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Description**Expansible plug**

The invention relates to an expansible plug for anchoring in a building component, consisting of an expansible sleeve and a threaded bolt, according to the preamble of claim 1.

An expansible plug having an expansible sleeve that has a plurality of slots extending along a portion of its length is known from DE 35 07 022 A1. For anchoring the expansible plug, a threaded bolt that is provided with an expansion cone is drawn into the expansible sleeve by means of a nut that bears against the rear face of the expansible sleeve by way of a washer. Such an expansible plug is suitable for push-through mounting in which the expansible plug is pushed right through the article that is to be fastened and into the drilled hole that has been pre-drilled in the building component until the nut comes to rest against the outer surface of the article that is to be fastened. Since the nut bears both against the article that is to be fastened and against the rear end face of the expansible sleeve, sufficient anchoring of the expansible sleeve, but only insufficient clamping of the article to be fastened, can be obtained. As a result of the expansible sleeve becoming fixed in the anchoring process, an axial displacement of only the threaded bolt

occurs but no axial displacement of the nut in the direction of the building component. As a result, no tightening forces can be brought to bear on the building component that is to be fastened. That is disadvantageous
5 above all when, for example, there is a void in the region of the fastening point owing to unevenness in the surface of the building component and/or in the article that is to be fastened.

In order to avoid that disadvantage, in the known
10 expansible plug a compressible zone is provided in the expansible sleeve, which zone directly adjoins the longitudinal slots. The compressible zone is formed by a plurality of oblique cut-outs that are arranged spaced one from another circumferentially. A similar compress-
15 sible zone is known, for example, also from WO 84/01005.

With such a compressible zone it is certainly possible to clamp the article that is to be fastened to the building component but a number of other disadvantages occur that considerably impair the ability of the known expansible
20 plugs to function. As a result of the oblique cut-outs, on compression of the expansible sleeve, the rear portion of the expansible sleeve is displaced radially in relation to the front portion thereof and becomes jammed in the drilled hole and/or on the threaded bolt. Since
25 the radial displacement is limited by the drilled hole and by the bolt, in addition the webs remaining between the cut-outs bulge uncontrollably both inwards and outwards. That results in further jamming of the threaded bolt with the expansible sleeve, which necessarily in-
30 creases the resistance to being drawn in of the threaded bolt for expanding the plug. As a result of the non-uniform bulging-out and radial displacement between the upper and lower portion of the expansible sleeve, the expansion cone also is drawn non-uniformly into the

expansible legs of the expansible sleeve that are formed as a result of the slots. As a result of the varying load on the expansible legs, the latter are expanded non-uniformly and some of them are so deformed by overloading
5 that correct anchoring is not possible. The known expansible plugs are therefore not suitable for fastenings where safety is important.

The problem underlying the invention is to provide an expansible plug having a compressible zone, which plug is
10 simple to manufacture and enables operationally safe anchoring.

The solution to that problem is obtained by the features given in claim 1.

As a result of the ends of the sickle-shaped cut-outs,
15 which ends point towards one another and overlap one another circumferentially in meandering formation, a compressible zone is produced that enables an axial shortening of the expansible sleeve without radial displacement or bulges. In the compression process, the
20 sickle-shaped cut-outs are pressed together, the bending webs formed by the overlapping ends of the cut-outs being deformed exclusively in the axial direction and therefore without radial bulging. The cut-outs with their ends pointing towards one another and overlapping one another
25 circumferentially permit an axial shortening of the expansible sleeve, without bulging, by twice the width of the cut-outs in the region of their apex. Since the expansible sleeve is shortened uniformly, the expansible legs of the expansible sleeve are also expanded uniformly
30 radially. By virtue of the shortening of the expansible sleeve, clamping of the article that is to be fastened is possible even in the case of very serious voids.

It is especially advantageous if the number of the cut-outs that form the compressible zone is twice the number of the longitudinal slots in the expansible sleeve and the apex of each of the sickle-shaped cut-outs that lie
5 closest to the front end of the expansible sleeve is aligned with a respective longitudinal slot. Accordingly, a mushroom-shaped connection of the expansible legs to the expansible sleeve is obtained, which connection is exactly aligned with the expansible legs with the
10 result that the shortening acts uniformly on all the expansible legs.

The longitudinal slots can either extend to the cut-outs that lie closest to the front end of the expansible sleeve or alternatively can end at locations spaced from
15 those cut-outs, in which case the end of the slot is preferably of enlarged form in order to facilitate opening-up of the expansible legs.

Especially advantageous compression behaviour is obtained if the width of the bending web between the overlapped
20 ends of the cut-outs is approximately the inside width of the sickle-shaped cut-outs in the region of their apex and the width of the web remaining between the ends of the circumferentially arranged cut-outs is approximately twice the inside width of the sickle-shaped cut-outs in
25 the region of their apex.

