

The preamble of claim 1 is based on DE-A-3 017 108, which discloses an expansible plug with expansion discs staggered one behind the other on the plug shank; the discs form a constricted screw channel inside the plug shank.

The plug shank of this known plug is a metal sleeve in which several expansion elements are supported in corresponding slits in the sleeve. The inwardly projecting edges of the expansion elements have a semi-circular indentation, each of which forms a bounding face of a screw channel. The opposite bounding face of the screw channel is provided by the next successive expansion element. For the known plug to function, each individual expansion element has to be separately guided in a slit and be radially secured therein. The individually supported expansion elements provide only a small expansible surface so that an application in cavity building bricks or double-webbed panels is impossible. In an application of that kind it is necessary for as many expansion elements as possible to engage within a web. Furthermore, to achieve high holding values it is necessary for the expansion elements to expand fully at the rear of the web and in the cavity and, by supporting one another, to form a large-area abutment at the rear side of the webs. The lack of a closed bore for each individual expansion element in the known plug means that the individual expansion elements are not secured in the radial direction. Accordingly, the known plug is suitable only for applications in solid building materials, in which the wall of the drilled hole is closed. Furthermore, the expansion elements have to be arranged so that the inner limiting edge of the expansion elements forms a counter-thread engaging in the thread of the fixing screw. In the known plug, a screw with a tapering core cross-section is required to achieve an axial displacement of the expansion

elements. Because of the tapering core cross-section, however, in the front region of the plug there is a relatively insignificant radial displacement of the expansion elements and in the rear part of the plug there is a relatively large radial displacement of the expansion elements, with the undesirable result that stress peaks occur in the region of the mouth of the drilled hole which could lead to a break-out.

The subject of the application is based on the problem of producing an expansible plug which is suitable both for anchoring in solid building materials and also for fixings in cavities.

To solve this problem, each expansion disc of the subject of application has an eccentric bore which is staggered with respect to the bore of the adjacent expansion disc and is overlapped to form the constricted screw channel. Furthermore, every second successive expansion disc is mounted on a common resilient joining member arranged parallel to the displacement direction of the expansion discs; the expansion discs engage over one another in a staggered configuration and project inwards.

The expansion discs acting as expansion elements are arranged over virtually the entire length of the expansible plug, so that a very uniform expansion is obtained over the entire expansion region. As a fixing screw is screwed in, the eccentrically arranged bores of the expansion discs are coaxially aligned, namely concentrically with the centre line of the fixing screw. The expansion discs are thus displaced depending on the position of the eccentric bore. Preferably, the bores of adjacent discs are staggered with respect to one another, so that adjacent discs also are displaced outwards in a staggered configuration as the fixing screw is screwed in. Thus, in an alternating manner, one expansion disc is

displaced to one side and the subsequent expansion disc is displaced to the other side. If the expansible plug is inserted into a solid building material, then the expansion discs are pressed in each case against the wall of the drilled hole on opposing sides. When used in a hollow building material, the expansion discs engage the cavities so that a positive engagement in the masonry is achieved in the region of each wall that defines a cavity.

The expansion discs are joined to one another by joining members, every second successive expansion disc being mounted on a common joining member. The expansion discs projecting inwardly from two separate joining members extending externally on the plug shank are staggered on each joining member with respect to the expansion discs of the other joining member.

On its shank end further from the plug head, the expansible plug preferably has a pressure collar, into which the fixing screw engages so that an axial clamping of the expansion region comprising a number of expansion discs is possible.

It is especially advantageous to construct the expansible plug with its associated fixing screw so that the pitch of the fixing screw is an integral multiple of the thickness of the expansion discs. The individual expansion discs are thus able to wedge themselves between the flanks of the screw thread and provided mutual support for each other. This means that the expansible plug mounted in masonry has a greater strength and thus a higher load-carrying capacity.

The invention is explained in detail below with reference to the drawings, of which
Figure 1 shows an embodiment of an expansible plug with a plurality of expansion discs,

Figure 2 shows two sectional views of the expansible plug of Figure 1,
Figure 3 shows a section through the expansible plug of Figure 1 before being installed,
Figure 4 shows a section through the expansible plug in its installed state,
Figure 5 shows a further view of the expansible plug of Figure 1, and
Figure 6 shows a view of the expansible plug installed in a hollow building material.

