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**US-A- 4 585 382**  
**US-B1- 6 315 510**



# **DESCRIPTION**

## **TECHNICAL FIELD**

**[0001]** The present invention relates to plugs for sealing and closing holes in walls and the like.

## **PRIOR ART**

**[0002]** Sealing plugs for closing holes in walls and the like, of the type comprising an elastic body and a stem such that the elastic body expands radially by pulling on the stem, are known. Such plugs are widely used for sealing holes that are provided for example in a concrete wall due to the manufacturing process. As is well known, concrete walls are manufactured allowing a gap between formwork panels which are arranged facing one another. Said panels are secured to one another by means of transverse bolts having threaded ends projecting out of the panels to be able to screw the corresponding nuts. Once the panels are secured, the concrete is poured into the gap which is arranged sandwiched between the formwork panels. To prevent the concrete from adhering to the transverse bolts once set, these bolts are usually first covered or placed inside a tube (normally made of plastic) which is sometimes removed when stripping formwork and other times not. Once the concrete has set, the formwork panels are dismantled and the transverse bolts are disassembled. Therefore, once said transverse bolts are disassembled, they generate through holes in the concrete wall which must be closed and sealed to prevent water leaks.

**[0003]** ES1060376 U discloses a sealing plug comprising an elastic body and a coaxially assembled stem. The elastic body comprises a main cylindrical body and a through hole to allow the passage of the stem. The stem comprises a head abutting with one end of the main body, whereas an abutting washer is arranged at the other end. When the stem is pulled on by the free end with the aid of a riveter or the like, the elastic body is compressed between the head of the stem and the thrust washer, causing radial expansion such that the elastic body is fitted over the hole of the concrete wall.

**[0004]** GB2157788 A discloses an anchoring device for joining two parts together according to the preamble of claim 1. Both parts comprise a bore hole that must be sealed. The device comprises an elastic body and a stem mounted coaxially. The elastic body comprises a main body which is expanded radially when the free end of the stem is pulled. The elastic body also comprises a head in the form of a cup-like washer comprising a solid body part and extending from said body part a flexible circular rim with a recess inside. When pulling from the stem the main body compresses and expands radially and the rim deforms exerting an axial closing pressure on the outer contact surface of one of the parts to be joined.

## **DISCLOSURE OF THE INVENTION**

**[0005]** The object of the invention is to provide a sealing plug for closing holes in walls and the like. This object is achieved by a plug according to claim 1.

**[0006]** The sealing plug of the invention comprises an elastic body and a stem coaxially assembled to one another. The elastic body comprises a main body which is suitable for being expanded radially when pulling on the free end of the stem which emerges out of said elastic body. Said elastic body also comprises a head attached to the main body, said head comprising a compressive strength less than that comprised in the main body.

**[0007]** The plug of the invention improves the sealing of a hole to be plugged in a wall or the like, for example, in a tank, in a simple, economical and reliable manner. Said plug assures good hermetic closure of the hole on the inner face thereof while at the same time assures good hermetic closure of the outer wall. Sealing the inner gap of the formwork, i.e., the inner face of the hole, is often insufficient because water leaks can still take place between the protective tube, which is placed to protect the transverse bolts used to attach the formwork panels together, and the concrete, for example. In addition to internally sealing the hole, the sealing plug of the invention also assures sealing from the outside such that said leaks between the protective tube and the concrete can be prevented without needing to use additional sealing means such as O-rings, fillers, cements or the like, which is very advantageous for sealing holes in the walls of a water tank in a reliable, economical and simple manner since special skills for sealing said hole on the outside are not required.

**[0008]** These and other advantages and features of the invention will become evident in view of the drawings and the detailed

description of the invention.

## DESCRIPTION OF THE DRAWINGS

### [0009]

Figure 1 shows a perspective view of a first embodiment of the sealing plug according to the invention.

Figure 2A shows a side view of the sealing plug of Figure 1.

Figure 2B shows a side view of a second embodiment of the sealing plug according to the invention.

Figure 3A is a cutaway view of the sealing plug of Figure 2A.

Figure 3B is a cutaway view of the sealing plug of Figure 2B.

Figure 3C is a cutaway view of a third embodiment of the sealing plug according to the invention.

