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Fischer

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[54] **EXPANSION ANCHOR UNIT**

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[30] **Foreign Application Priority Data**

Sept. 19, 1969 Germany.....P 19 47 369.9

[52] **U.S. Cl.** **85/68,** 29/432, 175/394

[51] **Int. Cl.**.....**F16b 13/06**

[58] **Field of Search**.....85/68, 79, 83, 84, 73, 74, 85/75, 76; 175/394, 325

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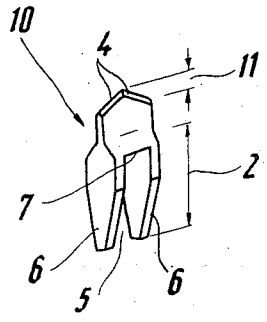
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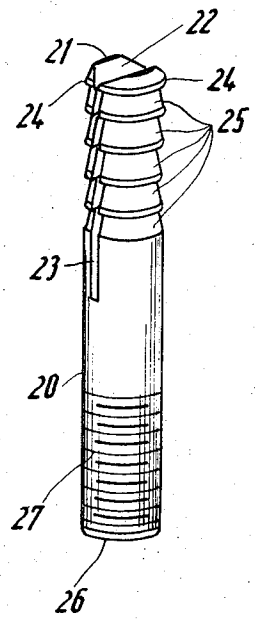
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[57] **ABSTRACT**

An expansion anchor unit has a first member a leading portion of which is provided with cutter edges for drilling a hole in a support structure, and a trailing portion of which converges in direction away from the leading portion. A second member is provided with a forward end portion matingly engageable with the trailing portion of the first member, and with a rearward end portion engageable by a tool which is operative for jointly rotating both of the members in a sense effecting drilling of a hole in a support structure by the cutter edges. The second member may itself be configurated as an expansion member to be expanded by the first member after the latter has drilled the hole in the support structure, or an additional expansion member may be provided which, after the second member is disengaged from the first member and removed from the hole, is inserted into the hole and forcibly wedged into contact with the first member to be expanded by the same.

9 Claims, 9 Drawing Figures





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SHEET 1 OF 2

Fig. 1

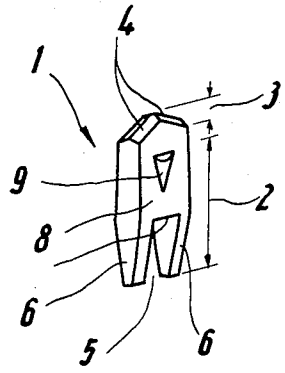


Fig. 2

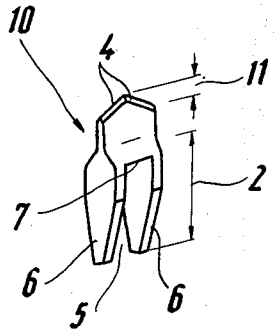


Fig. 3

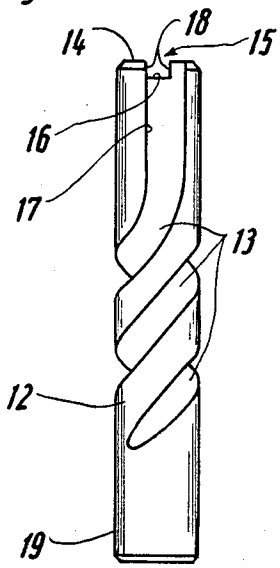


Fig. 4

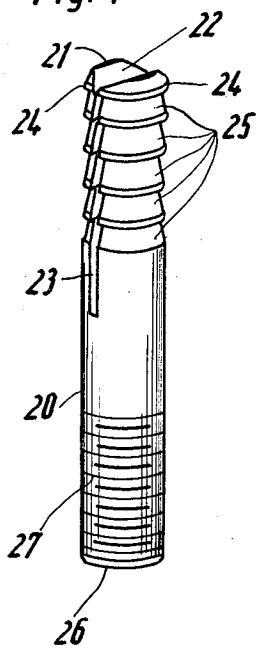
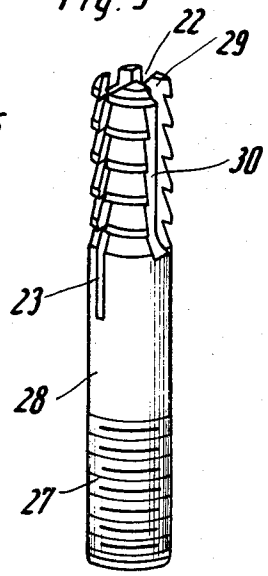


