of reduced cross-section. The length x of the intermediate section 8, which has a larger cross-section than the shank 9, is approximately twice the thickness y of the wall of the anchor bar.

The anchor bolt 6 is provided in the region of its free end with two threaded sections 10 and 11 located one behind the other and leaving a thread-free bolt section 12 between them. The end threaded section 10 is shorter than the threaded section 11 in front, and carries the anchor nut M. The diameter of bolt section 12 corresponds to the diameter of the shank 9. This means that the threaded sections 10, 11 have a larger diameter than the shank 9. The core diameter of the threaded sections 10, 11, however, is smaller than that of bolt section 12. Onto threaded section 10 can be screwed a nut M which then moves into the locking position relative to section 12 or possibly the thread of section 11, or a lock nut there.

To fix the anchor bolts 6, on the back 2 of the bar the anchor bar 1 forms raised areas 13 which are provided at the centre with an opening 14.

According to Figs. 1 to 3, each raised area is composed of three angularly adjoining individual sections 13', 13" and 13''' . In a particularly advantageous embodiment, these are arranged concentrically. The central individual section 13" is located beyond the space 15 for receiving the head, and extends approximately parallel to the interior of the bar. This means that its apex S defines the cavity H of the marginal section 13''' on a plane which is slightly higher than the inner surface of the back of the bar.

After forming the raised area 13, the opening 14 is produced by punching from the inside of the bar. There is a frustoconically oriented inner surface 14' of the opening, such that the larger diameter points towards the exterior of the back of the bar. The smaller diameter of the opening 14 roughly corresponds to the outside diameter of the intermediate section 8. If the anchor bolt 6 is now inserted from the inside of the bar, then the intermediate section 8 passes through the opening 14, while the inclined surface 7' of the countersunk head moves into a position abutting against the inner wall of the central section 13'. In this way, between the inner surface 14' of the opening and the intermediate section 8 is formed an annular peripheral wedge-shaped gap 16 which is filled by subsequent upsetting of the intermediate section 8, cf. in particular Fig. 2. The appropriate upsetting tool, not shown, engages the shoulder 17 between shank 9 and intermediate section 8. The upsetting process causes

structural compression. The length of the intermediate section 8 becomes shorter as it moves along. At the same time the wedge-shaped gap 16 is filled, obtaining stable form-locking support of the anchor bolt 6 on the anchor bar 1 by force fit. The upsetting pressure is continued into the wall of the opening 14 and causes the corresponding region of the intermediate section 8 to lie closely against the inner surface 14' of the opening. It can be seen from Fig. 2 that the inner surface 14' of the opening is approximately perpendicular to the frustoconical peripheral surface, i.e. the inclined surface 7' of the countersunk head 7.

According to the second embodiment shown in Figs. 4 to 6, the anchor bolt 6 is unchanged in design. On the other hand, the raised area 18 has a differently shaped cross-section. It has a central individual section 18' with the opening 14. On both sides of the space 15 for receiving the countersunk head extend sections 18" which are arched like a bridge towards the interior of the bar and which continue into outwardly curved sections 18". This cross-sectional profiling also causes stiffening in the region of the raised area 18, so that the anchor bolt fixed to the back 2 of the bar undergoes stabilisation of its position. The anchor bolts are fixed in the manner described above.

Fig. 4 and Fig. 4a differ in that in Fig. 4a the individual sections 18" are partial regions of a whole construction, so that bridge-like arching occurs over approximately the whole width of the raised area, and not only in the plane of the longitudinal section of the anchor bolt.

As an alternative to the threaded sections provided with nuts, the anchor bolt may be provided at its free end with an anchor head formed by upsetting. The upset anchor head, which has a larger cross-section than the shank, fulfils the same purpose, namely the formation of a support in relation to the embedding material for the anchor bar, and is cheaper to make. If it has the larger diameter, then upsetting takes place after fixing the anchor bolt in the bar, in which case the existence of the intermediate section 8, particularly with the shoulder 17, is likewise an advantage.

All new characteristics mentioned in the specification and shown in the drawings are essential to the invention, if they are contained in the claims.



1. Anchor bar (1) for structural engineering, with raised areas (13, 18) on the back (2) of the bar in which are provided openings (14) through which pass the shanks (9) of anchor bolts (6), the bolt (6) with a countersunk head (7) fitting snugly in the raised area (13), characterised in that the inner surface (14') of the opening of the raised area (13) is force fitted against the peripheral surface of the anchor bolt (6) as a result of deformation of material in such a way that the inner surface (14') of the opening is oriented frustoconically, with the larger diameter to the back (2), and the wedge-shaped gap (16) formed thereby is filled by upsetting an intermediate section (8) of the anchor bolt (6).
2. Anchor bar according to claim 1, characterised in that each raised area (13, 18) is composed of several angularly adjoining individual sections (13', 13'', 13'''; 18', 18'', 18''').
3. Anchor bar according to one or more of the preceding claims, characterised in that at least one raised area section (18''), which is arched like a bridge towards the interior of the bar, is provided on both sides of the space (15) for receiving the countersunk head.
4. Anchor bar according to one or more of the preceding claims, characterised in that the anchor bolt (6) is provided in the region of its free end with two threaded sections (10, 11) which leave between them a thread-free bolt section (12).
5. Anchor bar according to one or more of the preceding claims, characterised in that the core diameter is smaller in the thread region than in the region of the intermediate section (12).
6. Anchor bar according to one or more of the preceding claims, characterised in that the inner surface of the opening



is approximately perpendicular to the frustoconical peripheral surface (7') of the countersunk head (7).

7. Anchor bar according to one or more of the preceding claims 1 to 3 and 6, characterised in that the anchor bolt (6) comprises at its free end an anchor head formed by upsetting.

8. Anchor bar according to claim 7, characterised in that the cross-section of the upset head is larger than that of the intermediate section.