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TOOLS FOR DRIVING ANCHOR STUDS

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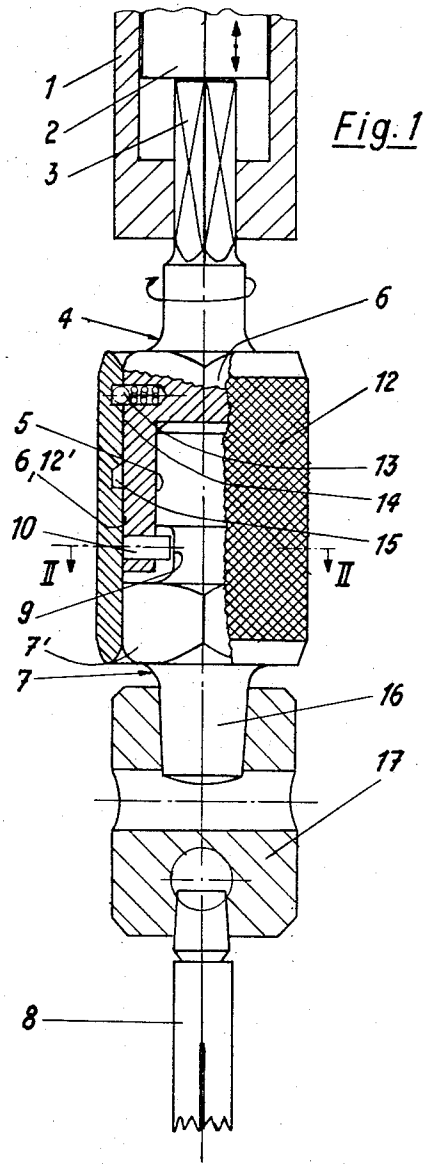
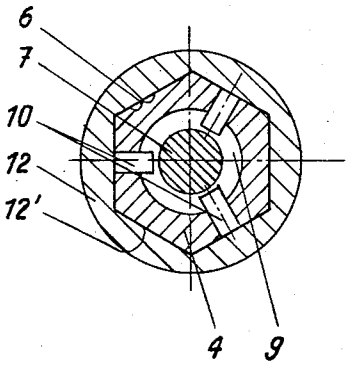


Fig. 1

Fig. 2



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TOOLS FOR DRIVING ANCHOR STUDS

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This invention relates to percussion tools for driving fasteners into receiving materials such as concrete, brick, masonry or the like, wherein at least a part of the fastener is driven into the receiving material so as to bore its own hole by repeated percussion tending to impact the fastener or fastener part into the receiving material, in combination with intermittent rotation thereof.

One such fastener is a so-called "self-drilling anchor" which comprises a tubular body having axially directed cutting teeth at one end and a break-off tapered shank at the other end and the body being weakened through part of its length from its toothed end by axially extending grooves therein so that such part can be expanded. Complementary to such body is a frusto-conical expansion plug. In fixing such an anchor, the body is fitted to the percussion tool by its shank, and is applied to the receiving material by its toothed end. The tool is then operated to impact the body into the receiving material initially without any rotation being applied to the body, to provide an initial start for the hole to be produced by the body. As soon as a sufficient start has been achieved, heavy pressure can be applied through the tool to the body, and the body is rotated as driving-in is effected.

When the body has been driven into the receiving material up to its junction with the snap-off shank, the body is withdrawn. The expansion plug is next inserted, narrow end first, into the body from the toothed end. The body, still fixed to the tool, is then reintroduced into the hole and the tool is operated again to drive the body into the hole. This has the effect of causing the plug (which abuts against the bottom of the hole) to be driven into the toothed end of the body, to spread and expand the same at opposite sides of the grooves to anchor the body firmly in the hole, whereupon the break-off shank can be removed substantially flush with the surface of the receiving material. The interior of the body of the fastener is internally threaded at least adjacent the break-off shank, so that a bolt can be screwed into the same.

In the known percussion tools of this type, a handle is provided for enabling the chuck or other tool holder thereof to be rotated or oscillated manually during the driving operation. This means, therefore, that a user of the tool can use only one hand to hold the tool steady and apply pressure thereon during the operation thereof, the other hand being occupied with manipulating the handle by swinging it to and fro to produce partial rotation of the chuck or tool holder, first one way and then the other. Accordingly it is extremely difficult, and often impossible, to use such tools for applying such fasteners into a ceiling or like location requiring the tool to be directed upwardly to the receiving material.

A further difficulty with such tools lies in withdrawing the fastener from the receiving material after completion of the hole, for assembly of the expansion plug into the body from the toothed end thereof, this being particularly tedious and time consuming.

An object of this invention is to provide an arrangement which eliminates the need for manual rotation of the chuck or a handle associated therewith for rotating the body during the driving operation, so that the user of the tool has both hands available for holding, steadying and guiding the tool.

A further object is to provide a simple and compact arrangement which can be easily and economically constructed so as to adapt the tool to be employed both for driving the fastener and for withdrawing the same for insertion of an expansion plug therein.