Fig. 5



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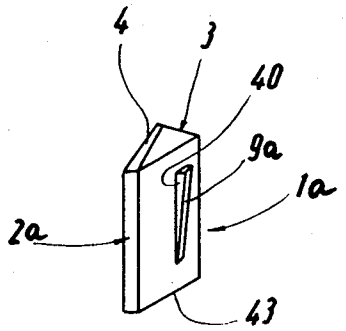
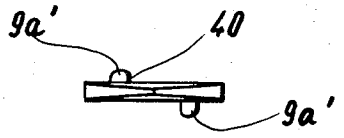


Fig. 6

Fig. 7



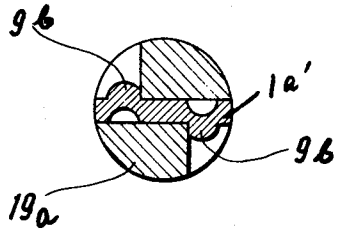


Fig. 8

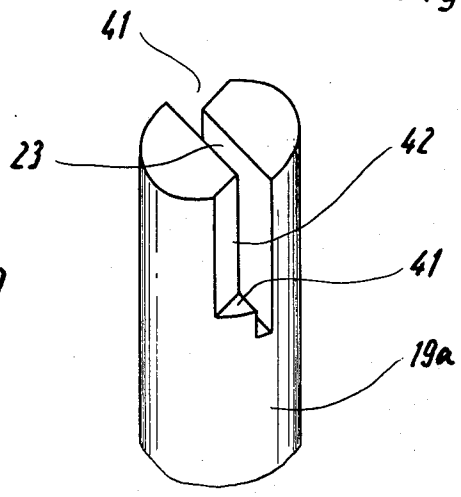


Fig. 9

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EXPANSION ANCHOR UNIT

BACKGROUND OF THE INVENTION

The present invention relates generally to expansion anchors, and more particularly to an expansion anchor unit.

Expansion anchors are of course not new per se. They are, in fact, available in a great variety of different types and sizes. One feature which most of the known expansion anchors have in common is that a hole must be drilled in a support structure before the expansion anchor can be connected with the support structure. The drilling of such holes requires a special drill which, when the hole is completed, is withdrawn to permit insertion of the expansion anchor. However, expansion anchors must be used in a great variety of different types of support structures, be they soft or hard, wood, plaster board, masonry or the like. In order to accommodate all of these different possibilities the drill used for making the hole is usually provided with cutting edges of hard metal. If, as is sometimes the case, such a drill is used occasionally for "do-it-yourself" installation of an expansion anchor, then this arrangement is fully satisfactory. If, on the other hand, the drill is used frequently for this purpose, as by a craftsman who installs such expansion anchors as a part of his daily routine, the cutting edges will quickly become blunt. While it is true that they can be sharpened again, this is possible only for a limited number of times and very quickly the time arrives when the drill must be replaced. This, evidently, is expensive, just as the repeated sharpening of the cutting edges of a drill is time-consuming.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to avoid the aforementioned disadvantages.

More particularly it is an object of the present invention to provide an improved expansion anchor unit which is not possessed of these drawbacks.

Still more particularly it is an object of the present invention to provide an expansion anchor unit which is self-drilling.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the present invention resides in an expansion anchor unit which, briefly stated, comprises a first member having a leading portion provided with cutter edges for drilling a hole in a support structure, and a trailing portion which converges in direction away from the leading portion. A second member is provided with a forward end portion which is matingly engageable with the trailing portion of the first portion, and with a rearward end portion which is engageable by a tool operative for jointly rotating both the first and the second member in a sense effecting drilling of a hole in a support structure by the cutter edges.

It is clear that the first member of the unit according to the present invention thus serves a dual purpose, namely to drill its own hole and subsequently to act as the expander member of the unit. This is a most simple and as time-consuming as inexpensive method of mounting an expansion anchor unit in a support structure, and it requires no tools other than those previously needed, namely a power drill. Moreover, every time an expansion anchor unit is to be mounted in a support structure, a new set of cutting edges is available, so that no loss of cutting efficiency due to blunting of the edges from the previous formation of an expansion anchor hole is experienced. It is no longer necessary to sharpen blunted cutting edges, and the lost time and increased expense involved previously in sharpening such cutting edges and eventually discarding the drill entirely have been eliminated according to the present invention.