Figure 3D is a cutaway view of Figure 3C but without the intermediate washer.

Figure 3E shows a side view with a partial cutaway of another embodiment of the sealing plug according to the invention.

Figure 4 shows the sealing plug of Figure 1 inserted and in a deformed state into a hole in a wall where the protective tube has been removed.

Figure 5 shows the sealing plug of Figure 1 inserted and in a deformed state into a hole in a wall where the protective tube has not been removed.

## DETAILED DISCLOSURE OF THE INVENTION

[0010] The sealing plug 1 according to a first embodiment of the invention comprises an elastic body 2 and a stem 3 coaxially assembled to one another as shown in Figure 1 and in the rest of the drawings. The elastic body 2 comprises a main body 2a which is suitable for being expanded radially when pulling on the free end 3a of the stem 3 which emerges out of said elastic body 2. Said elastic body 2 also comprises a head 2b attached to the main body 2a, said head 2b comprising a compressive strength less than that comprised in the main body 2a.

[0011] The stem 3 of the plug 1 of said first embodiment is preferably a rivet, like in the rest of the embodiments that will be detailed later.

[0012] The description and arrangement of the stem 3 of this first embodiment is similar to the rest of the embodiments that will be detailed throughout the description. Therefore, as seen in Figures 1, 2A, 2B, 3A, 3B, 3C, and 3D, one end of the stem 3 is arranged inside the elastic body 2 whereas the other end, preferably having a sharp-pointed shape, emerges from one end of the elastic body 2 corresponding with the free end of the head 2b of said elastic body 2.

[0013] The main body 2a of the elastic body 2 is substantially cylindrical and, as shown in Figures 1 and 2A, is attached at one end to the head 2b which comprises a greater diameter. The other end of the main body 2a is a closed end and comprises preferably a bell shape although said shape is not relevant for the invention.

[0014] In addition, the stem 3 of the plug of said first embodiment, like the rest of the embodiments, comprises a main rod 3', preferably having a cylindrical shape, attached to a head 3" having a greater diameter. The free end 3a emerging from the elastic body 2 corresponds with the free end of said main rod 3'. The head 3" of the stem 3 is arranged inside the elastic body 2, preferably inside the main body 2a and more specifically close to the bell-shaped end.

[0015] As seen in the example of Figure 3A, the plug 1 of the invention according to the first embodiment comprises a first thrust washer 5a and a second thrust washer 5b. The first thrust washer 5a is arranged in the main body 2a close to the end of the main body 2a opposite to the area of attachment between said main body 2a and the head 2b. Said first washer 5a is preferably arranged inside said main body 2a, as seen in detail in the example of Figure 3A. The second thrust washer 5b is arranged

adjacent to the free outer face of the head 2b of the elastic body 2 as seen in the drawings.

**[0016]** For sealing the hole 4 in a wall (such as that shown in the example of Figure 4), the plug 1 is introduced into said hole 4 such that the main body 2a and possibly at least part of the head 2b are arranged inside the hole 4. In addition, as a result of it having a diameter greater than the main body 2a and the hole 4 to be plugged, at least part of the head 2b is arranged outside said hole 4 such that it abuts with the wall itself which will be referred to hereinafter as the outer contact wall 4a. Since most holes comprise a first conical portion, the head 2b of the elastic element 2 according to any of the embodiments preferably comprises a conical shape so that the plug 1 better adapts to or fits over both the hole 4 and the outer contact wall 4a.

**[0017]** The plug 1 also comprises a rivet sleeve 9 as shown in the figures. When the stem 3 is pulled on by its free end 3a by means of a riveter or a similar tool, the head 3" of the stem 3 compresses and therefore deforms the rivet sleeve 9 exerting compression pressure on the first thrust washer 5a by means of the deformed rivet sleeve 9 (see figures 4 and 5). The plug 1 is compressed between said first thrust washer 5a and the second thrust washer 5b.

