

June 23, 1970

A. BERNER

3,516,324

EXPANDABLE PLUGS

Filed Jan. 25, 1968

FIG. 1

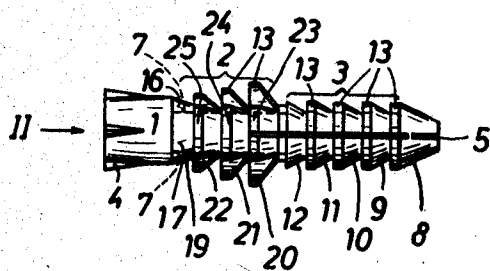


FIG. 2

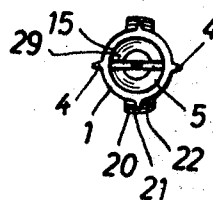


FIG. 3

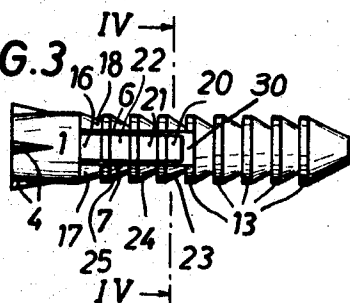


FIG. 4

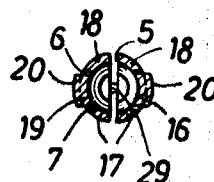


FIG. 5

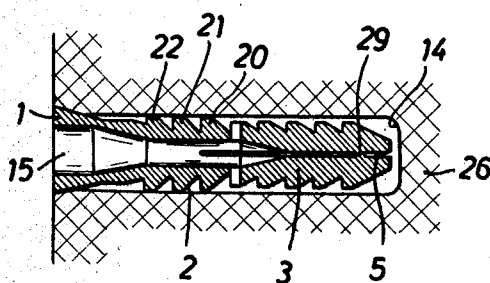
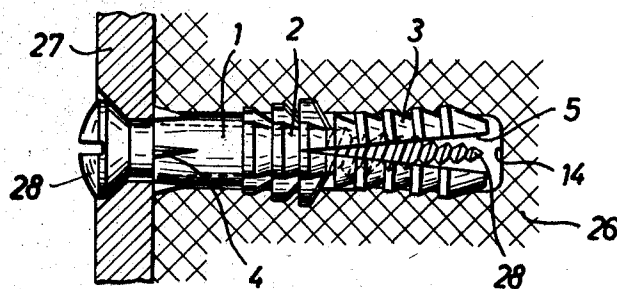


FIG. 6



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EXPANDABLE PLUGS

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Filed Jan. 25, 1968, Ser. No. 700,482

Int. Cl. F16b 13/12

U.S. Cl. 85—83

3 Claims

ABSTRACT OF THE DISCLOSURE

The invention relates to an expandable plug having integral front, intermediate and rear portions and includes on the front and intermediate portions a first set of off-standing teeth of substantially equal radial extent with spaced groups of teeth of decreasing length carried by the intermediate portion and interposed between the first set of teeth. The body of the plug has an axial perforation which communicates with orthogonally related slotted areas in both the front and intermediate portions.

BACKGROUND OF THE INVENTION

This invention relates to a longitudinally slotted expandable plug having a hollow space extending longitudinally through the plug for the insertion of a fastening element, for example a screw, and having raised portions of a cross-sectional shape similar to inclined teeth provided on the outside of the part to be spread out, said plug being made of a material, preferably a plastic material, adapted to be deformed by the driving-in of the fastening element.

Expandable plugs having longitudinal slots extending over their entire width are known, for example, from the disclosures of British patent specification No. 589,648 and from German patent specifications Nos. 910,588, 1,097,117, and 1,102,375. These specifications disclose such plugs having slots which begin at the front end of the plug, while the British patent specification No. 589,648 also discloses a plug having slots beginning at the rear end of the plug. These specifications also already show raised portions of a cross-sectional shape similar to sawteeth or inclined teeth. From German patent specification No. 569,700, which relates to a square-type plug or sleeve of sheet metal, it is also known to have projections similar to sawteeth cut deeper at the front end of the sleeve than toward the rear thereof.

In known plugs the essential clamping action is produced only at the front end of the plug. The problem underlying the invention is to improve the clamping action and to provide a plug giving a clamping and anchoring action extending over the greater part of the length of the plug and obtained even when the opening, for example, in the brickwork or other material in which the plug is inserted is of ample size in relation to the diameter of an envelope cylinder circumscribing the essential regions of the plug body. At the same time this aim is to be achieved without use of sensitive elements, that is to say, elements which can easily break off, on the surface of the plug.