Moreover, the material and the hardness of the first member provided with the cutter edges can be selected in accordance with the fact that the cutter edges need withstand only a single drilling application, namely when the hole is drilled for the expansion anchor unit of which the first member having the cutting edges is a part. Thus, material can be used which is considerably less expensive than heretofore was necessary for making separate drills.

In addition, the first member is much more readily connectable with and disconnectable from the second member, and vice versa, than the frequently necessary removal and subsequent re-insertion of a conventional drill in the chuck of a power drilling machine.

The second member may itself serve exclusively the purpose of engaging the first member while the latter is used to drill a hole in the support structure. Subsequently, the second member may be removed and a third member, also constituting a part of a novel expansion anchor unit according to the present invention, may be inserted into the bore hole in such a manner and to such an extent that is is expanded into tight engagement with the wall surrounding the hole by the first member which at the completion of the drilling step has remained in the bore hole. The formation of the bore hole and the mounting of the expansion anchor unit therein is extremely simple when utilizing a unit according to the present invention, and it is fast as well as in expensive. The third member is essentially rod or bolt-shaped and optimum holding conditions in the bore hole are obtained if the diameter of the third member corresponds to the diameter of the bore hole formed by the first member.

The latter may be provided, incidentally, on its oppositely longitudinally extending surfaces with one or more projecting ribs or projections which are elongated substantially in longitudinal direction of the first member and engage in corresponding mating recesses provided on the second member or the third member, or on both. Such projection can be formed in simple manner by cold deformation when the first member is produced, and they may converge gradually in the direction towards the leading portion and the cutter edges of the first member, which is to say that they diverge in the opposite direction and thus act as a wedge which facilitates radial expansion of the expansion member associated with and forming a part of the novel unit. Their major purpose, however, is to provide proper engagement with either the second member or the third member, to prevent displacement of the first member with reference to either one of the others. Of course, these projections may have other configurations, and may be located at different points of the first member as long as mating recesses are correspondingly provided on the second and/or third member.

The second and/or third member may be provided with two or more helically convoluted grooves in its

outer circumferential surface, the purpose being to allow escape of comminuted material of the support structure through these grooves to the outer side of the support structure. According to the invention the terminal portions of these grooves in the region of the forward end portion of the second and/or third member which is engaged with the first member, will extend in at least substantial axial parallelism with the axis of the second and/or third member, and the projections of the first member will be lodged in these terminal sections. So constructed, a particularly simple and easy connection of the first member with the second and/or third member is achieved, and correspondingly an equally simple and easy disconnection is obtainable. On the other hand, the projections abut against the lateral surfaces bounding the terminal sections of the grooves and thus rotation of the first with reference to the second and/or third members is prevented during drilling. Such abutment further serves the additional purpose of preventing deformation or breaking of the projections during drilling.

It is advantageous if the first member is in form of a rather flat elongated member with the projections being located on the two opposite lateral surfaces of the same. Two or more such projections may be provided, and if there are two of them then they may be offset with reference to one another. The second and/or third member may be provided with a longitudinal slot, corresponding to the thickness of the first member—that is the dimension between the aforementioned two surfaces of the same—and in which the first member is partially receivable with its leading portion formed with the cutter edges extending forwardly beyond the slot. The outer circumferential surface of the second member may be provided with recesses in diametrally opposite edges bounding the slot and in these recesses the projections of the first member may be lodged when the first member is temporarily connected with the second member for drilling purposes. A first member so configurated is particularly easy to manufacture, and the projections may be formed simply by a stamping process as the first member is being manufactured. Similarly, the slot may be readily provided by milling or in other suitable manner in the second member, and the recesses are then subsequently formed also in suitable manner, for instance by milling. The opposite location of the projections, and the diametrally opposite location of the recesses, assures that lateral sliding of the first member out of the slot of the second member is prevented so that the first member will always be centered with reference to the second member, a consideration which is important during drilling.

