

REPLACED SHEETS		SG
☒	Description : paged ...1... to paged ...7.....	
☒	Claim(s) : paged ...7... to paged ...9.....	
☒	Drawing(s) : paged ...1/2... to paged ...1/2.....	
☒	Abstract : paged ...1/2... to paged ...1/2.....	
DATE OF RECEIPT		

- 1 -

P 1747

Expansible anchor of metal and a process for the manufacture thereof.

The invention relates to an expansible anchor of metal for anchoring in a hole drilled in a component, according to the preamble of Claim 1, and to a process for the manufacture thereof.

Expansible anchors of that kind are especially suitable for use in hard building materials; by screwing a nut onto the threaded shank projecting beyond the component and the article to be fixed, the expander cone integrally formed with the shank is drawn into the expansible sleeve bearing against the wall of the drilled hole. The expansible sleeve is consequently expanded and becomes wedged in the drilled hole. The expansible sleeve is braced in the drilled hole by locking elements provided on it, which catch against the wall of the drilled hole.

Expansion of the expansible sleeve is normally facilitated by several longitudinal slits. The longitudinal slits create expansible segments, which at the end of the longitudinal slits revert to the closed sleeve shape. The holding force of such an expansible anchor depends very considerably on the wall thickness of the expansible sleeve, and is limited to avoid too great a cross-sectional weakening of the reduced portion receiving the expansible sleeve. If the wall thickness is inadequate and the expansible segments are therefore lacking in rigidity, the withdrawal path of the expander cone into the expansible sleeve is relatively long, and this is apparent as a loss in holding force especially in the case of relatively large drilled holes. The same effect is also apparent

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when the drilled hole widens subsequently as a consequence of cracks forming. Because the expansible segments buckle behind the expander cone due to inadequate rigidity, there is a considerable loss in holding force. The known expansible anchors are therefore not suitable for use in the tensile zone in which cracks may form as a result of tensile stresses occurring in the concrete.

The invention is based on the problem of improving an expansible anchor of the kind mentioned in the preamble which guarantees reliable fixing in the tensile zone of a concrete part.

This problem is solved by the features specified in claim 1. The longitudinal slits starting at the front end edge and extending for the major part of the length of the expansible sleeve create expansible segments which can be expanded by drawing in the expander cone integrally formed with the shank. The punchings provided on the expansible segments reinforce the expansible segments so that as the expander cone is drawn in these bend in less readily and therefore press more firmly into the wall of the drilled hole. The higher degree of expansion achieved thereby inevitably gives rise also to higher holding values. In the event of the drilled hole widening as a result of cracks forming, the expander cone is better able to slide up subsequently since the greater rigidity of the expansible segments reduces the surface pressure on the expander cone. At the same time, the expansible sleeve expands further to compensate for widening of the drilled hole.

The punchings serve simultaneously as locking elements, to fix the expansible sleeve capively in the drilled hole in order to draw in the expander cone. The triangular shape of the punchings with tips pointing towards the front end of the expansible



segments creates several edges arranged one behind the other and effective at right angles to the withdrawal direction of the expansible anchor; during the expansion process, the edges dig into the wall of the drilled hole. Because the tips of the punchings are directed towards the front end of the expansible segments, the expansible anchor can be driven into the prepared drilled hole without difficulty.

Advantageous and preferred developments are given in the subsidiary claims. Four punchings per expansible segment provides a satisfactory rigidity of the expansible segments and ensures that the application force needed to drive in the expansible anchor is still reasonable. The punchings have an overall length corresponding to approximately half the length of the expansible sleeve and a maximum width corresponding to approximately one third of the width of one expansible segment. Furthermore, it is advantageous if the height of the punchings corresponds approximately to a third of the wall thickness of the expansible sleeve and if each punching slopes away towards its tip.

In a further advantageous construction, the longitudinal sides of the expansible segments may have several opposing indentations. This increases the flexibility of the expansible segments in the region of the indentations since these indentations reduce the former shell and width of the expansible segments at these points. The expansible segments reinforced by the punchings are therefore rendered more flexible at one or two points. This facilitates sliding up of the expansible sleeve on the expander cone, so that during expansion less torque is required and subsequent expansion is assisted in the event of the drilled hole widening as a result of cracks forming.



To improve the frictional characteristic between the expander cone and the expansible sleeve, the front inner edge of the expansible sleeve may have a bevel. Furthermore, for the same purpose the front corner edges of the expansible segments of the expansible sleeve may be rounded.

The invention is also based on the further problem of producing the expansible anchor and the expansible sleeve such that functional improvements of the expansible anchor are achieved on the basis of the manufacturing process.

This problem is solved by the process specified in claim 7. The compaction of the expansible sleeve produces a structural change which leads to an improvement in the apparent yielding point. The harder surface of sleeve on the one hand and the smoothing of the surface as a consequence of the pressing procedure on the other hand produce improved sliding properties of the expansible sleeve on the expander cone of the expansible anchor, which have a favourable effect both during the expansion process and during subsequent expansion behaviour. The improvement in the apparent yielding point is moreover attributable to the expansion sleeve having a portion for deformation of greater resilience. The expansible sleeve consequently acts as a kind of spring element which expands as the drilled hole widens, for example as a result of cracks forming, and therefore allows the expander cone to slide up subsequently in the expansible sleeve.

A further advantage of the pressing operation is to be found in the enlargement of the stamped sheet steel blank. The slit widths are thus somewhat reduced again subsequently and the effective areas of the expansible segments are enlarged. Relatively





- 5 -

thick and therefore more wear-resistant stamps can therefore be used to stamp out the slits.

In order to facilitate expansion of the expansible sleeve on the reduced portion of the expansible anchor, it is an advantage for the expansible sleeve to be pre-bent in a U-shape at the same time as the locking elements are punched out after the pressing operation.