SUMMARY OF THE INVENTION

Accordingly, the present invention comprises a longitudinally slotted expandable plug having a hollow space passing through it in a longitudinal direction and serving for the introduction of a fastening element, for example, a screw, having raised portions similar in cross-section to inclined teeth provided on the outside of the parts to be expanded, and being made of a material, preferably a plas-

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tic material, adapted to be deformed by the driving-in of the fastening element, characterized in that apart from a longitudinal slot which starts from the front end of the plug, is situated substantially in the middle, and extends over approximately half the length of the plug, there are provided, starting from an annularly closed rear portion of the plug body, in the middle region of the plug two longitudinal slots, which run substantially parallel to one another in spaced relationship, extend in planes at right angles to the plane of the front longitudinal slot, and which extend to a point approximately halfway along the length of the plug body.

In addition to the front expandable portion serving to produce a clamping action, the plug constructed according to the invention consequently has a second, differently expandable portion which adjoins the first-mentioned portion at the rear and likewise produces a clamping action, and which because of the annular rear portion of the plug body will be referred to as the middle portion, so that a double expanding and clamping action is achieved, and this is done differently in the two portions used to obtain an expanding and clamping action. Thus, the probability that the plug will comply with the requirements imposed on it in all conceivable applications is increased in an advantageous manner.

If the central longitudinal slot starting from the front end of the plug and the abovementioned rear slots overlap, the connection of the two expanding regions is more resilient than when there is no overlap, so that the expansibility of the clamping elements of the rear region is improved.

According to an optional feature of the invention, the cross-section of the teeth, particularly in the region of the middle portion of the plug body, increases toward the front end of the plug; the anchoring action is thereby further improved.

Another optional feature of the invention consists in that in the four band regions formed by the double slotting in the middle portion of the plug, teeth projecting farther radially outward on the periphery alternate with teeth projecting to a lesser radial extent outwardly. This contributes toward preventing the plug from rotating.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be more readily understood, reference is made to the accompanying drawings which illustrate diagrammatically and by way of example, one embodiment thereof, and in which:

FIG. 1 is a side elevation of a plug constructed according to the invention;

FIG. 2 is an end view of the plug illustrated in FIG. 1, viewed in the direction of the arrow II in FIG. 1;

FIG. 3 is a side elevation of the same plug in a position rotated through 90° about the longitudinal axis in relation to FIG. 1;

FIG. 4 is a section on the line IV—IV of FIG. 3;

FIG. 5 shows in longitudinal section the plug inserted into an opening in a wall; and

FIG. 6 shows the plug expanded in the opening in the wall.

DESCRIPTION OF THE EMBODIMENT

In the drawings, viewed from rear to front in the direction of the axis, the plug according to the invention has three portions, that is an annular rear portion 1, a middle portion 2, and a front portion 3 of the plug body. On the annular rear portion 1 of the plug body there are

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provided wedge-shaped ribs 4, which in the example illustrated are uniformly spaced around the circumference of portion 1 by 90° in relation to one another. Starting from the plane containing slots 6—6 and that containing slots 5 extending over the entire cross-section of the plug runs to the rear, passing not only through the entire front portion 3 of the plug in the example illustrated, but also continuing into the middle portion 2 of the plug. The slot 5 divides the front portion 3 into two front legs which are free at their front terminus and hingedly attached to about the mid portion of the plug at their rear terminus, where the slot 5 ends. An expandable plug having such front legs is known in the art. In the middle portion 2 there are provided four longitudinal slots 6—6 and 7—7 which run substantially parallel to one another in spaced relationship. It is particularly well seen in FIG. 4 that the plane containing slots 6—6 and that containing slots 7—7 are, on the one hand, parallel with one another, and, on the other hand, extend normal to the diametrical plane containing slot 5. Slots 6—6 and 7—7 begin at the rear annular portion 1 of the plug body and extend through the entire middle portion, so that they overlap the longitudinal slot 5. A comparatively weak connection 29 bridging over the longitudinal slot 5 provisionally holds the plug halves or front legs together on each side of the longitudinal slot 5, so that they will not open out or be accidentally pressed apart before the plug is inserted into means defining an opening 14. However, when a screw 28 or other fastening element is threaded into the plug, the connection 29 is automatically broken.

On the front part 3 there are disposed annular projections 8 to 12, which in projection and in cross-section have sawtooth-like boundaries, the inclined tooth back facing the front end of the plug and the steep tooth front facing the rear end of the plug. These annular projections, which hereinbelow will be referred to for short as "teeth," decrease in size from front to rear, viewed in the direction of the longitudinal axis of the plug. In the radial direction they have equal diameters, that is to say the same diameter as the rear annular portion 1 of the plug body, so that they can be inscribed in an enveloping circular cylinder to which the dimensions of the means defining the opening 14, which is provided in a wall and into which the plug is to be inserted, must correspond. The crowns 13 of the teeth 8 to 12 are flattened.

The frontmost largest tooth 8 forms a forwardly tapering truncated cone, so that the plug body, viewed as a whole, thus has a truncated conical tip.