The projections may be outwardly convexly curved, to facilitate and ease the expansion when the second member, or the third member, as the case may be, is driven into the bore hole to the extent necessary to provide such expansion. When such convex configuration is chosen, then there will only be a line contact between the projections and the engaging surface portions of the second or third member, so that very little friction is opposed to the forcible insertion of the second or third member into the bore hole, making it possible for the second or third member to be readily driven far into the bore hole with the first member entering far into the slot of the second or third member and thereby obtaining an excellent engagement of the expansion anchor unit in the expansion anchor hole, having a high resistance to forces tending to draw the unit out of the hole.

The projections may gradually merge out of the respective surfaces of the first member, so as to diverge in direction towards the cutter edges thereof. However, it is possible to have the projections merge from their widest or most divergent portion gradually tapering in the direction towards both the leading and the trailing portion of the first member. This latter construction makes it possible to effect entry of the first member into the longitudinal slot of the second or third member in either direction, a consideration which is particularly of importance if the second member is not only an engagement for the first member during drilling with the latter, but also constitutes the expansion member of the anchor unit. In this case the first member will abut against an abutment portion in the slot of the expansion member so that the latter is not already expanded during the drilling period. Subsequently, the expansion member is withdrawn partially or completely from the bore hole, at least to such an extent as to disconnect it from the first member, turned in circumferential direction until its longitudinal slot becomes aligned with the trailing portion of the first member, and then forcibly inserted into engagement with the first member in a sense effecting the necessary expansion.

If the first member is of relatively flat configuration, and the projections are located centrally on opposite surfaces thereof, this affords the possibility to form the second or third member with two slots which cross one another so that at least the forward end portion of the second or third member is subdivided into four sections. Insertion of the second or third member into the bore hole in a sense causing expansion by the first member then results in radial expansion of all four sections in four different directions, thus assuring a strong uniform expansion in all directions and a good anchoring of the unit. Moreover, the initial drilling characteristics afforded by a flat cutting edge are of course highly advantageous and can be provided by making the first member of flat configuration.

Of course, the most simple form of the novel expansion anchor unit is for the second member to be not only the engaging member which engages with its forward end portion the first member and with its rearward end portion a drilling tool, such as a power drill, but also to act subsequently to drilling as the expansion member itself which becomes expanded in and anchored in the bore hole in the support structure. This is not only the most inexpensive type of expansion anchor unit according to the present invention, but also requires the least amount of work for its installation. It goes without saying that with such a construction stocking problems are also greatly reduced.

A very simple manner of making the second or third member of the novel expansion anchor unit is to take a length of rod of polygonal cross-sectional configuration and to twist it about its longitudinal axis, providing it at its forward end portion with engaging means for engaging the first member, and forming a longitudinal slot permitting subsequent radial expansion. The slot may be increased stepwise for facilitating such expansion.

This method of construction provides in a most simple manner the helical grooves in the outer circumferential surface of the second member which are desirable for escape of comminuted material of the support structure. The stepwise increase of the longitudinal slot has the additional advantage that the first step may serve as an abutment for the first member while the same is used to drill a bore hole in a support structure, so that premature expansion of the second member by the first member is avoided. At the same time this guarantees that the leading portion of the first member provided with the cutter edges will always project forwardly of the forward end portion of the second member, always assuming of course that the first step of the slot is located at such a spacing rearwardly from the forward end of the second member that this relationship is obtained.

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 drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view showing one embodiment of a first member for an expansion anchor unit according to the present invention;

FIG. 2 is a view similar to FIG. 1 but illustrating a further embodiment of the first member;

FIG. 3 is a perspective view showing a second member for use with one of the members of FIGS. 1 and 2;

FIG. 4 is a perspective view showing a third member which, together with the member of FIG. 3 and one of the members of FIGS. 1 and 2, constitutes an expansion anchor unit according to the present invention;

FIG. 5 is a view analogous to FIG. 4 but showing a member which both serves to connect one of the members of FIGS. 1 and 2 with the non-illustrated power drill, and which subsequently serves as the expansion member of a two-member anchor unit;

FIG. 6 is a perspective view similar to FIG. 1 but illustrating yet an additional embodiment of the first member;

FIG. 7 is an end view of a member similar to that of FIG. 6 but provided with different projections;

