Feb. 25, 1964 R. E. DIETERICH ET AL 3,122,049

DRIVE-IN CONCRETE FASTENER OR THE LIKE

Filed July 31, 1961

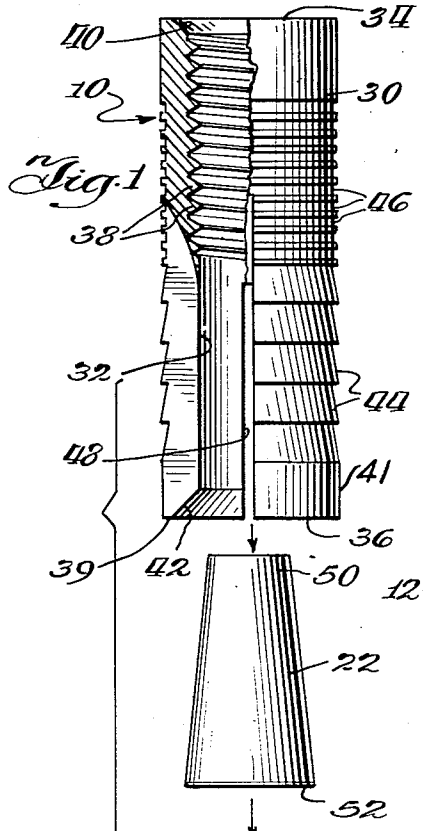


Fig. 1

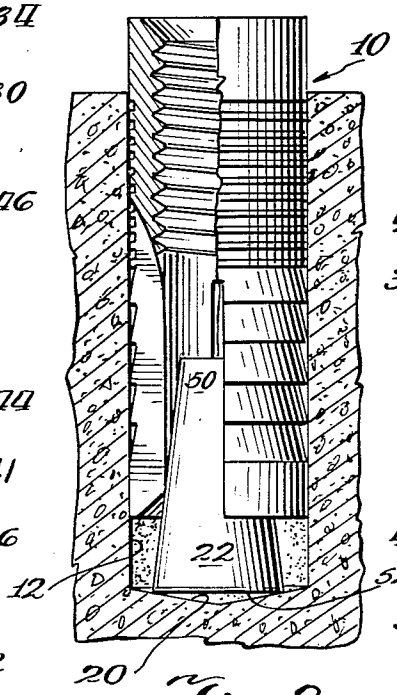


Fig. 2.

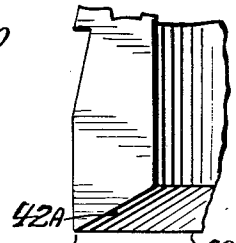


Fig. 5.

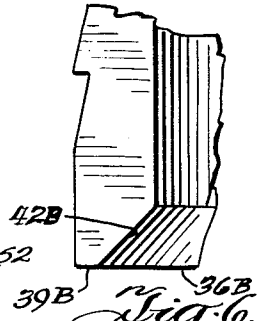


Fig. 6.

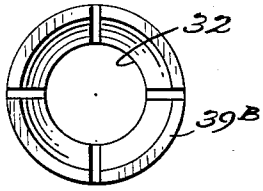
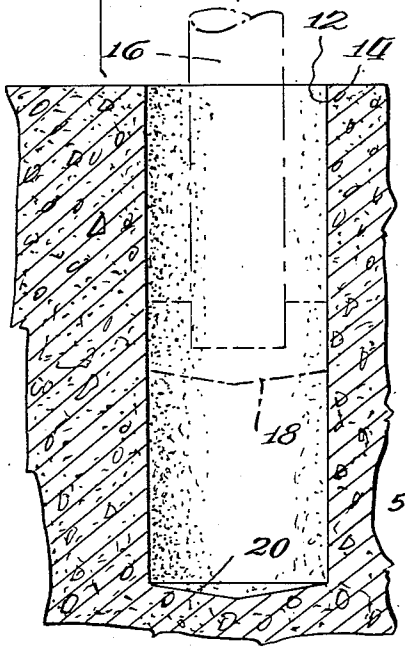


Fig. 4.



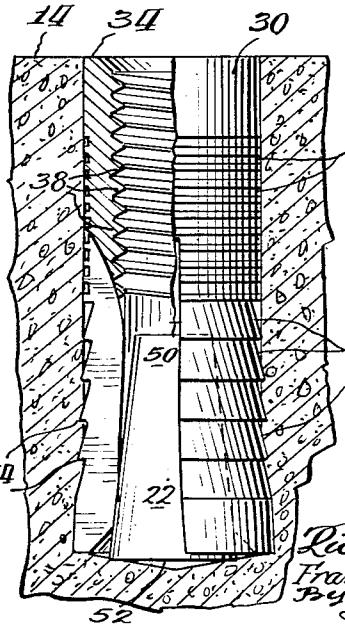


Fig. 3.