**[0018]** Radial expansion of the plug 1 consequently occurs upon compressing the plug 1. Expansion continues until the stem 3 breaks at a notch, not shown in the drawings, comprised in the main rod 3' of the stem 3 and arranged close to the head 3". As a result of the radial expansion of the main body 2a, the latter one adapts to and fits with the inner face of the hole 4 while at the same time exerts radial closing pressure "p" on said inner face, internally plugging and sealing said hole 4. Likewise, the elastic body 2 also assures the sealing of the outer contact wall 4a of the hole 4 to be plugged because at least part of the head 2b changes its geometry to adapt to and to fit with the shape of the outer contact wall 4a, while at the same time exerts axial closing pressure "P" on said outer contact wall 4a of the hole 4 to be plugged, as shown in Figures 4 and 5, thus assuring good hermetic closure of the hole 4. The fact that the head 2b of the elastic body 2 comprises a compressive strength less than the main body 2a assures that the head 2b deforms and exerts said axial closing pressure "P" on the outer contact wall 4a before the stem 3 breaks, which is normally determined by the radial closing pressure "p".

**[0019]** The elastic body 2 of the plug 1 is kept deformed by means of the rivet sleeve 9, as shown in Figures 3A, 3B, 3C, 3D and 3E, which, as explained above, is also compressed when pulling on the stem 3 by means of the riveter or a similar tool, thus preventing the elastic body 2 from recovering its initial geometry.

**[0020]** Everything that has been described up until now is also applicable for the rest of the embodiments that will be detailed throughout the description.

**[0021]** According to the first embodiment of the sealing plug 1, the main body 2a and the head 2b form a single part. However, according to a second embodiment of the invention both parts are independent from one another even though they are attached.

**[0022]** The plug 1 according to this second embodiment of the invention comprises all the features of the plug of the first embodiment and further comprises an intermediate washer 5c arranged between the first thrust washer 5a and the second thrust washer 5b. As shown in Figures 2B and 3B, said intermediate washer 5c is preferably arranged between the main body 2a and the head 2b, such that the intermediate washer 5c is arranged joined to the main body 2a, being visible from the outside. Said intermediate washer 5c allows better control of the deformation of the head 2b caused by the expansion of the plug 1 towards the outer contact wall 4a, thus favoring sealing the outer wall of the hole 4 to be plugged.

**[0023]** Both in the first and in the second embodiment of the invention, for the head 2b to comprise less compressive strength, said head 2b can comprise a material softer than the material of the main body 2a. Another way for the head 2b to comprise less compressive strength, considering that both the head 2b and the main body 2a may or may not be made of the same material, can be to remove material from the head 2b in order to weaken it. In this sense, as shown in the examples of Figures 3A, 3B, 3C and 3D, the head 2b internally comprises a cavity 6. Said cavity 6 provides a gap in the head 2b after the stem 3 has been assembled in the plug 1 and before said head 2b has been deformed. To prevent complicating the manufacture of said head 2b, this cavity 6 could be an enlargement of the hole for the passage of the stem 3. On one hand, the cavity of the head 2b prevents oversizing the main body 2a to obtain the desired compressive strength difference between the head 2b and the main body 2a. On the other hand, said cavity 6 also favors the fluidity of the head 2b allowing the material to flow more readily and better adapt to the geometry of the outer contact wall 4a, exerting the necessary axial closing pressure "P" on said outer wall, contributing to an improved sealing of the hole 4 in this sense. The greater the deformation of the head 2b, the greater the portion of the outer contact wall 4a surrounding the hole 4 to be plugged would be covered by the plug 1, the sealing of the hole 4 is therefore significantly improved.

**[0024]** In many applications, plugging the hole only in the inner portion is insufficient since said hole can have irregularities, in

concrete walls for example, that enable water or other liquids to leak in, even through the outer front contact wall. In this sense, use of the plug 1 according to any of the embodiments of the invention is particularly advantageous for hermetically plugging and sealing holes in a concrete wall, particularly in a concrete wall of a water tank.

[0025] In many other applications in which the protective tube 8 is not removed from the concrete wall, the sealing of the inner diameter of said protective tube 8 does not prevent leaks between the outside of the protective tube 8 and the outer concrete wall. Therefore, with the sealing plug 1 according to any of the embodiments of the invention hermetic sealing both of the inside and of the outside of the protective tube 8 with respect to the concrete wall is achieved, as seen in Figure 5.