FIG. 8 is a cross-sectional view illustrating another embodiment of a member analogous to that of FIG. 6 but provided with different projections and inserted in an expansion member; and

FIG. 9 is a perspective view of a second or third member for an expansion anchor unit according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail and firstly the embodiment illustrated in FIG. 1, it will be seen that what I have shown in this Figure is a first member for a two-part or three-part expansion anchor unit according to the present invention. The member 1 in FIG. 1 is the expander and drilling member of the unit and is provided with a trailing portion 2 serving subsequently for expansion of the expansion member of the unit, and with a leading portion 3 which is formed with conventional cutting edges 4. The trailing portion 2 is provided with a U-shaped cutout 5 extending towards but short of the leading portion 3 and being bounded at opposite sides by the arms or legs 6. These, it should be noted, conically or frustoconically taper in the direction away from the leading portion 3 of the member 1. At opposite longitudinally extending surfaces 8 (one visible) the member 1 is provided with respective substantially centrally located projections 9 which diverge outwardly of the respective surface 8 in the direction towards the leading portion 3 and serve to further facilitate expanding or spreading of an expansion member associated with the member 1 as part of an expansion anchor unit according to the present invention. The bottom wall 7 of the cutout 5 constitutes an abutment.

The embodiment illustrated in FIG. 2 differs from that in FIG. 1 in that the member 10 which replaces the member 1 of FIG. 1, has its leading portion 11—corresponding to the portion 3 of the member 1 in FIG. 1—made of a thinner, flatter configuration than the portion 3 of the member 1. In other respects the member 10 corresponds to the member 1.

The member 12 identified and illustrated in FIG. 3 is not an expansion member, but only constitutes a connecting member connecting the member 1 with a power drill or the like used to rotate the member 1 so that the cutting edges 4 thereof will drill a hole in the non-illustrated support structure. A unit utilizing the member 12 must therefore have an additional member which constitutes the expansion member of the unit and is identified with reference numeral 20 in FIG. 4, which will be discussed presently. The member 12 in FIG. 3 is provided in its outer circumferential surface with at least two helically convoluted grooves 13 through which comminuted material of the support structure can escape from the bore hole, thus facilitating the drilling operation. At its forward end portion 14 the member 12 is provided with a centrally located impression 15 whose length and width-but not depth-corresponds to the respectively corresponding dimensions of the member 1 of FIG. 1 or the member 10 of FIG. 2. The depth of the depression 15 is such that when the member 1 or the member 10 is partially received therein, the bottom face 7 bounding the respective cutout 5 will abut against the bottom face 16 bounding the depression 15, with the respective leading portion 3 or 11 and the cutting edges provided thereon, extending forwardly from the forward end portion 14. According to the present invention the terminal sections of the grooves 13 extend in at least substantially parallelism with the longitudinal axis of the member 12, as shown in FIG. 3, and the arms or legs 6 of the members 1 or 10 are received in these terminal sections at diametrally opposite sides of the member 12 when the members 1 or 10 are connected with the member 12, with the arms or legs 6 abutting against the side faces 17 bounding the grooves, or rather the terminal sections of the grooves 13, to prevent relative rotation between the members 12 and 1 or 10 respectively. The side faces 18 bounding the recess 15 serve the same purpose. The rearward portion 19 of the member 12 is configurated so it can

be engaged readily by a tool, such as a power drill, which is used to rotate the members **12** and **1** or **10** in unison, so that the members **1** or **10** will form their own bore holes in a support structure.

As mentioned before, an expansion anchor unit according to the present invention which utilizes either the member **1** or the member **10** of FIGS. **1** and **2** in conjunction with the member **12** of FIG. **3** also requires an expansion member which is identified with reference numeral **20** in FIG. **4**. It will be seen that it is provided with a conically tapering kerf **22** in its leading end face **21**, with this kerf merging into an axially extending slot **23** which extends through the member **20** almost half way towards the trailing end face **26** thereof. The slot **23** subdivides the forward portion of the member **20** into two sections **24** which are spread apart in radial direction when the member **20** is inserted into a bore—subsequent to withdrawal of the member **12**—and forcibly driven into the bore hole until the trailing portion **2** of the member **1** (or the trailing portion **2** of the member **11**) first enters the kerf **22** and subsequently the slot **23**, thus effecting radial spreading of the sections **24**. A plurality of saw-tooth-profiled circumferential ridges **25** is provided at least on the forward portion of the member **20**, to afford tighter engagement of the sections **24** with the material of the support structure surrounding the bore hole. The trailing portion of the member **20** is provided with an outer screw thread **27** which extends over substantially one third of the length of the member **20**, the intention being that the portion provided with the screw thread **27** will extend outwardly from the bore hole after the sections **24** have been expanded to the maximum extent, so that an article to be secured to a support structure by means of the novel expansion anchor unit can be mounted on this outwardly extending portion, with a nut or the like being used to mesh with the screw threads **27** and secure such article in place. It goes without saying, of course, that the rear portion of the member **20** could also be hollow and the screw threads provided internally.