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DRIVE-IN CONCRETE FASTENER OR THE LIKE

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4 Claims. (Cl. 85—2.4)

This invention relates generally to fastener devices for installation in concrete, masonry and the like and more particularly, relates to an improved expandible fastener or anchor of the character described adapted to be installed without requiring the use of a percussive or power hammer for drilling a hole with an anchor.

The fastener device embodying the invention may be referred to as a drive-in or insert type and is to be distinguished from the well known self-drilling expansion shell or anchor provided with axially extending teeth or cutting edges at an end thereof which permit the shell or anchor to be driven to cut its own hole by means of percussive forces applied to the opposite end thereof. Such self-drilling expansion shells are described, for instance, in Letters Patent Nos. 1,966,121 and 1,746,050. To a major extent, such shells are installed for industrial and commercial use by means of power or percussive hammers used to drill the hole with the anchor and, for other specific circumstances, manually operated tools for installing such self-drilling shells are available.

The concrete fastener or anchor with which the herein invention is concerned is intended to be installed without the use of percussive hammers drilling the hole with the anchor, that is to say, the hole in which the fastener is to be set or installed is intended to be pre-cut or bored by other means, and thereafter, the fastener is driven into the hole. Consequently, the concrete fastener embodying the invention does not have cutting teeth or edges at an end thereof and chuck engaging means at the opposite end for driving the shell but, in other respects, does utilize some of the advantageous structural features of the well known self-drilling shells in a unique and unobvious manner.

It is recognized that upon a comparative basis, anchor shells of the self-drilling type probably have significant advantages over the concrete fasteners embodying the invention. Notwithstanding, the subject concrete fasteners provide specific advantages which are desirable within the restricted or special use to which they may be put. Within this definable area, it may be recognized that the concrete fasteners with which the invention is concerned are more economical to manufacture and yet, enable the user thereof to realize significant holding characteristics using such an insert or drive-in type fastener in concrete and masonry surfaces over lead-type anchors, for example. Also, the fastener embodying the invention can be used advantageously in softer cementitious surfaces where the user can employ a conventional drill or bit first to drill the installation hole and thereby not require a suitable percussive hammer and chuck assembly such as commonly used with self-drilling expansion shells.

Accordingly, it is a primary object of the invention to provide a concrete fastener or anchor of the character described characterized by a novel structure which will permit such distinctive advantages as are enumerated hereinabove, as well as others, to be achieved.

Another important object of the invention is to provide a concrete fastener of the character described which comprises a substantially cylindrical hollow shell or body having an axially extending socket at opposite ends thereof, said body having axially extending expander grooves or cuts in the circumferential wall thereof commencing

from one end and terminating short of the opposite end thereof, the interior annular surface of the body being partially threaded commencing at a point spaced from the opposite end of the body to permit said opposite end to be deformed without deforming said thread.

Other objects of the invention are to provide a concrete fastener or anchor of the character described which is characterized by the realization of significant economies in the manufacture and use thereof, which is sturdy and provides desirable holding characteristics for this type of construction and which permits the fastener or anchor to be rigidly installed in a cementitious surface by means of a common hand hammer, for instance.

The foregoing and other advantages of the invention will become apparent from the disclosure thereof which ensues. A preferred, as well as modified embodiments thereof, have been described in detail in the specification and illustrated in the accompanying drawing with the contemplation that minor variations in structural features may occur to the skilled artisan without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawing:

FIG. 1 is a composite view showing the concrete fastener or anchor embodying the invention in plan, a plug for expanding the shell and a portion of a cementitious surface having a hole therein for receiving said fastener, portions of the fastener being broken away to show details thereof.

FIG. 2 is a plan view of said fastener or anchor shown in a preliminary stage of being installed in said pre-cut hole which has been sectioned to reveal the anchor, and portions of the anchor being broken away also to show details.

FIG. 3 is a view similar to FIG. 2 but showing the fastener completely secured in the said hole.

FIG. 4 is an end-on elevational view of said fastener considered from the bottom or inner end of the fastener, when installed.

FIG. 5 is a fragmentary elevational view of the bottom or inner end of a modified form of fastener with portions removed to show details thereof.

FIG. 6 is a similar fragmentary elevational view of the bottom end of another modified form of the fastener with portions removed to show details.

