United States Patent

[11] 3,626,803

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[21] Appl. No. **782,553**
[22] Filed **Dec. 10, 1968**
[45] Patented **Dec. 14, 1971**
[32] Priority **Dec. 16, 1967**
[33] **Germany**
[31] **P 16 25 394.4**

[54] **EXPANSION ANCHOR**
2 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **85/72,** 85/74
[51] **Int. Cl.** **F16b 13/06**
[50] **Field of Search** 85/67, 69, 73, 74, 75, 76, 79, 72

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ABSTRACT: An expansion anchor has an expansion anchor sleeve having in the region of its leading end and inwardly spaced from the leading end two sections of a central passage which converge in the direction from the leading end towards the trailing end. Expander members are provided each of which cooperate with one of the converging sections and an actuating screw or the like is provided which extends through the central passage of the sleeve from the leading end towards the trailing end, engaging the expander members and drawing them in the direction towards the trailing end, thereby effecting radial expansion of the sleeve at two longitudinally spaced locations and in one and the same direction.

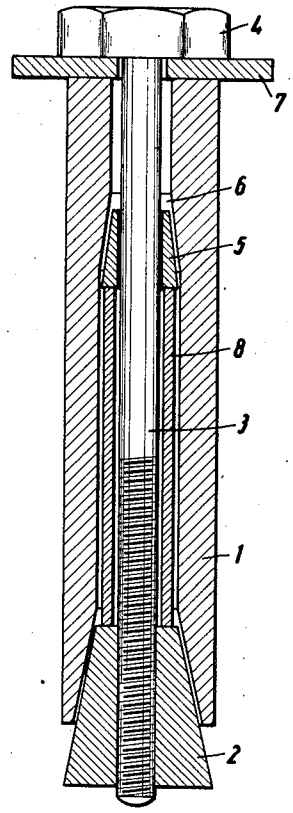


FIG. 1

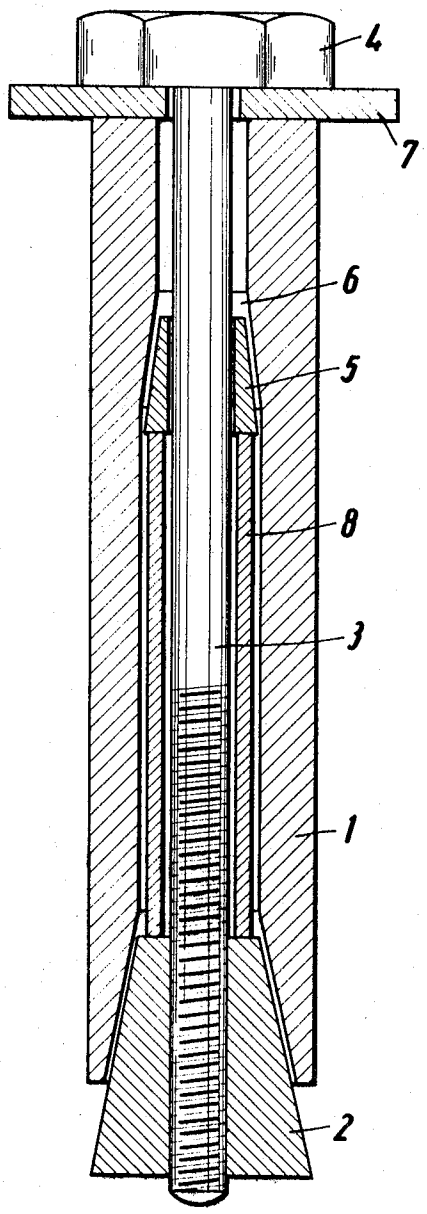
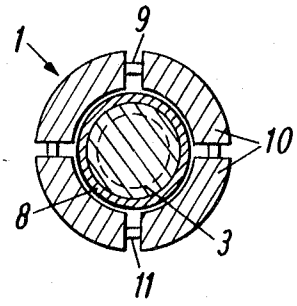


FIG. 2



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EXPANSION ANCHOR

BACKGROUND OF THE INVENTION

The present invention relates generally to expansion anchors, and more particularly to the type of expansion anchor which is insertable into an expansion anchor hole provided in a support structure such as a masonry wall or the like.