Coming to the embodiment in FIG. **5** it will be seen that the member **28** illustrated therein replaces the members **12** and **20** of FIGS. **3** and **4**. The member **28** thus can be used with the members **1** or **10**, respectively, and constitutes with either one of the two a two-member expansion anchor unit, rather than the three-member expansion anchor unit previously described. The member **28** is provided not only with the slot **23**—and also with the projections **25** corresponding to those of the member **20** in FIG. **4**—but with an additional depression or recess corresponding to the one identified with reference numeral **15** in FIG. **3**, and extending in a plane transverse to the plane of the slot **23**. This recess or depression is identified with reference numeral **29**. Extending rearwardly from the recess or depression **29** in axial direction of the member **28** and located at diametrally opposite sides of the member **28** are grooves **30** provided in the outer circumferential surface of the member **28**. Thus, the members **1** or **10** can be connected with the member **28** in the same manner as they can be connected with the member **12** in FIG. **3**, and their arms or legs **6** will become lodged in the grooves **30**. The latter, incidentally, can be formed by milling or in other suitable manner.

FIG. **6** shows that the member **1***a*—corresponding to the members **1** and **10** of FIGS. **1** and **2**, respectively—can be provided on its trailing portion **2a** with elongated ridges **9a** which extend substantially lengthwise of the member **1***a*, diverging outwardly from the respective surfaces in the direction towards the leading portion **3** of the member **1***a*. They each have (one projection **9a** is shown) a longitudinally extending abutment edge **40**.

FIG. **7** shows an embodiment which corresponds essentially to that of FIG. **6**, except that the projections **9***a* of FIG. **6** are replaced by projections **9***a'*, differing from the projections **9***a* only in that they are convexly curved in direction outwardly away from the respective surfaces on which they are provided.

The embodiment of FIG. **8** shows, in section and inserted in a member **19***a* which is illustrated in FIG. **9**, a further possible embodiment of the member **1a** shown in FIG. **6**. It is modified in so far as in FIG. **8** the member **1***a'*—corresponding to the member **1***a* of FIG. **6**—is provided with longitudinally extending projections **9b** which are produced by deformation pressure, whereas those of the embodiment in FIG. **7** may for instance be produced by cold forming of the material.

The member **19***a* shown in perspective in FIG. **9** in fragmentary form and shown in section in FIG. **8** is provided with a longitudinal slot **23** corresponding to the similar slots in the preceding Figures. The member shown in FIG. **7**, or the member **1***a'* shown in FIG. **8**, can be inserted into this slot **23** for drilling purposes, and the projections **9***a'* or **9***b* of FIGS. **7** and **8** will become lodged in the grooves **41** which are formed, as clearly shown, in the outer circumferential surface of the member **19***a* along diametrally opposite lateral edges of the slot **23**. The projections **9***a'* or **9***b* abut against the surfaces **42** bonding one side of the grooves **41**, as evident for instance from FIG. **8**. Of course, the projections **9***a'* or **9***b* diverge in the same sense and direction as the projections **9a** in FIG. **6**. Thus, and because of their outwardly convex configuration, there is only line contact between them and the surfaces bounding a slot in an expansion member of the anchor unit, and this facilitates forcible insertion of the expansion member into the bore hole.

It will be appreciated that member **19***a* corresponds—as illustrated—to the member **12** of FIG. **3**, that is an expansion anchor unit utilizing the member **19a** and for instance the member **1***a'* of FIG. **8**, will additionally have a third member corresponding for instance to the member **20** of FIG. **4**. However, it would also be possible to modify the member **19***a* in such a manner that it could be used in the same manner as the member **28** of FIG. **5**, thus combining the functions of the members **12** and **20** of FIGS. **3** and **4**, respectively.