[0026] The plug 1 according to a third embodiment of the invention comprises all the features of the plug 1 of the first embodiment. Optionally, it can also comprise the intermediate washer 5c described for the plug 1 of the second embodiment. However, the main body 2a of the elastic body 2 of the plug 1 of this third embodiment also internally comprises a cavity 7 as shown in Figure 3C. Said cavity 7 provides a gap in the main body 2a after the stem 3 has been assembled in the plug 1 and before said body 2a has been deformed. This cavity 7 allows improving the fluidity of the body 2a during the deformation of the plug 1, allowing the material to flow more readily, being better adapted to the geometry of the hole 4.

[0027] The plug 1 according to another embodiment of the invention comprises all the features of the plug 1 of the first embodiment. Furthermore, the main body 2a and the head 2b can form a single part or be independent from one another, and the main body 2a can optionally comprise the cavity 7 described for the plug 1 of the second embodiment, and the plug 1 can also comprise the intermediate washer 5c described for the plug 1 of the second embodiment. However, in this embodiment the head 2b internally comprises a rigid body which can be made of metal, plastic or the like, as shown in Figure 3E, and which performs the same function as the second thrust washer 5b, i.e., said rigid body allows the plug 1 to be compressed between the first thrust washer 5a and said rigid body when the stem 3 is pulled on by means of a riveter or a similar tool. As a result of said operation of pulling on the stem 3, the deformable portion of the head 2b can thus comprise a compressive strength less than that of the main body 2a while at the same time the head 2b is reinforced by means of said rigid body which, as its own name indicates, gives "body" to the head 2b. The deformable portion of the head 2b surrounds the rigid body and when the stem 3 is pulled on, said deformable portion of the head 2b changes its geometry to adapt to the shape of the outer contact wall 4a of the hole 4 to be plugged, exerting axial closing pressure "P" on said outer wall.

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description

- [ES1060376U \[0003\]](#)
- [GB2157788A \[0004\]](#)

**Forseglingsprop til tillukning af huller i vægge og lignende****Patentkrav**

1.           Forseglingsprop til tillukning af huller (4) i vægge og lignende af typen, der omfatter et elastisk legeme (2) og et skaft (3) koaksialt monteret til hinanden, hvor det  
5   elastiske legeme (2) omfatter et hovedlegeme (2a), der er egnet til at blive udvidet radiale, når der trækkes i den frie ende (3a) af skaftet (3), der rager ud fra det elastiske legeme (2), og således skabe et radiale lukkettryk (p) på indersiden af hullet (4), der skal forsegles, og et hoved (2b) fastgjort til hovedlegemet (2a), hvor hovedet (2b) er egnet til at blive komprimeret og skabe aksiale lukkettryk (P) på den ydre kontaktvæg (4a) af hullet (4), der  
10   skal forsegles, når der trækkes i den frie ende (3a) af skaftet (3), og hvor hovedets (2b) kompressionsstyrke er mindre end hovedlegemets (2a) kompressionsstyrke, således at mindst en del af hovedet (2b) ændrer dets geometri for at tilpasse sig formen af den ydre kontaktvæg (4a) af hullet (4), der skal forsegles, **kendetegnet ved, at** proppen (1) desuden omfatter en første trykskive (5a) anbragt tæt på enden af hovedlegemet (2a)  
15   modsat området, hvor hovedet (2b) og hovedlegemet (2a) er fastgjort til hinanden, og en anden trykskive (5b) anbragt på ydersiden af hovedet (2b), således at den muliggør kompression af proppen (1) mellem de to trykskiver (5a, 5b).
2.           Forseglingsprop ifølge krav 1, hvor den første trykskive (5a) er anbragt indeni hovedlegemet (2a).
- 20   3.           Forseglingsprop ifølge krav 1 eller 2, hvor skaftet (3) skaber kompressionstryk på den første trykskive (5a), når der trækkes i den frie ende (3a) af skaftet (3).
4.           Forseglingsprop ifølge ethvert af kravene 1 til 3, der omfatter en mellemliggende skive (5c) anbragt mellem den første trykskive (5a) og den anden  
25   trykskive (5b).
5.           Forseglingsprop ifølge krav 4, hvor den mellemliggende skive (5c) er anbragt mellem hovedlegemet (2a) og hovedet (2b).
6.           Forseglingsprop ifølge ethvert af de foregående krav, hvor hovedlegemet (2a) og hovedet (2b) udgør en enkelt del.
- 30   7.           Forseglingsprop ifølge ethvert af kravene 1 til 5, hvor hovedlegemet (2a) og hovedet (2b) er to uafhængige dele fastgjort til hinanden.
8.           Forseglingsprop ifølge ethvert af de foregående krav, hvor hovedet (2b) indvendigt omfatter mindst ét hulrum (6), efter skaftet (3) er blevet monteret på forseglingsproppen (1) og før hovedet (2b) er blevet deformeret.

