

[54] CONCRETE PENETRATING PIN

[75] Inventor: Friedrich Karl Knohl, Roselle, Ill.

[73] Assignee: Illinois Tool Works Inc., Chicago, Ill.

[22] Filed: Dec. 26, 1973

[21] Appl. No.: 428,590

[52] U.S. Cl. 85/28; 85/30

[51] Int. Cl. F16b 15/00

[58] Field of Search 85/10 R, 10 E, 30, 28, 85/16, 19

[56] References Cited

UNITED STATES PATENTS

231,322	8/1880	Hyslop	85/10 R
970,423	9/1910	Cunningham	85/28
2,873,447	2/1959	Catlin et al.	85/30
3,276,820	10/1966	Ditson	85/19
3,459,095	8/1969	Hsu et al.	85/10 E

FOREIGN PATENTS OR APPLICATIONS

1,556,765 12/1968 France 85/10 E

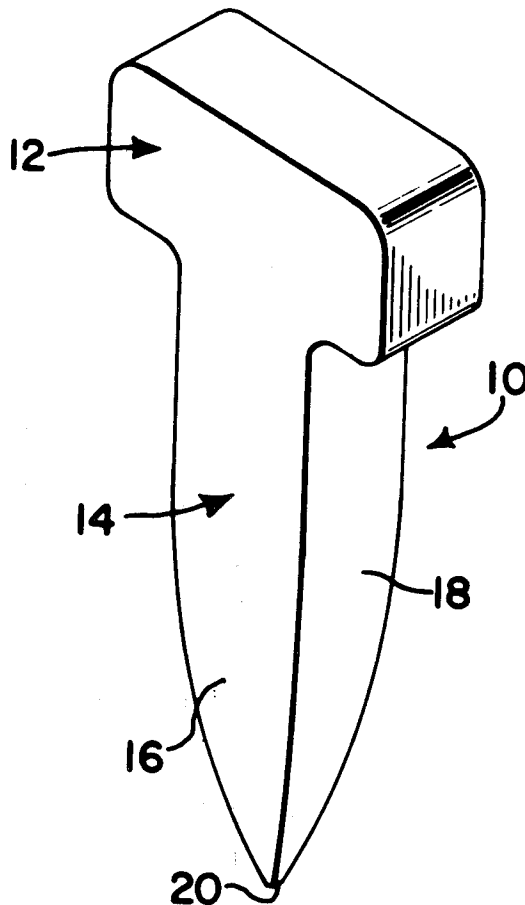
Primary Examiner—Marion Parsons, Jr.