Except for the longitudinal slot 5 extending through it, the front portion 3 of the plug body is solid, whereas the rear annular portion 1 of the plug body contains a cylindrical hollow space 15 (see FIG. 5) which continues through the extent of the middle portion 2. At their front terminus, the slots 6 and 7 on both sides of the plug are interconnected by a short transversal slot 30 as shown in FIG. 3. Thus, slots 6, 7 and 30 on one side of the plug define a band region 16, while corresponding slots 6, 7 and 30 on the other side of the plug define a band region 19. It is seen that band regions 16 and 19 are, at their rear terminus, attached to the rear annular portion 1 of the plug body, whereas, by virtue of transversal slots 30, they are free at their front end. Band regions 16 and 19 are separated from one another by intermediate band regions 17 and 18 each merging with both the rear portion 1 and the front portion 3 of the plug. The regions 16—19 may all be of equal width (see FIG. 4) or may alternatively have different widths. Stating the afore-described structure in different terms, the band regions 16 and 19 are in fact rear legs which have a free front terminus by virtue of transversal slots 30, and a rear terminus hingedly attached to the rear annular portion of body 1 substantially rearwardly of the location of hinged attachment of the front legs. It is thus seen that the expandable plug according to the invention, in addition to front legs, has similarly constructed rear legs which—as it will

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be discussed in more detail later—substantially duplicate the clamping action of the front legs. Although the slot 5 overlaps the four slots 6—6, 7—7, the plug is still held together, because extensions of the band regions 16 to 19 still exist between the slots and connect the front portion 3 to the middle portion 2. This can best be seen in FIG. 1, where the projection lines produced in the middle part 2 by the slot 7, the plane of which lies at right-angles to that of the slot 5, are shown.

On the band regions 16 to 19 of the middle portion 2 there are likewise situated teeth, which in section are similar to the teeth provided on the front portion 3 of the plug body, but which are not all of the same type. On the band regions or rear legs 16 and 19 there are in fact provided teeth 20 to 22 which project to different extents outwardly in a radial direction.

The teeth 20 which face the front end of the plug project farthest to the outside in a radial direction, in fact considerably beyond the envelope cylinder circumscribing the teeth 8 to 12 and the rear annular portion 1 of the plug body. The teeth 22 facing the rear portion of the plug are the lowest. The teeth 20 to 22 have flattened portions similar to the flattened portions 13.

On the band regions 17 and 18 there are provided teeth 23 to 25 which, like the teeth 8 to 12, can be inscribed in the envelope cylinder.

When the plug is inserted into the cylindrical opening 14, for example, in brickwork 26, the middle portion 2 is compressed, this compression being greater in the plane of the teeth 20 to 22 provided on the regions 16 and 19 and projecting further in the radial direction, than in the plane transverse thereto. After the screw 28, which may hold a plate 27, has been screwed into the plug, the clamping, holding, and gripping engagements indicated in FIG. 6 are obtained. Thus, it will be apparent that by this plug design some of the teeth particularly those in the middle portion 2 of the plug project radially farther outward than those disposed at the front and rear portions thereof. This together with the slots 6 and 7 provide a plug which is secured firmly against turning.

Although only one embodiment of the invention has been depicted and described, it will be apparent that this embodiment is illustrative in nature and that a number of modifications in the apparatus and variations in its end use may be effected without departing from the spirit or scope of the invention as defined in the appended claims.

What is claimed is:

1. In an expandable hollow plug of the type having at least two axially extending front legs free at their front terminus and hingedly attached at their rear terminus to about the mid portion of said plug, said front legs adapted to spread radially outwardly when a fastening element is driven through the rear terminus of said plug axially thereof, said front legs having a plurality of teeth at locations substantially along their entire length frictionally engaging the inner wall of a bore when said front legs are spread by said fastening element, the improvement comprising, at least two axially extending rear legs each having a free front terminus disposed approximately adjacent the rear terminus of said front legs, each said rear leg further having a rear terminus hingedly attached to said plug at a location substantially rearwardly of the rear terminus of said front legs, said rear legs adapted to spread radially outwardly when a fastening element is driven through the rear terminus of said plug axially thereof, said rear legs having a plurality of teeth substantially along their entire length, rearwardly successive teeth of said rear legs projecting therefrom in a decreasing extent.

2. An expandable plug as defined in claim 1, wherein the location of hinged attachment of said front legs is, when viewed axially, between the free front terminus of said rear legs and the location of hinged attachment of said rear legs.

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3. An expandable plug as defined in claim 1, wherein said free front terminus of each rear leg is located at approximately the middle of the length of said plug.

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U.S. Cl. X.R.

85—84

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,516,324 Dated June 23, 1970

Inventor(s) Albert Berner

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In col. 3, line 4, "the plane containing slots 6--6 and that containing slots" should read --the front end of the plug body, a central longitudinal slot--

SIGNED AND
SEALED

SEP 29 1970

(SEAL)

Attest:

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Commissioner of Patents