The expansible plug illustrated in Figure 1 is in the form of a so-called frame plug which, when used for through-mounting applications, can be inserted through a bore of a frame part that is to be fixed, into a hole drilled in masonry. The expansible plug has a plug shank 1 with an expansion region 2, which is formed by a plurality of successive expansion discs 3, 4. In its upper region, the plug shank 1 is in the form of a plain plug sleeve, at the upper end of which there is a plug head 5 widened in the shape of a funnel. The plug head 5 is suitable for receiving the screw head of a countersunk screw.

At the lower end 6 of the shank, the expansible plug has a pressure collar 7 with an axial bore 8, which is in the form of a threaded bore.

The expansion discs 3, 4 are arranged alternately on a left-hand joining member 9 and a right-hand joining member 10.

Figure 2 illustrates the two sections AB and CD of the plug shank 1 of Figure 1. The section AB shows the expansion disc 3 with an eccentric bore 12 projecting from the joining member 9 towards the right.

The section CD shows the expansion disc 4 with an eccentric bore 13 projecting from the joining member 10 towards the left.

The two expansion discs 3, 4 are arranged one on top of the other and so that they are laterally displaceable in the case of the expansible plug illustrated in Figure 1, the eccentric bores 12, 13 being oppositely arranged.

In Figure 3, the position of the bores 12, 13 inside the expansion region 2 can be seen. The eccentric bores 12, 13 overlap in the region of the centre point 14 of the axis, so that in this region a constricted screw channel 15 is formed. The expression "a constricted screw channel" can be used here because the screw thread diameter of the fixing screw to be inserted into the plug corresponds approximately to the diameter of the bores 12, 13. If the fixing screw is now screwed into the expansible plug shown in Figure 1, then this results in the eccentric bores 12, 13 being moved out of their eccentric position into a coaxial position, as illustrated in Figure 4. The expansion discs 3, 4 are thus constrained to move downwards and upwards into the position illustrated in Figure 4.

Figure 5 illustrates the expansible plug of Figure 1 partly in section, the eccentric bores 12, 13 of the discs 3, 4 being staggered laterally with respect to one another.

Figure 6 illustrates the expansible plug of Figure 5 mounted in a hollow building material. The hollow building material here comprises a honeycomb brick with walls 16, 17, in which there are respective coaxial bores 18, 19. On the wall surface 20 there is a frame part 21, into the through-bore 22 of which the expansible plug has been pushed, initially without a fixing screw. After screwing in a fixing screw 23, the expansion discs 3, 4 have been displaced in opposite directions into the position illustrated, so that the expansible plug is located positively in the

masonry in the region of the walls 16, 17. In the region of the bores 18, 19, the expansion discs 3, 4 press against the wall of the drilled hole. At the transition region from the bores 18, 19 to the cavities 24, 25, the joining member 9 has a bulge 26 resulting from the differing displacement of the expansion discs 3.

The fixing screw 23 is a customary countersunk screw, the countersunk head 27 of which lies in the funnel-shaped plug head 5. If the fixing screw 23 is tightened to an appropriate degree, then the pressure collar 7 is thereby drawn in the direction of the plug head 5, with the result that the expansion discs of the expansion region are clamped together. The plug mounted in the masonry thus has considerable rigidity imparted to it, which guarantees an extremely reliable fixing.

The pitch of the fixing screw 23 is preferably such that it corresponds to an integral multiple of the breadth of the expansion discs 3, 4. In the embodiment illustrated, the pitch corresponds to the breadth of two expansion discs 3, 4.

Patent Claims

1. Expansible plug with expansion discs staggered one behind the other on the plug shank and forming a constricted screw channel inside the plug shank, which expansion discs are arranged to be displaced radially outwards as a fixing screw is screwed in, characterized in that each expansion disc (3, 4) has an eccentric bore (12, 13) which is overlapped by the bore of the adjacent expansion disc to form the constricted screw channel, and every second successive expansion disc (3, 4) is mounted on a common resilient joining member (9, 10) arranged parallel to the displacement direction of the expansion discs, the expansion discs (3, 4) projecting inwards from the joining members (9, 10) and engaging over one another in a staggered configuration.

2. An expansible plug according to claim 1, characterized in that at the end (6) of the shank further from the plug head (5) a pressure collar (7) with an axial bore (8) joins the joining members (9, 10) which in the region of the plug head (5) become a sleeve-shaped shank part joining them.

3. An expansible plug according to one of the preceding claims, characterized in that the expansible plug comprises two plug halves engaging in one another by means of their expansion discs (3, 4).

4. An expansible plug with fixing screw according to one of the preceding claims, characterized in that the pitch of the fixing screw (23) is an integral multiple of the thickness of the expansion discs (3, 4).