With these objects in view, the present invention provides a percussion tool for driving fasteners, such as self-drilling anchor studs, comprising a percussion member, a rotary shaft, a connector including two concentric members one of which connects with the rotary shaft so as to be acted on by the percussion member, and the other of which has a chuck or tool holder connected thereto, the connector having coupling means by which the two concentric members can be coupled for rotation together and uncoupled to permit relative rotation therebetween.

With such an arrangement, the following advantages are achieved. The tool will initially be used with the coupling means uncoupled so that during "starting" of a driving operation and formation of the first part of the hole in the receiving material the chuck or tool holder will not rotate relative to the receiving material. This permits accurate positioning or centering of the hole to be achieved. As soon as the hole has reached an appropriate depth, the tool is stopped momentarily whilst the coupling means is actuated to couple the concentric members for rotation together, whereafter operation of the tool results both in rapid impacting and rotation of the chuck or tool holder to provide for rapid hole formation. Both hands are, therefore, free to hold and guide the tool, so that applying such fastening studs into ceilings and other hitherto difficult locations are rendered more practicable.

If the two concentric members are arranged so that only a very limited relative axial movement is possible therebetween (as will later be explained) then the tool can be employed not only for driving in a fastener, but can also be employed for withdrawing such fastener, simply by the user pulling on the tool so as to tend to withdraw the same away from the receiving material, the percussions of the tool then acting in the opposite directions to that in which it acts during driving-in.

In the preferred embodiment of the invention the two concentric members are advantageously a socket which is connected to the rotary shaft of the tool and a plug to which the chuck or tool holder is connected. The socket may then have a hexagonal outer surface with a corresponding hexagonal surface being provided on a part of the plug projecting axially beyond the socket. The coupling means is shown in the form of a sleeve having an interior surface of a hexagonal shape complementary to the socket and enclosing the latter. The sleeve is shiftable axially between a coupling position wherein the hexagonal part of the plug is within the sleeve, and an uncoupling position wherein the sleeve is clear of such hexagonal part of the plug. In the latter case, the plug is, of course, free to rotate in the socket.

Conveniently a spring-loaded detent is provided for retaining the sleeve in one or the other of its two positions.

The plug is conveniently retained within the socket by radial pegs or the like fixed in the socket and projecting into a circumferential groove in the plug, and the width of the groove is such as to permit only limited axial movement of the plug in the socket so that the tool can be employed both for driving and withdrawing operations as previously mentioned.

In order that the invention may be fully understood, it will be described further, by way of example, with reference to the accompanying drawing, in which:

FIGURE 1 is a fragmentary part-sectional side elevation illustrating a preferred embodiment of the tool of

the invention showing the body of a self-drilling anchor stud fitted in the tool and ready for driving; and

FIGURE 2 is a cross-sectional plan view taken on the line II—II of FIGURE 1.

In the drawings, a percussion tool is illustrated which incorporates novel features of the present invention for driving fasteners, such as self-drilling anchor studs, and comprises a rotary hollow shaft **1** enclosing a percussion member **2**, drive means (not shown) being provided for rotating the shaft **1** and simultaneously impacting the percussion member **2** so that the latter reciprocates as indicated by the double-headed arrows shown on such member in FIGURE 1.

The end of the shaft **1** is provided with an axial opening having flat sides to receive an axial shank **3** formed integrally with and projecting from a socket element **4** forming a first concentric part of a connector serving to connect a chuck or tool holder **17** to the shaft **1**. The socket **4** has an axial bore **5** which is open at its end remote from the shank **3**, and the outer surface of the socket **4** is hexagonal as indicated at **6**.

Complementary to the socket **4** is a second concentric part of the connecting coupling in the form of a plug **7** having an end providing a close sliding fit in the blind opening **5** in the socket **4** and an end which protrudes from the socket in a direction away from and axially aligned with the shank **3**. The plug **7** has a circumferential groove **9** and pegs **10** (see particularly FIGURE 2) project radially inward from the socket into such groove **9**. The width of the groove is such that the pegs **10** have a clearance fit therein, so that the plug **7**, whilst being held captive in the opening **5** of the socket **4**, is capable of rotating therein and also of having limited axial movement therein.

Plug **7'** is formed with a hexagonal portion **7** where it protrudes from the socket **4** and has the same dimensions as the hexagonal outer surface of the socket **4**, so that when appropriately oriented the hexagonal portion **7'** of the plug effectively constitutes a continuation of the hexagonal surface of socket **4**.

Enclosing the socket **4** is a coupling sleeve **12**, the inner surface **12'** of which is of hexagonal shape so that it has a sliding fit on the socket **4** and can be shifted axially therealong. Two recesses, **14** and **15** respectively, are provided in the interior surface of the sleeve **12** for engagement therein of a detent in the form of a spring-loaded ball **13** set into a radial hole in the socket **4**. The recesses **14** and **15** are spaced axially of the sleeve **12** and serve to define two relatively axial positions of the sleeve. The sleeve is releasable by the spring-loaded balls **13** to locate the sleeve in one or other of such positions.