Referring now to the drawing, the reference character 10 designates generally the concrete fastener or anchor embodying the invention. As seen in FIG. 1, the fastener 10 is intended to be installed in a hole 12 which has been bored or drilled in a concrete, masonry or the like surface 14. The hole 12 is bored prior to installation of the fastener such as by a drill bit 16 having a cutting end 18 the outside diameter of which is substantially identical to the outside diameter of the fastener. Preferably, the cutting end 18 has a pronounced flat V-shaped configuration as distinguished from the usual sharply angled V-shaped cutting end of a carbide bit, for instance, suitable for boring into cementitious surfaces so that the bottom 20 of the hole will be as flat as possible. As readily appreciated, the bit 16 can be chucked in a suitable percussive hammer (not shown) for boring the hole 12. The fastener 10 is installed in the hole 12 in conjunction with an expander plug 22 of generally frusto-conical configuration, as will be hereinafter explained.

Fastener or anchor 10 comprises a hollow, cylindrical body or shell 30 of suitable metal provided with a tubular bore 32 opening to opposite ends 34 and 36 of the body. Preferably, the body 30 is of uniform outside diameter from end to end thereof. The internal circumferential surface of the body has a series of screw threads 38 commencing at a location inwardly spaced from said end 34 and traversing a portion of the shell and the end

34 preferably is countersunk, as indicated at 40. The opposite annular end 36 has a flat or planar end face 39 and is tapered inwardly from said end face 39 as indicated at 42. An annular ring 41 is formed on the bottom end terminating in a sharp edge at the end face 39.

On the external circumference thereof, the body 30 has a series of annular broaching or cutting grooves 44 which extend approximately one-half the axial length of the body commencing from adjacent the end 36. Next adjacent the grooves 44 is a series of annular grooves 46 which terminate substantially short of the end 34. Commencing from the end 36, there is a plurality of elongate, axially extending expansion cuts 48 in the circumferential wall of the body 30, said cuts 48 extending entirely through said wall.

The ring 41 presents a cylindrical exterior surface and the diameter thereof is the same as the external diameter of the shell 30, and, hence, is the same as the broaching surfaces 44 and ribs 46. The ring 41 not only provides the shell with a gripping surface adjacent the end 39 which is effective upon expansion of the shell end 39 when the shell is installed, but affords an additional, but unobvious beneficial function to be described hereinafter.

If one were to commence the broaching surfaces 44 at the end face 39, upon expansion, the bottom-most broaching surface would, at most, act as any other broaching surface to abut the wall of the hole only at the annular edge of said surface. Further, the normal expectation would be that the said annular edge would dig deeper into the hole at the bottom thereof when percussive force is applied to expand the shell. Without the additional surface afforded by the ring 41, the said leading edge would be insufficient to prevent lateral translation of the shell and subsequent loosening of the same. In contrast, the additional surface afforded by ring 41 functions to establish a tight frictional engagement with the wall of the hole and contributes substantially to resist axial translation of the shell subsequent to installation thereof. In addition, the ring 41 lends additional strength to the shell end 39, both for the incorporation of the tapered inner surfaces 42A and 42B, and to enable the undercutting adjacent the bottom of the hole performed by said ring 41 and retention of the end 39 in said undercut area.

The manner of installing the fastener 10 will be explained. After the hole 12 has been bored, the drill bit 16 is removed and the hole cleared of any residual debris such as, by means of a squeeze bulb or other suitable evacuating means. The expander plug 22, which is made of a suitable metal, is inserted into the end 36 with its narrower diameter extremity 50 last. The opposite end 52 of the plug has a diameter which is greater than the internal diameter of the bore 32 adjacent the end 36. The fastener 10 then is inserted into the hole 12, end 36 thereof first, as seen in FIG. 2 with the protruding plug 22 engaged against the bottom 20 of the hole. As seen in FIG. 2, at this stage of the installation, the end 34 protrudes outwardly from the hole 12.

The shell 30 now can be driven home into the hole 12 by means of a conventional hand hammer applied against the end 34. As the shell is driven into the hole, the circumferential wall of the body will be expanded by the plug along the expansion cuts 48 thereby causing the leading edges of the broaching grooves and the edge 39 of the annular ring 41 to bite into the annular wall defining the hole 12, as seen at 54 in FIG. 3. The annular ring 41 will extend radially outward the greatest amount, and, as a result, the leading edge 39 will undercut the hole 12 at its bottom end, with the debris for a great part entering the space defined by the taper 42 and the plug 22. Since the hole is undercut, and the ring 41 is expanded in this undercut, and since the debris does not interfere with the plug being tightly held in the bore 32, the holding power of the anchor is considerable.

Because the threads 38 commence a substantial distance below the top end 34, there is no concern with deforming said end during installation of the shell without deforming the threads. As seen in FIG. 3, the shell 30 has been flush mounted into the hole 12, that is to say, the end 34 of the shell is flush with the surface 14. The end face 39 of the shell 30 likewise tends to conform somewhat with the bottom 20 of the hole, which is as flat as possible.