Embodiments of the invention are illustrated in the drawing, in which:

Figure 1 shows the expansible plug according to the invention having longitudinal slots that
30 extend to the compressible zone;

Figure 2 shows the expansible plug having longi-

tudinal slots extending to locations spaced from the compressible zone; and

Figure 3 shows the expansible plug according to Figure 2 anchored in a building component.

- 5 The expansible plug according to Figure 1 consists of an expansible sleeve 1 that has longitudinal slots 4 that start from its front, insertion-side end 2 and form a plurality of expansible legs 3. If the expansible sleeve is manufactured by being punched out of a sheet metal
10 blank and subsequently rolled up, then one of the longitudinal slots is formed by the gap 4a resulting from rolling up (see Figure 3). Inserted through the expansible sleeve 1 is a threaded bolt 5, on the front end of which there is formed integrally an expansion cone 6.
15 On the rear end of the threaded bolt is a threaded section 7, onto which a nut 9 that has a crimped-on washer 8 is screwed.

As the compressible zone, the expansible sleeve 1 has a plurality of sickle-shaped cut-outs 10, 11 that are
20 arranged spaced one from another circumferentially and axially. The ends 12 of the cut-outs 10, 11 point towards one another axially and overlap each other circumferentially in meandering formation so that bending webs 13 are produced between the ends. In the embodiment il-
25 lustrated, the expansible sleeve has three longitudinal slots 4 and six cut-outs 10, 11 that form the compressible zone. The apex of each of the cut-outs 10 is aligned with a respective one of the longitudinal slots 4. Since the offset above-lying cut-outs 11 are
30 therefore necessarily aligned with the expansible legs 3, a mushroom-shaped symmetrical connection of the expansible legs 3 to the expansible sleeve 1 is obtained. In the embodiment according to Figure 1, the longitudinal

slot 4 opens into the cut-out 10 that lies closest to the front end 2 of the expansible sleeve 1.

Figure 2 illustrates an embodiment in which the longitudinal slots 4 end at locations spaced from the cut-outs 10, 11 that form the compressible zone. In order to facilitate opening-up of the expansible legs 3, the longitudinal slots 4 end in an enlargement 15. Sufficient rigidity of the expansible sleeve 1 combined with good compressibility is obtained by the fact that the width of the bending web 13 between the overlapped ends 12 of the cut-outs 10, 11 is approximately the inside width of the cut-outs 10, 11 in the region of their apex and the width of the web 16 remaining between the ends 12 of the circumferentially arranged cut-outs is approximately twice the inside width of the cut-outs 10, 11 in the region of their apex.

Figure 3 illustrates the expansible plug anchored in a building component 18. For anchoring the expansible plug, the latter is pushed into the drilled hole 19 of the building component 18 until the nut 9 rests by its crimped-on washer 8 against the outer surface of the article 20 that is to be fastened. By drawing in the expansion cone 6 into the slotted region of the expansible sleeve 1, the expansible legs 3 are pressed radially outwards and thereby expanded and, at the same time, if there is a void between the building component 18 and the article 20 that is to be fastened the expansible sleeve 1 is compressed in the region of the compressible zone formed by the cut-outs 10, 11. Maximum compression is reached when the two bounding edges that form each cut-out rest on top of one another.



Patent Claims

1. Expansible plug for anchoring in a building component, consisting of an expansible sleeve that has a plurality of slots that start from its front, insertion-
5 side end and extend along a portion of its length forming expansible legs and also a compressible zone, formed by cut-outs, that adjoins the slots, and of a threaded bolt that passes through the sleeve, on the front end of which bolt there is arranged an expansion cone to be drawn into
10 the slotted portion of the expansible sleeve, characterized in that the compressible zone is formed by a plurality of sickle-shaped cut-outs (10, 11) that are arranged spaced one from another circumferentially and axially, the ends (12) of the cut-outs (10, 11) pointing
15 towards one another axially and overlapping one another circumferentially in meandering formation to form bending webs (13).

2. Expansible plug according to claim 1, characterized in that the number of the cut-outs (10, 11) that form
20 the compressible zone is twice the number of the longitudinal slots (4) in the expansible sleeve (1) and the apex of each of the cut-outs (10) that lie closest to the front end (2) of the expansible sleeve (1) is aligned with a respective one of the longitudinal slots (4).

25 3. Expansible plug according to claim 1, characterized in that the longitudinal slots (4) extend to the



cut-outs (10) that lie closest to the front end (2) of the expansible sleeve (1).

4. Expansible plug according to claim 1, characterized in that the longitudinal slots (4) end at locations
5 spaced from the cut-outs (10) that lie closest to the front end (2) of the expansible plug (1).

5. Expansible plug according to claim 1, characterized in that the width of the bending web (13) between the overlapped ends (12) of the axially arranged
10 cut-outs (10, 11) is approximately the inside width of the cut-outs and the width of the web (16) remaining between the ends (12) of the circumferentially arranged cut-outs (10, 11) is approximately twice the inside width of the cut-outs (10, 11) in the region of their apex.