It is already known to provide expansion anchors with a dual-expanding action. Such expansion anchors conventionally comprise an expansion anchor sleeve, an actuating member in form of a spool or the like extending through the central passage of the sleeve from the trailing end towards the leading end which is first to be inserted into the expansion anchor hole, and a suitable expander member which meshes or is otherwise connected with the actuating member to be drawn by the latter in the direction towards the trailing end of the sleeve, thereby radially expanding the same into engagememt with the surrounding material of the support structure. In dual-action types of expansion anchors it is known to provide two expander members each of which is located proximal to one of the ends of the expansion anchor sleeve with the one located adjacent the trailing end providing an expansion in radially outwardly and forwardly oriented direction, that is the direction deeper into the expansion anchor hole, whereas the other one located adjacent the trailing end provides an expansion which is directed radially outwardly and rearwardly, that is out of the expansion anchor hole. These opposite directions of expansion provide a better fastening of the expansion anchor sleeve in the expansion anchor hole than would be possible with a single expander member. However, under certain circumstances the strength with which expansion anchors of this type are secured in their associated expansion anchor holes is still not entirely adequate and could be further improved.

It is, accordingly, an object of the present invention to provide an expansion anchor construction of the general type here under discussion which provides such improvement.

SUMMARY OF THE INVENTION

In accordance with the above object, and others which will become apparent hereafter, one feature of my invention resides in the provision of an expansion anchor having an expansion anchor sleeve provided with a trailing end and a leading end, the latter of which is arranged to be inserted into an expansion anchor hole in a support structure. First and second expander means is provided and associated with the sleeve at locations which are respectively closer to the leading end and the trailing end. Actuating means cooperates with the expander means and is operative for effecting movement of the expander means relative to the sleeve in direction towards the trailing end, and the first and second expander means are both operative for effecting radial expansion of the sleeve in response to movement in the aforementioned direction.

With this construction the expanding force of both expansion means acts in one and the same direction, namely in direction outwardly of the expansion anchor hole. This, in turn, means that if subsequent to the installation of the expansion anchor strong tensile stresses are exerted upon the latter in a sense tending to withdraw it form the expansion anchor hole—for instance vibrations, shocks, alternating tensile stress and relaxation—then these stresses will be simultaneously transmitted to both expander means and act thereupon in such a manner that both expander means will provide additional expanding action. The greater the forces which act upon the actuating means, which is usually a screw serving not only to draw the expander means into the expansion anchor sleeve, but also to hold an object which is to be secured, such as a picture or the like, the stronger will be the force with which the trailing end of the expansion anchor sleeve, will force the expansion anchor sleeve to expand radially. Thus, the present construction is in very decided contrast to known dual-expansion types of expansion anchors wherein excessive stresses cause the trailing expander means to undergo a reduction in its expansion effectiveness as opposed to the present construction where this expansion effectiveness is strongly increased under such circumstances.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an axial section through an embodiment; illustrating the invention; and

FIG. 2 is a transverse section of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The section taken in FIG. 1 assumes that the expansion anchor sleeve is of the type provided with incisions requisite for forming it with radially deflectable locking tongues. For clarity of illustration the section is taken not along the slots but through the tongues.

The expansion anchor sleeve is identified with reference numeral 1 and provided in known manner with longitudinal slots 9 so as to be subdivided into a plurality of tongues 10 for example four such tongues. At their free ends they may be connected with rupturable webs 11 or the like, also in known manner, so that they initially are held together and become separated only subsequent to insertion into an expansion anchor hole and expanding by the expander means. If such webs are provided, they are generally provided in the region of the trailing end of the expansion anchor sleeve, (near the top of FIG. 1 although they can also be provided in the region of the leading end.

In accordance with my invention two expander means in form of two expander members are provided. One of these is identified with reference numeral 2 and provided at the leading end of the expansion anchor sleeve 1. As FIG. 1 shows, it meshes with the external screw threads of a screw, bolt or other actuating member 3 which extends through the central passage of the expansion anchor sleeve 1 and has its head 4 located outside the trailing end of the sleeve 1 so that it can be turned in a sense effecting a drawing of the expander member 2 deeper into the expansion anchor sleeve 1. The second expander member is identified with reference numeral 5 and located closer to the trailing end of the expansion anchor sleeve 1. However, it is not located directly proximal to the trailing end but rather inwardly spaced therefrom, the location being so selected that between the expander member 5 and the trailing end of the expansion anchor sleeve 1 inclined inner surface portions 6 can be provided which taper in the direction towards the trailing end and with which the expander member 5 cooperates.

A washer 7 is provided beneath the head 4 of the actuating member 3 and abuts against the trailing end of the expansion anchor sleeve 1 so that the head of the actuating member 3 can bear against the washer 7 when it is rotated in a sense drawing the expander members 2 and 5 deeper into the expansion anchor sleeve 1. It is advantageous if the washer 7 extends radially outwardly beyond the expansion anchor sleeve 1 so that it may abut against the surrounding material of the support structure in which the expansion anchor hole is formed. Such radial outward projection is illustrated in FIG. 1.