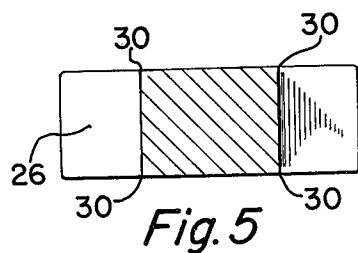
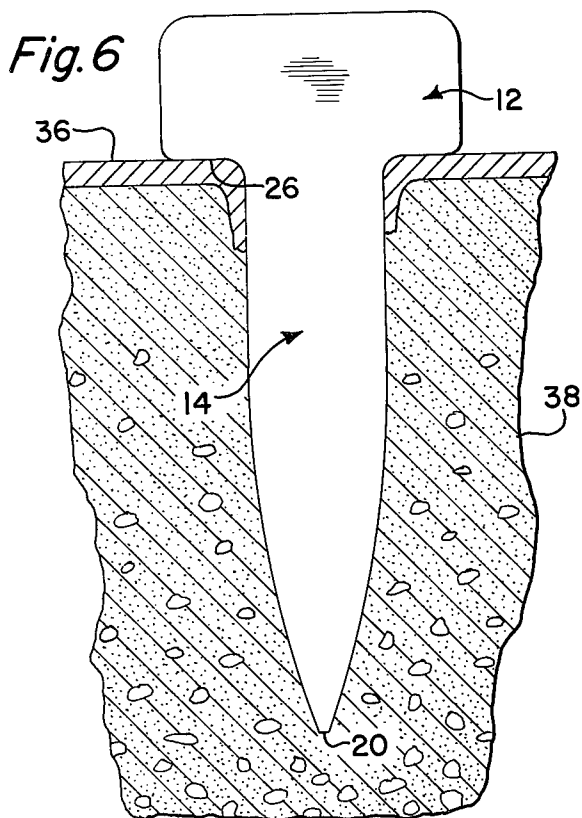
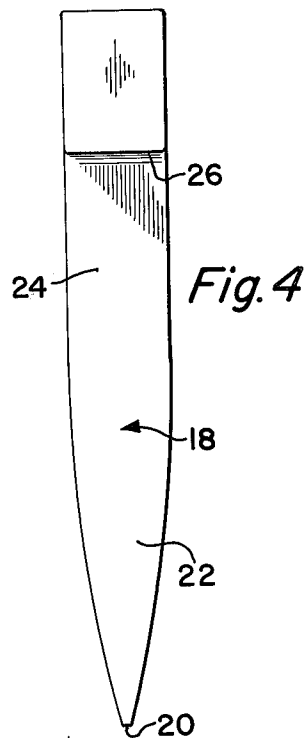
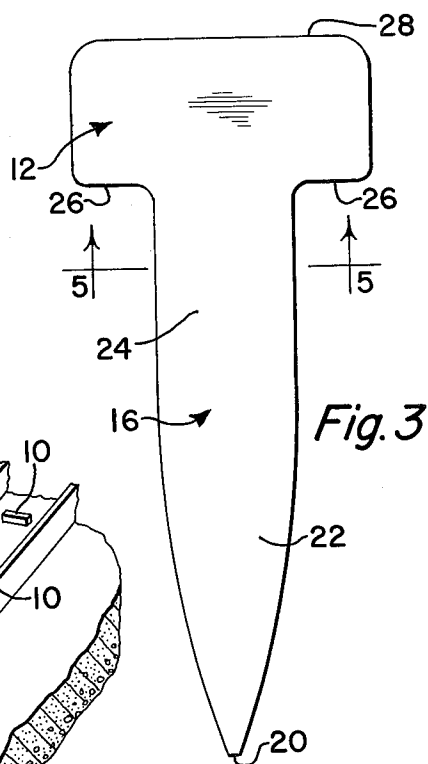
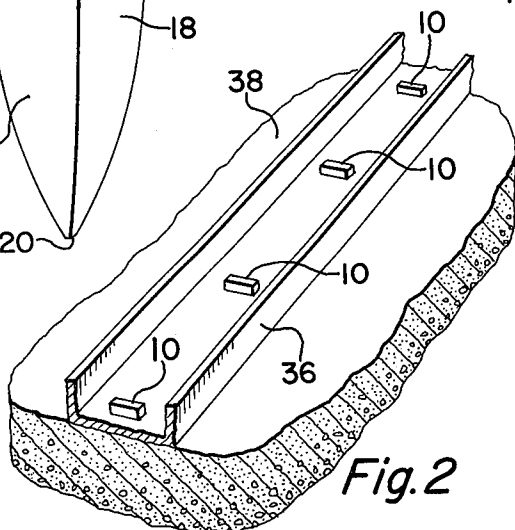
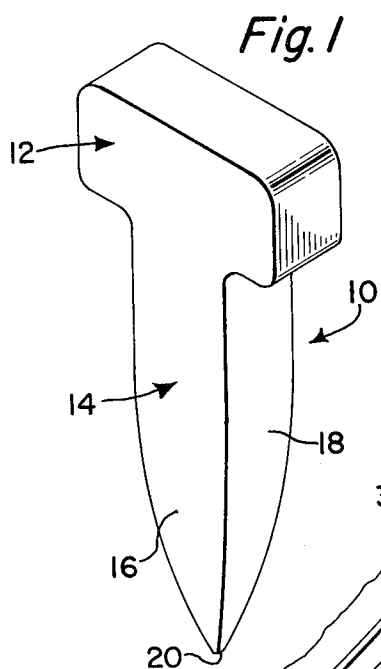
Attorney, Agent, or Firm—Robert W. Beart; Thomas W. Buckman

[57] ABSTRACT

A fastener device which is adapted to be driven into relatively hard workpiece material, such as steel or concrete, at relatively low velocities and energy levels. The fastener includes a shank and an integral head with the shank comprised of four surfaces intersecting to form four longitudinal cutting edges. The shank is relatively short in length and includes an entering portion having an arcuate configuration with each arcuate surface merging with the other to form a penetrating point.

