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# PATENT SPECIFICATION

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DRAWINGS ATTACHED.

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## COMPLETE SPECIFICATION.

### Wall Plug.

I, ARTHUR FISCHER, a German citizen, of Tumlingen, Kreis Freudenstadt, Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a wall plug, more especially for use in porous materials, of the type which is provided with a longitudinal bore commencing at one end and with a longitudinal slot commencing at the other.

Plugs of this type are anchored in holes drilled in masonry by introducing an expanding element, for example a screw, into the longitudinal bore of the plug. During this process, the portions of the plug bounding the longitudinal bore are expanded in a radial direction relatively to the wall of the drilled hole. Anchoring of the plug is thus effected as a result of the outer plug surface being urged against the wall of the hole. A plug thus secured can safely withstand large extraction forces provided that the material surrounding the hole is very hard and therefore has the necessary inherent strength.

In the case of soft materials without the necessary inherent strength a satisfactory anchorage cannot be achieved between the external surface of the plug and the wall of the drilled hole merely by pressure. Excessive pressure will destroy, i.e. crumble, the material surrounding the drilled hole. The particles of the material surrounding the hole will thus cease to support each other, so that the plug can be withdrawn without particular effort from the drilled hole, together with the crumbled, small-grain material. In order to achieve a firm hold for the plug in material of this kind, it has been proposed to provide the outer

circumference of the plug with teeth which embed themselves in the material surrounding the hole when the plug is expanded. In spite of the provision of such teeth, however, only a limited hold is achieved for the plug in very soft and porous material.

The size of the teeth, particularly their height of projection from the circumference of the plug, must be related to the outer diameter of the plug in order to facilitate introduction of the plug into the hole prior to expansion of the plug. Consequently, the teeth can penetrate into the surrounding material only to a small extent. After expansion of the plug, the efficiency of its anchorage depends on how firmly the particles of material between the teeth are bonded to, and have engaged with, the rest of the material. If the plug is subjected to a load acting only in the direction of extraction, there is thus the risk that the particles of material between the teeth will become sheared from the rest of the material by the teeth.

The object of the present invention is to provide a plug that can be anchored in very soft and porous materials and which, once secured, can withstand large forces of extraction.

The invention accordingly provides a wall plug for use in porous materials having an elongated body, an internal bore commencing from one end of the body and extending longitudinally along the body, a transverse slot commencing from the other end of the body and extending longitudinally along the body, and a plurality of helical external ridges or fins extending longitudinally along the body and spaced around the circumference thereof. The ridges or fins may project beyond the circumference of the body to any desired extent, their height from the body varying according to the material in-

[Price 5s. 0d.]

to which the plug is to be introduced. To insert the plug, it is driven into a prepared hole the diameter of which corresponds to that of the plug body. The ridges arranged on the plug circumference penetrate into the surrounding material. Owing to the fact that the ridges twist about at least part of the plug circumference, the plug rotates about its longitudinal axis while being driven in. After the wall plug has been driven into the hole, an expanding element, for example a screw, is introduced into the longitudinal bore of the plug, with the result that the longitudinally slotted portion of the plug expands inside the drilled hole. The diameter of the screw is related to the diameter of the bore provided in the plug in such a way that expansion is limited, to avoid crumbling of the material surrounding the drilled hole. The anchorage attained as a result of the expansion also has the purpose of securing the plug against rotation. Such rotation could otherwise occur if the plug were pulled in a longitudinal direction, since if the plug were not secured against rotation, it could easily rotate to the same extent as it did when it was driven in, but in the opposite direction, and it could thus become detached from its anchorage. However, since this rotatability is prevented not only by the expansion of the plug, but also by other measures, for example the provision of locking tongues, extraction is safely avoided. The above-mentioned ridges or fins extend over a large proportion of the circumference of the material surrounding the drilled hole. Owing to their helical shape and the rotation of the plug, caused thereby during introduction of the plug into the hole, the ridges or fins engage the material over an arc of the circumference corresponding to the projection of the ridges or fins in the longitudinal direction of the plug on a plane extending at right angles to the plug axis.