A sleeve 8 or tubular member 8 in the form of a hollow cylinder is located between the expander members 2 and 5. Its length is such that the trailing expander member 5 which can be loosely shifted on the actuating member 3 in axial direction thereof, can abut against the tubular member 8 and be supported via the same on the rearwardly directed end face of the leading expander member 2. The length of the tubular member 8 is so selected that the expansion provided by the expander members 2 and 5 is substantially simultaneous

although it should be understood that, depending on the given requirements of any situation, the sleeve or tubular member 8 could also be made somewhat longer so that the trailing expander member 5 would first provide for radial expansion with the expansion provided by the leading expander member 2 following thereafter. Conversely, if the length of the tubular member 8 is somewhat reduced, then expanding action will first be provided by the leading expander member 2 and subsequently by the trailing expander member 5.

It will be noted that in case of strong tensile stresses resulting in a tendency to withdraw the actuating member 3 from the expansion anchor sleeve 1, additional radial expansion will be provided not only by the leading expander member 2, but also by the trailing expander member 5 so that the expansion anchor according to my present invention is capable of withstanding loads which could not otherwise be withstood by such a construction. Evidently, of course, there are limits in this case also, and here these limits are largely dictated by the strength of the material of the support structure in which the expansion anchor hole is formed. It should be pointed out that it is not necessary that the cone angles of the expander members 2 and 5 are identical or substantially identical, although this is ordinarily preferred. However, by utilizing different cone angles it is possible to obtain different radial pressures by the two different expander members. Of course, in all circumstances it is necessary to assure that their configuration is such that they cannot be drawn beyond their respectively associated inclined inner surface portions.

While in the illustrated embodiment the actuating member 3 is shown to be provided with an integral head 4, it will be clear that it is possible to use an actuating member having no head and being rigid with and suitably secured to the leading expander member 2, with a nut being provided in place of head 4.

It is desirable that the expansion provided by both expander members 2 and 5 be as much in parallel as possible, and therefore the two expander members 2 and 5 are not to be too close together. For this reason it is desirable that the expander member 5 be located so far towards the trailing end of the expansion anchor sleeve 1 as possible, but in any case only so far that in a condition of maximum expansion the rearwardly facing end face of the expander member 5 cannot project beyond the opening of the central passage at the trailing end of the expansion anchor sleeve 1. Of course, if the rupturable webs mentioned earlier are provided in the region of the trailing end, then it is particularly desirable to have the expander member 5 be located as far towards the trailing end as possible. On the other hand the rupturable webs, which are not illustrated, could of course be provided at other locations, for instance in the region of the inclined surface portions 6.

Generally speaking, I prefer to have the expander member 5 be located in the trailing half of the expansion anchor sleeve 1, which means that the inclined surface portions 6 are not to extend forwardly beyond the center line between the trailing end leading halves of the expansion anchor sleeve 1.

In the illustrated embodiment shown in FIG. 1, the tubular member 1 as well as the expander members 2 and 5 are discrete elements. However, the tubular member 1 may be integral or rigid with one or both of the expander members, or it may be of one piece with one or both thereof. In fact, where the construction of the expansion anchor is such that the expander members 2 and 5 are located closely together, they may be manufactured of one piece without the interposition of the tubular member 8.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in an expansion anchor, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended

1. An expansion anchor, comprising an expansion anchor sleeve having a trailing end, a leading end having an opening and being arranged to be inserted into an expansion anchor hole in a support structure, and four circumferentially distributed slots extending from said leading end toward said trailing end and subdividing a longitudinally extending section of said sleeve into four tongues; rupturable webs connecting adjacent ones of said tongues in the region of said trailing end; an elongated through-passage provided in said sleeve and including a first inner circumferential conical surface portion in the region of said leading end and a second inner circumferential conical surface portion closer to said trailing end, both of said surface portions converging towards said trailing end and being located in said section and an intermediate cylindrical surface portion extending between the narrower rear end of said first conical surface portion and the wider front end of said second conical surface portion, an internally threaded first expander member located in said passage within said first surface portion and a second tubular expander member located in said passage within said second surface portion, both of said expander members diverging in direction towards said leading end; a tubular spacing member located in said passage intermediate and abutting with its opposite ends against said first and second expander members; and an elongated bolt member having a rear portion freely extending from said trailing end through said second expander member and said tubular spacing member, and a screw-threaded front portion extending into and meshing with the screw threads of said first expander member, said through passage and said surface portions having such cross-sectional dimensions as to admit of insertion of said expander members and said spacing member into said passage from said leading end of said sleeve.

2. An expansion anchor as defined in claim 1, wherein said first and second expander members are spaced from one another lengthwise of said sleeve by a predetermined distance at the time of initial engagement with the respectively associated first and second surface portions, and wherein said tubular spacing member has a length which is slightly smaller than said predetermined distance.

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