9. Forseglingsprop ifølge ethvert af kravene 1 til 7, hvor hovedet (2b) indvendigt omfatter et stift legeme.
10. Forseglingsprop ifølge ethvert af de foregående krav, hvor hovedlegemet (2a) indvendigt omfatter mindst ét hulrum (7), efter skaftet (3) er blevet monteret på  
5 forseglingsproppen (1) og før hovedlegemet (2a) er blevet deformeret.
11. Forseglingsprop ifølge ethvert af de foregående krav, hvor hovedet (2b) omfatter et materiale, der er blødere end hovedlegemets (2a) materiale.
12. Forseglingsprop ifølge ethvert af de foregående krav, hvor skaftet (3) på forseglingsproppen (1) er en nagle.



DRAWINGS

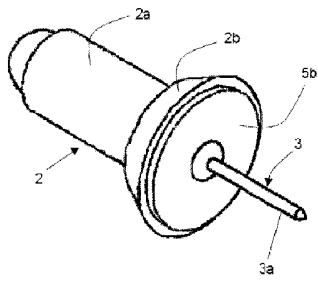


Fig. 1

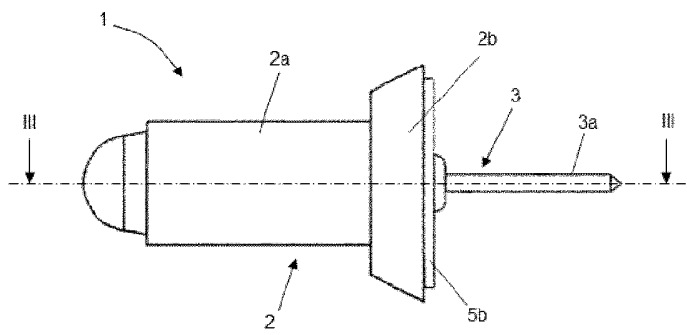


Fig. 2A

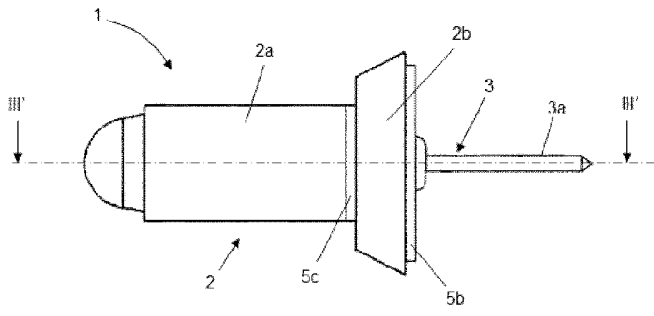


Fig. 2B

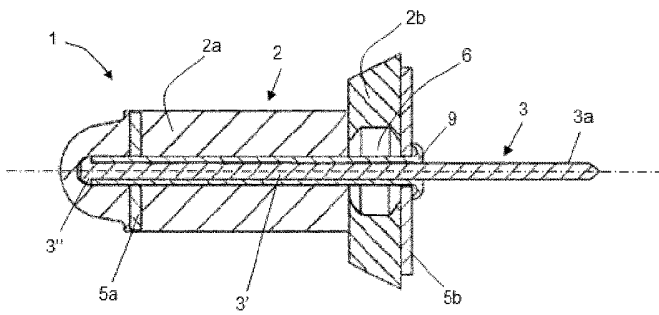


Fig. 3A

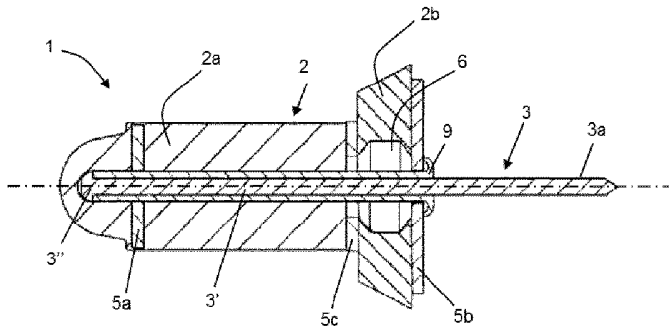


Fig. 3B

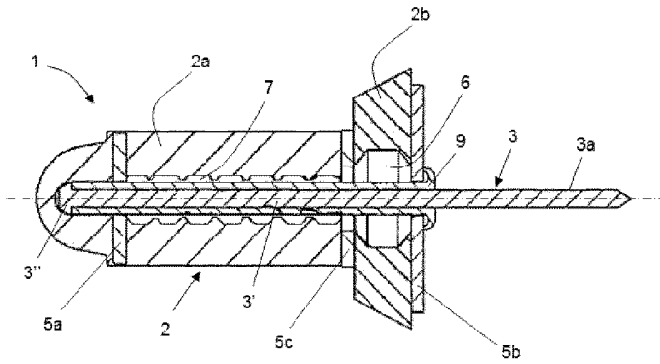


Fig. 3C

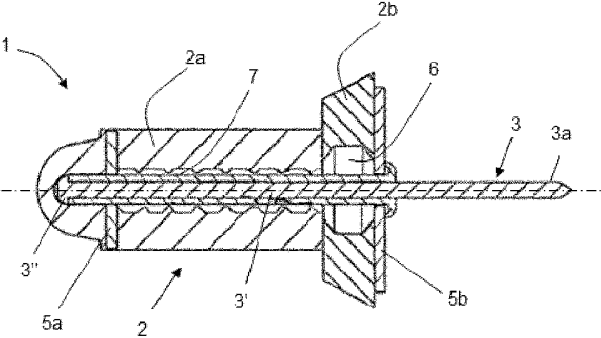


Fig. 3D

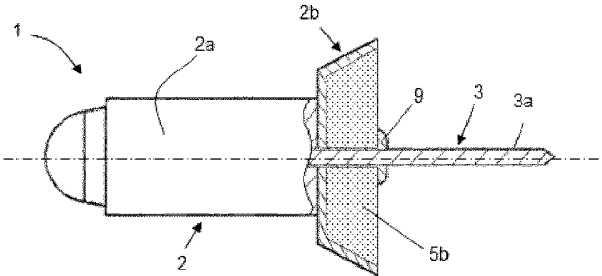


Fig. 3E

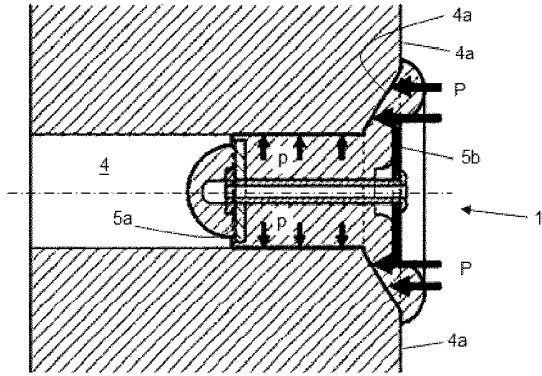


Fig. 4

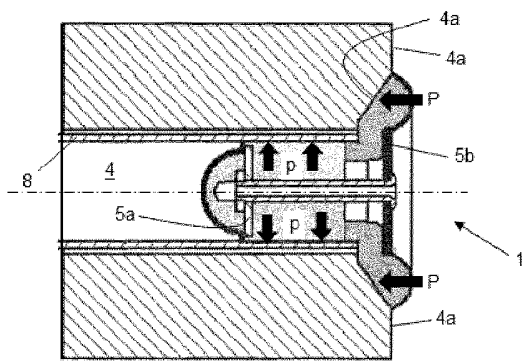


Fig. 5