On the one hand, an increased anchoring effect, safe-guarding against extraction, could be achieved by ridges or fins with a large helix angle. On the other hand, however, such a design would create the risk that the plug, while being driven in, could not rotate about its longitudinal axis to the required extent, so that the material surrounding the drilled hole would be destroyed during the insertion of the plug. To achieve an optimum hold, preferably the helix angle of each of the ridges or fins is such that each end face thereof has a portion which lies on a common axial generatrix with an end face portion of an adjacent ridge or fin at the other end of the plug. The projection of these ridges or fins upon an imaginary plane extending at right angles to the longitudinal plug axis would thus be an unbroken collar surrounding the plug.

According to one embodiment of the invention, the end faces of the ridges or fins at the end of the plug from which the slot commences form an acute angle with the longitudinal axis of the plug and are shaped to form cutting edges. This is to facilitate the introduction of the plug into the material.

According to another feature of the embodiment of the invention, the said slot is twisted helically about the longitudinal axis of the plug. This results in a more uniform distribution of the expanding action of the plug on the inner surface of the drilled hole. In the case of a straight slot, the expanding action would operate merely on a plane extending at right angles with the slot. In the case of a twisted slot, the expanding action is distributed over a larger part of the circumference.

The ridges or fins advantageously twist in a clockwise direction such that when a right-hand threaded screw is introduced into the plug, this will thus cause the plug to be screwed still further into the drilled hole and not twisted out of the same.

The invention is illustrated by way of example in the accompanying drawing, in which:

Fig. 1 is a side view of a wall plug according to the invention, and

Fig. 2 is an end view of the plug shown in Fig. 1, viewed from the bored end.

The plug 1 shown in Fig. 1 comprises a generally cylindrical body 2 provided at one end with a longitudinal bore 3 which is conically tapered over at least part of its length as shown. The other end of the plug body 2 has a transverse slot 4 extending longitudinally into the region of the bore 3, which slot is twisted helically about the longitudinal axis 5 of the plug. Over its circumference the plug body is provided with a plurality of uniformly spaced helical ridges or fins 6 having a relatively large pitch. The end faces 7 of the ridges or fins 6, adjacent the end of the plug having the longitudinal slot 4 are inclined at an acute angle to the longitudinal plug axis 5 and are shaped to form cutting edges. At the circumference of the plug body 2, the centre of each end face 7 is situated on the same longitudinal generatrix as the centre of the end face 8 of an adjacent ridge or fin at that end of the plug provided with the longitudinal bore 3. In Fig. 1, one such generatrix coincides with the longitudinal axis 5. The projection of the ridges or fins in the longitudinal direction upon a plane extending at right angles to the longitudinal axis 5 will thus produce an unbroken collar surrounding the plug body 2, as shown in Fig. 2.

When this plug is to be used in very porous materials, for example aerated concrete

or similar materials, it may be possible to do without a drilled hole. In these cases the plug may be driven into the material, and to facilitate this it is preferably provided with a pointed end 9.

The number or arrangement of ridges or fins 6 may be varied as desired to suit given requirements, without departing from the scope of the invention as defined in the appended claims.

The wall plug shown may consist of any one of the materials usually employed for wall plugs. Synthetic plastics materials such as polyamide, for example, are especially suitable.

WHAT I CLAIM IS:—

1. A wall plug for use in porous materials having an elongated body, an internal bore commencing from one end of the body and extending longitudinally along the body, a transverse slot commencing from the other end of the body and extending longitudinally along the body, and a plurality of helical external ridges or fins extending longitudinally along the body and spaced around the circumference thereof.

2. A wall plug as claimed in claim 1,

in which the helix angle of each of the ridges or fins is such that each end face thereof has a portion which lies on a common axial generatrix with an end face portion of an adjacent ridge or fin at the other end of the plug.

3. A wall plug as claimed in claim 1 or 2, in which the end faces of the ridges or fins at the end of the plug from which the slot commences form an acute angle with the longitudinal axis of the plug and are shaped to form cutting edges.

4. A wall plug as claimed in any one of claims 1 to 3, in which the said slot is twisted helically about the longitudinal axis of the plug.

5. A wall plug as claimed in any one of claims 1 to 4, in which the said helical ridges or fins twist in a clockwise direction.

6. A wall plug substantially as described herein with reference to the accompanying drawing.

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