Of course, various different materials including, but not limited to, metallic material are suitable for the various members of the expansion anchor units illustrated herein.

The invention also relates to a highly advantageous method of mounting an expansion anchor unit according to the present invention in a support structure. Specifically, the member **12** is releasably engaged with one of the members **1** or **10**, or the member **19a** is releasably engaged with for instance the member shown in FIG. **7** or the member **1***a'* shown in FIG. **8**,

and the members **18** or **19a** are then in turned engaged with the chuck of a power drill or the like, and rotated so that the cutting edges **4** of the members **1**, **10**, **1a'** or the like will form a bore hole in a support structure against which the cutting edges **4** are placed. Thereupon, the member **12** or **19a** is withdrawn from the bore hole, leaving the associated member (for instance the member **1**) behind in the bore hole. Now, an expansion member, such as the member **20** of FIG. **4**, is inserted into the bore hole and forcibly driven into the same until the trailing portion—for instance the trailing portion **2** of the member **1**—enters into the slot **23** and expands the sections **24** into tight engagement with the material surrounding the bore hole. Of course, other expansion anchor units according to the present invention may be utilized in different manner, for instance the unit which has as one of its two constituent components the member **28** of FIG. **5**.

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 unit, 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.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the specific or generic aspects of this invention and, therefore, such adaptation should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

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

1. An expansion anchor system comprising a first member of substantially flat configuration and having a leading portion provided with cutter edges for drilling a hole in a support structure, and a trailing portion converging in direction away from said leading portion and having a first engaging portion extending towards said leading portion; a second member provided with a forward end portion having a second engaging portion extending rearwardly and being matingly but releasably engageable with said first engaging portion of said trailing portion of said first member, and with a rearward end portion engageable by a tool operative for jointly rotating both of said members in a sense effecting drilling of a hole in a support structure by said cutter edges; a third member having a front portion and a screw-threaded rear portion, said third member being provided with at least one third engaging portion in form of a slot dimensioned for entry of said first member and extending from said front portion towards said rear portion so as to subdivide at least the former in two parallel sections which spread apart in radially outward direction in response to forcible axial insertion of said third member into the drilled hole subsequently to disengagement of said second member from said first member and withdrawal of said second member, the entry of said first member into said third member resulting in radial expansion of said front portion into wedging engagement with the wall bounding said hole.

2. A system as defined in claim **1**, said first member having two opposite sides, a pair of projections each being provided on one of said sides and offset with reference to the other projection; wherein the second member has an outer circumferential surface and is provided with a rearwardly extending slot in said forward end portion and a pair of elongated recesses extending rearwardly in said forward end portion along respective diametrally opposite edges of said slot, for receiving the respective projections therein when said first member is in part located in said slot; and wherein said third member is also provided with a pair of elongated recesses in its outer circumference extending rearwardly in said front portion along respective diametrally opposite edges of said slot in said third member.

3. A system as defined in claim **1**, said first member having two transversely spaced surfaces extending between opposite ends of said leading and trailing portions; further comprising at least a pair of projections each provided on one of said surfaces and elongated substantially in direction between said opposite ends; and mating recesses provided in said forward end portion of said second member and said front portion of said third member and being positioned to receive the respective projections for preventing displacement of the respectively engaged members with reference to one another.

4. A system as defined in claim **3**, said second member having an outer circumferential surface; and further comprising at least two helically convoluted grooves provided in said outer surface extending between the axial ends of said forward and rearward end portions and each having in the region of said forward end portion a groove section which extends in at least substantial parallelism with the longitudinal axis of said second member and constitutes one of said mating recesses.

5. A system as defined in claim **3**, said projections being convexly curved in direction outwardly from the respective surface.

6. A system as defined in claim **1**, said second member being of polygonal cross-section and helically twisted about its longitudinal axis.

7. A system as defined in claim **6**, wherein the cross-section of said third member decreases stepwise in direction from said rear portion towards said front portion.

8. A system as defined in claim **1**; further comprising a plurality of ridges provided on an outer circumferential surface of at least said front portion and encircling the latter.

9. A system as defined in claim **8**, wherein said ridges are of sawtooth-shaped profile.

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