The invention is explained in further detail hereinafter with reference to the drawing, in which

Figure 1 shows the expansible anchor according to the invention with the expansible sleeve (corresponding to section B-B) in position,

Figure 2 shows the section A-A of the expansible anchor illustrated in Figure 1,

Figure 3 shows the expansible anchor anchored in a hole drilled in a concrete part and

Figure 4 shows the developed view of the expansible sleeve in the form of a stamped/bent component,

Figure 5 shows the developed view of the expansible sleeve after the pressing operation and

Figure 6 shows the expansible anchor pre-bent into a U-shape pushed onto the expansible anchor.

The expansible anchor illustrated in Figure 1 consists of a shank 1 having at its rear end a threaded portion 2 for clamping an article securely. In the front region of the shank 1 there is a stepped portion 3 adjoining which towards the front end there is an expander cone 4. An expansible sleeve 5, the expansion region of which is formed by longitudinal slits 6 starting from the front end edge of the sleeve, is arranged near the portion 3. To fix the expansible sleeve in the drilled hole, locking elements formed by four interconnected punchings 7 running in the longitudinal direction of the expansible segments are



provided on the expansible sleeve 5. The punchings 7 are triangular in shape and the tip 8 is directed towards the front end of the expansible segments. At the same time, the punchings 7 slope away towards the tip 8 to facilitate driving of the expansible anchor into the drilled hole. The height of the punchings 7 is approximately one third of the wall thickness of the expansible sleeve 5. The front edges of the punchings 7 therefore form barbs which enable the expansible sleeve 5 to be firmly fixed in the drilled hole.

Figure 2 illustrates the section corresponding to the section line A-A. The longitudinal slits 6, 6' create several expansible segments 9, which expand to anchor the expansible anchor as the expander cone 4 is drawn into the expansible sleeve 5. To facilitate its sliding on the expander cone 4, the expansible sleeve 5 is provided with a bevel 10.

Figure 3 shows an expansible anchor anchored in a hole 11 drilled in a concrete part 12. The anchoring, and at the same time the clamping of the article 13 to be fastened, is effected by screwing the nut 14 onto the threaded portion 2 of the expansible anchor. Through the axial displacement of the shank 1 of the expansible anchor, the expander cone 4 is drawn into the expansible sleeve 5 held captive in the drilled hole by the locking elements to effect anchoring of the expansible sleeve.

Figure 4 shows the developed view of an expansible sleeve 5 stamped from sheet metal with three expansible segments 9. Each expansible segment is provided with four punchings 7, arranged one behind the other, the punchings being of triangular shape with a tip 8 pointing towards the front end. The expansible segments 9 result from the longitudinal slits 6 and the border 6' of the rolled-up member. The longitudinal sides of the expansible segments 9 have indentations 15

which lie opposite one another to reduce the width of an expansible segment 9. The expansible anchor according to the invention is created by bending the stamped component onto the reduced portion 3 of the shank 1. To reduce the friction between the expander cone and the expansible sleeve, the corner edges of the expansible segments 9 are rounded at 16.

Figure 5 illustrates the stamped metal blank of the expansible sleeve 5 after the pressing operation. The dotted outline 17 shows the stamping contour which is enlarged slightly by the pressing operation to the outer measurement illustrated in Figure 5.

After the pressing operation, the locking elements 7 are punched out and at the same time the expansible sleeve 5 is pre-bent into a U-shape so that it can be pushed laterally onto the reduced portion 3 of the expansible anchor 1. In a further operation, the longitudinal edges of the expansible sleeve are then bent round the reduced portion 3.

If stainless steel is used for the expansible sleeve, it can be advantageous to provide the expansible sleeve with an additional coating to improve the sliding properties further. A coating process in which a mixture of nickel and Teflon is applied chemically in an immersion process has proved especially advantageous.





- 8 -

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P 1747

Patent Claims

1. An expansible anchor for anchoring in a hole drilled in a concrete part, consisting of a shank, which at its rear end has means for fixing an article and at its front end has a portion of reduced cross-section with an adjoining expander cone, and, positioned over the portion, an expansible sleeve having longitudinal slits creating expansible segments and locking elements extending beyond the diameter of the expansible sleeve and arranged on the expansible segments, characterized in that the locking elements comprise several interconnected punchings (7) extending in the longitudinal direction of the expansible segments (9), each punching being of triangular form with a tip (8) directed towards the front end of the expansible segments.

2. An expansible anchor according to claim 1, characterized in that per expansible segment (9) there are four punchings (7), which have an overall length corresponding to approximately half the length of the expansible sleeve and a maximum width corresponding to approximately one third of the width of one expansible segment (9).

3. An expansible anchor according to claim 1, characterized in that the height of the punchings (7) corresponds approximately to a third of the wall

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- 9 -

thickness of the expansible sleeve (5) and each punching slopes away towards its tip (8).

4. An expansible anchor according to claim 1, characterized in that the longitudinal sides of the expansible segments (9) have several opposing indentations (15).

5. An expansible anchor according to claim 1, characterized in that the front inner edge of the expansible sleeve (5) has a bevel (10).

6. An expansible anchor according to claim 1, characterized in that the front corner edges of the expansible segments (9) are rounded (16).

7. A process for the manufacture of the expansible anchor of metal according to one of the preceding claims, characterized in that the contour of the blank constituting the expansible sleeve (5) is pre-stamped slightly undersized, the sheet metal thickness is subsequently compacted in a pressing operation, and after the compaction the locking elements (7) are punched out.

8. A process according to claim 7, characterized in that as the locking elements (7) are being punched out, the expansible sleeve (5) is pre-bent into a U-shape.

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