As shown, the sleeve **12** is in the coupling position with the ball **13** engaging in the recess **14**. In this coupling position, the hexagonal part **7'** of the plug **7** is within the sleeve **12** and accordingly the plug must rotate with the socket **4**. If the sleeve **12** is shifted axially in an upward direction considered in relation to FIGURE 1 of the drawings, until the ball enters in the recess **15**, such sleeve **12** is then in its uncoupling position wherein it is clear of the hexagonal part **7'** of the plug **7** and the latter can rotate freely relative to the socket **4**.

The plug **7** is formed at its end remote from the socket **4** with a shank or tang **16** having an interference fit with the chuck or tool holder **17**. This chuck or tool holder **17** is shown, in FIGURE 1, as having a self-drilling anchor stud **8** (of the type already discussed in detail) fitted therein by its break-off tapered shank. The operation of the tool is next explained.

For initial starting of the driving operation, the sleeve **12** is moved to its uncoupling position so that the plug **7**, and therefore the tool holder or chuck **17** and the anchor stud **8** are not constrained to rotate with the socket **4**. The tool is then positioned so as to offer the toothed end of the anchor stud **8** to the receiving material

(not shown) and the tool is set into operation so that the stud **8** is subjected to rapid impacts to drive it into the receiving material. This is continued until a sufficient start has been made in the receiving material to provide for proper positioning of the hole about to be produced. The tool is now stopped momentarily whilst the sleeve **12** is shifted to its illustrated coupling position and is then restarted, so that the body **8** is both rapidly impacted into the receiving material and rotated. This provides for rapid driving of the stud **8** into the receiving material and formation of a corresponding hole therein, and considerable pressure can be applied through the tool as this driving is effected.

When the stud **8** has been driven in up to the junction with the snap-off shank thereof, pressure is no longer applied to the tool. Instead the operator pulls on the tool so as to tend to withdraw the stud **8**, with the result that vibrations from the percussion member **2** are transmitted, by way of the pegs **10**, to the plug **7** and thence to the stud **8** so that continued operation of the tool serves to assist withdrawal of the stud. In this connection, it is to be observed that the resistance of the stud **8** to withdrawal will normally be less than the resistance of the stud to withdrawal from the tool holder or chuck **17** or of withdrawal of the tang **16** from the tool holder or chuck **17**, so that the parts of the tool do not separate. The shank **3** can, of course, be an interference fit with the rotary shaft **1** so that separation thereof will not occur, or a positive fastener can be provided to prevent such separation.

After the fastening stud **8** has been withdrawn a tapered plug is inserted in its outer end as previously explained. The stud **8** is then reinserted in the drilled hole and the tool restarted to again drive the stud. As the forward end of stud **8** strikes the bottom of the hole, the tapered plug is driven into the stud to spread its end and lock the stud in the receiving material. After the stud is locked in position its projecting end is broken off flush with the surface of the material into which the stud is driven.

While the foregoing describes the specific details of a preferred practical embodiment of the invention, it is to be understood that variations may be made thereto without departing from the scope of the following claims. For instance any suitable coupling means may be provided for coupling or uncoupling the two concentric members which are exemplified by the plug **7** and socket **4**.

What is claimed is:

1. A percussion tool for driving self-drilling anchor studs and like fasteners comprising a percussion member, a rotary shaft, a chuck for holding a fastener to be driven and a connector connecting said chuck to said rotary shaft, said connector comprising two concentric members, a first one of which is connected to said rotary shaft so as to be acted upon by said percussion member and a second one of which has said chuck connected thereto, and a coupling member mounted to slide longitudinally of said concentric members and having surfaces interlocking with said members, said coupling member being shiftable between a coupling position engaging both members wherein it couples said two concentric members for rotation together and an uncoupling position engaging one member only wherein said two concentric members are free to rotate one relative to the other.

2. A percussion tool according to claim **1** wherein said two concentric members are a socket and a plug, respectively.

3. A percussion tool according to claim **2** wherein said socket is connected to said rotary shaft and said plug has said chuck connected thereto.

4. A percussion tool according to claim **2** further including radial pegs secured in said socket and projecting radially inwards therein, and a circumferential groove around said plug and engaged by said pegs, said groove providing a clearance for said pegs to permit limited axial movement of said plug within said socket.

5. A percussion tool according to claim **2** wherein

said socket has a hexagonal outer surface and said plug having a part protruding from said socket, said protruding part of the plug having a hexagonal outer surface and said coupling member comprising a sleeve surrounding said socket and shiftable axially between said coupling position, wherein said hexagonal part of said plug is within said sleeve, and said uncoupling position wherein said sleeve is clear of said hexagonal part of said plug.

6. A percussion tool according to claim 5 further including a spring-loaded detent protruding from said socket, said sleeve having two axially spaced recesses for engagement therein of said detent, respectively, in said coupling and uncoupling positions.

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