After the shell 30 is installed, as seen in FIG. 3, a bolt (not shown) can be threaded into the bore 32 through said open end 34 for securing an article to the cement surface 14.

Referring to FIGS. 5 and 6, a fragment of the bottom or inserted end of the concrete fastener embodying the invention is illustrated with modifications respectively thereof. The end shown in each of the figures corresponds to the end 36 of shell 30, that of FIG. 5 being designated 36A and that of FIG. 6 being designated 36B. Except for the modifications in the bottom ends thereof, said fasteners are identical to fastener 10. Bottom end 36A is tapered as indicated at 42A to provide a sharp end face 39A whereas bottom end 36B is somewhat thicker as seen from end face 39B. The somewhat sharp end 36A may assist in facilitating entry of the shell 30 the full length of the hole 12 by more easily severing protruding portions of the wall surrounding the hole and more easily undercutting the same at the bottom end; however, it may be recognized that the greater thickness of the end 36B may contribute greater structural strength of the bottom end of the shell.

As explained previously, certain similarities of the fastener 10 to a self-drilling expansion shell of said mentioned patents, upon a cursory analysis, may become apparent. However, the more pronounced differences are to be noted which in substantial measure alter the character of the fastener 10. Immediately apparent is that the shell 30 does not have cutting teeth at the bottom or inserted end 36 thereof. Consequently, no special hardening or annealing of end 36 is required, as is the case with shelf-drilling shells. No chuck or tool holder is required for driving the fastener 10 into the hole. All that is necessary is to bore the hole 12 using a suitable bit having a cutting end the diameter of which is approximately equal to the outside diameter of the body 30. Although during installation of the shell, their function need not be required, it is considered that annular ribs 46 may be useful in preventing binding and their resulting grooves of value in capturing some debris during insertion of the fastener into the hole. Of considerable importance is the spacing of the internal threads 38 from the top end 34 of the shell which permits even a conventional manual hammer to be applied against the face of said end 34 without concern for deforming said threads. As a result, the shell 30 can be manufactured and used with significant economies, such as requiring no special tool holders and chucks and power hammers, as is the case with self-drilling expansion shells. The holding characteristics of fasteners 10 were found to be excellent.

It is believed that the invention has been described sufficiently to enable understanding and practice thereof by the skilled artisan. In the claims, the invention has been defined in language intended to be broadly and liberally construed.

We claim:

1. A concrete or like fastener of the drive-in, expansion type adapted to be set into a hole in a concrete or like surface, the diameter and length of which hole is substantially identical to the outside diameter and axial length of the fastener; said fastener comprising, a hollow cylindrical metal body member having a central bore opening to opposite ends of the body, the internal circumference of the body having a series of screw threads commencing at a location spaced from one end of the body and traversing a portion of the body, said one end of said body

being countersunk to permit said one end to be deformed during setting of the fastener in the hole without deforming the threads thereof, the opposite end of the internal circumference of the body having a tapered surface extending from said central bore and connecting with the end face at said opposite end, the external circumference of the body having a series of annular broaching grooves commencing spaced from the opposite end of said body and defined by a surface inclined inwardly toward the central bore and toward said one end and by a radially extending surface which faces said opposite end of said body, and a circumferential ring presenting a smooth cylindrical exterior surface adjacent said opposite end, said ring having an external diameter which is the same as the diameter of the body at the leading edges of the broaching grooves, said tapered surface joining said central bore within the axial extent of said ring, and a plurality of elongate axially extending cuts in the circumferential wall of said body intersecting said central bore and opposite end to permit expansion of said body whereby said broaching grooves and ring can be urged against the interior wall of the hole closely adjacent the bottom of said hole with the leading edges thereof biting into said wall and wedging the circumferential ring in tight, gripping engagement with the said wall and the said one end of the fastener body flush with the concrete or like surface.

2. The fastener as defined in claim 1 in which the said end face has a sharp edge.

3. The fastener as defined in claim 1 in which said external circumference is provided with a plurality of annular rib portions between the said one end and said broaching grooves, said rib portions serving to prevent the binding of the body within the hole during installation of the shell.

4. The fastener as defined in claim 1 in combination with a frusto-conical metal plug member adapted to be seated in said opposite end partially within said central bore, said body of the fastener adapted to be driven against said plug member by force applied to said one end of said body in the absence of surface to surface contact of the plug member with the said tapered surface, whereby to expand said body to urge said broaching grooves against the interior wall of said hole with the leading edges thereof biting into said wall, the circumferential ring biting into said wall the greatest amount to form an undercut therein adjacent the bottom of said hole, the said exterior cylindrical surface being tightly engaged within the undercut thereby formed with debris therefrom disposed in the area defined between the plug and said tapered surfaces.

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