1 Claim, 6 Drawing Figures





CONCRETE PENETRATING PIN

Fasteners driven into concrete for fastening fixtures thereto have conventionally been circular in cross section with a ballistic or nail point and have generally been relatively long. Such fasteners have typically been driven at great velocity by high energy tools, such as powder actuated tools.

High energy sources and relatively large lengths on fasteners have heretofore been found to be necessary because of the structural nature of concrete. A conventional fastener, as described above, will normally create a spall area for an appreciable depth into the concrete because the impact of such a fastener causes stress waves to travel through the concrete which tend to compress and fracture the concrete about the fastener. This fracture or spalling area virtually eliminates any holding power in the upper levels of the concrete. Thus, such a fastener was designed to have a length great enough to penetrate to a depth below the fracture or spall area to allow the concrete to be compressed about the shank and provide holding power. It is customary in the prior art to design a fastener so that its length is approximately eight times its diameter to penetrate into the zone beneath the spall area where the shank is mechanically retained by the pressure of the concrete on the shank. Of course, such a penetration requires relatively high driving energies and the accompanying disadvantages of using such high driving energy sources. In addition, such fasteners are frequently used to penetrate a fixture, such as steel, thus placing further burdens on the fastener. It is also recognized in certain finished concrete installations that the uppermost zone of the concrete will be relatively free of aggregate but the deeper zone of the concrete will, of course, not be free of aggregate. The presence of such aggregate in the concrete and the frequency thereof will hinder the penetrating and holding capability of a fastener.

It is accordingly an object of the present invention to provide a fastener capable of being driven at relatively low velocity and with relatively low energy levels to penetrate concrete.

It is another object of this invention to provide a fastening device which is capable of penetrating and holding in a limited depth of concrete and without creating substantial spalling of concrete.

It is yet another object of the invention to provide a fastener which is designed so as to penetrate and be driven through a fixture, such as steel, as well as being capable of penetrating and holding in short depths of concrete.

The above and other objects and advantages are obtained by the present invention in which a fastener device includes an enlarged driving head portion and a shank portion formed by a plurality of longitudinal cutting edges which terminate in a sharp penetrating point. The shank of the fastener will include an arcuate entering section and a generally straight trailing section. The trailing section and entering section are preferably substantially equal to maximize the penetrating and holding ability in small depths. A further aspect of the invention is the incorporation of these features in an extremely small fastener and yet retain good holding capabilities while minimizing the driving energy and velocity required to penetrate and hold.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the fastening device made in accordance with the invention.

FIG. 2 is a perspective view of a plurality of fasteners of the present invention as they are used in the attachment of a steel channel to a concrete surface.

FIG. 3 is a front elevation view of the fastening device.

FIG. 4 is a side elevation view of the fastening device.

FIG. 5 is a cross-sectional view taken along the lines 5—5 of FIG. 3.

FIG. 6 is a partial sectional elevation of the fastening device in a completely driven condition in an environment such as shown in FIG. 2.

Referring now to the drawing, it will be seen that one embodiment of the fastening device envisioned by the present invention is designated generally by the numeral 10. The fastener 10 includes an enlarged driving head 12 and an elongated shank 14 having a substantially sharp entering point 20. The shank 14 basically is comprised of a relatively straight trailing portion 24 immediately beneath the head and merging with an arcuate entering portion 22 which extends from the straight portion to the point 20.

Referring to FIGS. 3, 4 and 5, it will be seen that the fastening device may be constructed so that the shank has a generally rectangular configuration and is shown as having two pair of opposing side surfaces 16 and 18. The transverse dimension of side 16 being slightly greater than the transverse dimension of side 18. The transverse dimension of the side 18 forming the thickness of the fastener and such thickness being substantially uniform from the top surface 28 of the driving head to the juncture of the trailing portion 24 with the entering portion 22. The head 12 basically being a pair of ears extending laterally of the shank axis of the same transverse dimension as side 18.

Attention is drawn to the provision of longitudinally extending cutting edges 30 formed by the intersection of the pairs of side surfaces 16 and 18. In the embodiment shown, these edges 30, in conjunction with the sharp entering point 20, serve to cuttingly penetrate the concrete and minimize the impact shock which would tend to create a spall area in the uppermost zone of the concrete. It is also to be noted that the entering portion 22 provides a gradual wedging effect as it penetrates the concrete and preferably extends about one-half of the distance of the shank. The entering portion 22 is formed by curvilinear surfaces providing outwardly arcuate surfaces immediately behind the penetrating point 20.

As a consequence of the combination of the novel structural features described above, the fastener 10 may be constructed of extremely small sizes relative to the fastener devices of the prior art. For example, a fastener having an overall length of .47 inches, shank length of .37 inches, a dimension from the top of the head to the juncture of the entering portion with the trailing portion of .23 inches, an entering portion of .24 inches, a width of .1 inches, and a thickness of .07 inches, has been found adequate to penetrate a steel fixture and a supporting concrete surface without appreciable spalling and in such a manner as to completely retain a runner or channel of the type shown in FIG. 2. It should be understood that the above dimensions are representative of the size of the fastener em-

bodily the teachings of this invention but should not be interpreted as limiting the invention thereto.

In FIG. 2 a steel channel 36 is attached to a concrete structure 38 with a plurality of fastener devices 10. FIG. 6 is representative of the driven condition of one of the fasteners shown in FIG. 2. The channel 36 may typically be a 25 gauge thickness and may be used to retain vertical steel stud members positioned within the channel and extending perpendicularly thereto for subsequent attachment of a finish wall, such as dry wall or the like. These channels are typically used on both the floor and overhead concrete surfaces. FIGS. 2 and 6 represent the typical condition of the concrete 38 in that there is normally less aggregate near the surface of the concrete than there is at a lower depth. Thus, it should be apparent that the chances of a failure in driving a fastener into concrete increases if the fastener is of any appreciable length.

Due to the arcuate configuration of the entering portion 22, the point 20 can penetrate fixtures, such as a steel channel 36. Once the steel has been penetrated the longitudinal cutting edges 30 and the wedging effect of the entering portion 22 are effective to penetrate the concrete 38 without producing substantial stress waves upon impact and thus the spalling is substantially reduced by the present invention. As the fastener 10 becomes seated and the undersurface 26 bears against the fixture, the compressive force of the concrete will act on the axial extent of the trailing portion 24 to provide a substantially balanced peripheral stress on the shank and thus contributes greatly to the holding power. Since there will be essentially no spall area, the concrete will be able to exert the compressive or holding power on substantially the entire depth of penetration of the shank 14.

Thus, it is apparent that there has been provided, in accordance with the invention, a fastening device capable of being relatively small in length and which will penetrate and hold in concrete with substantially low driving energies and velocities. While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those

skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications, and variations as fall within the spirit and broad scope of the appended claims.

I claim:

1. A fastener device for penetration of steel and a concrete support surface utilizing relatively low velocity and driving energy, including a shank portion and enlarged driving head portion, the shank having a rectangular cross-sectional configuration along its entire length and formed by four longitudinal side surfaces all of which present surfaces which are substantially linear in a direction transverse the axis of the fastener, four longitudinally extending corners formed by the intersection of the side surfaces and functioning as longitudinal cutting edges to facilitate entry of the fastener into the concrete, the shank including an entering and trailing portion, the trailing portion being directly beneath the head with the longitudinal side surfaces thereof being substantially parallel to the longitudinal axis of the shank, the entering portion forming a workpiece penetrating point by the convergence of all longitudinal side surfaces to a substantially sharp point, the four longitudinal side surfaces forming the entering portion being curvilinear in the direction of the axis of the shank and providing outwardly arcuate surfaces from the trailing portion to the substantially sharp point, the entering portion having an axial extent at least as great as the axial extent of the trailing portion, the driving head portion having a thickness and length with the thickness being equal to the thickness of the shank and the length of the head formed by integral ears extending laterally to either side of the shank providing workpiece engaging surfaces, the total axial extent of the fastener device being generally one-half inch, the total shank length being generally three-eighths inch, and the length of said entering portion being approximately one-fourth inch and the width and thickness of the shank being generally not greater than one-sixteenth inch thereby allowing the fastener to penetrate the steel to an anchoring depth in the concrete without requiring substantial driving energy.

* * * * *

45

50

55

60

65