

May 21, 1968

K. LEITNER

3,383,894

POWER TOOLS FOR SETTING BLIND FASTENERS

Filed Oct. 23, 1965

3 Sheets-Sheet 1

Fig. 1

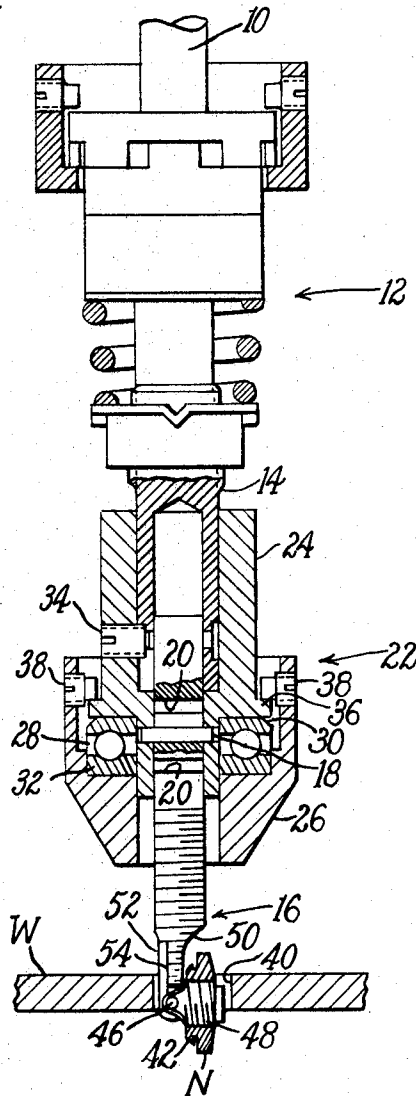
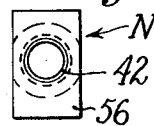


Fig. 1^a



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Fig. 2

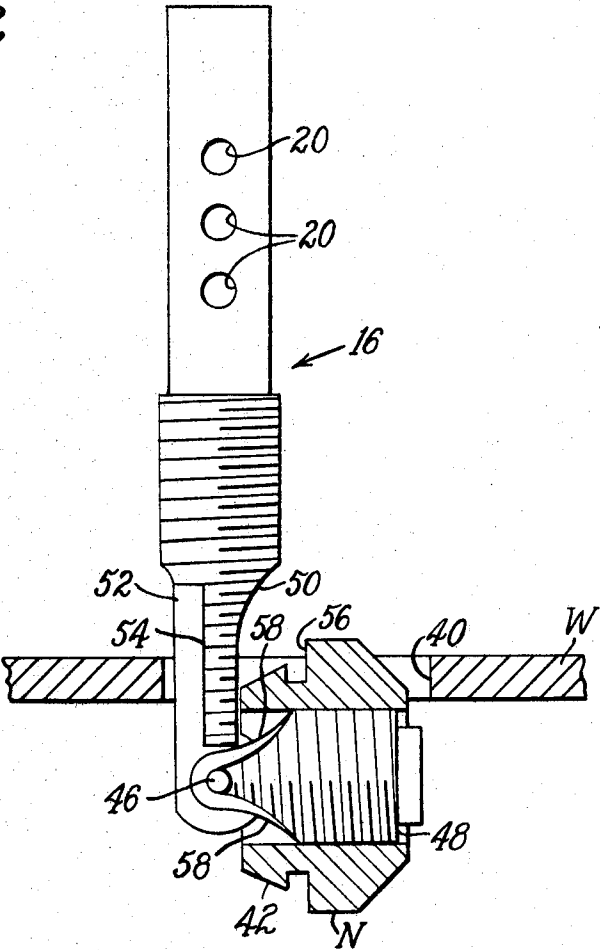
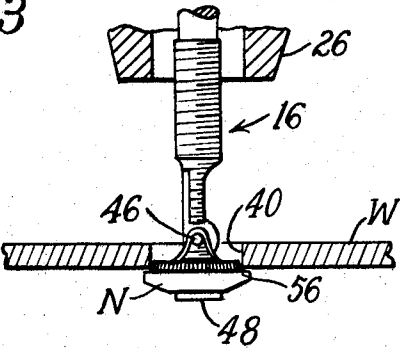


Fig. 3



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Fig. 4

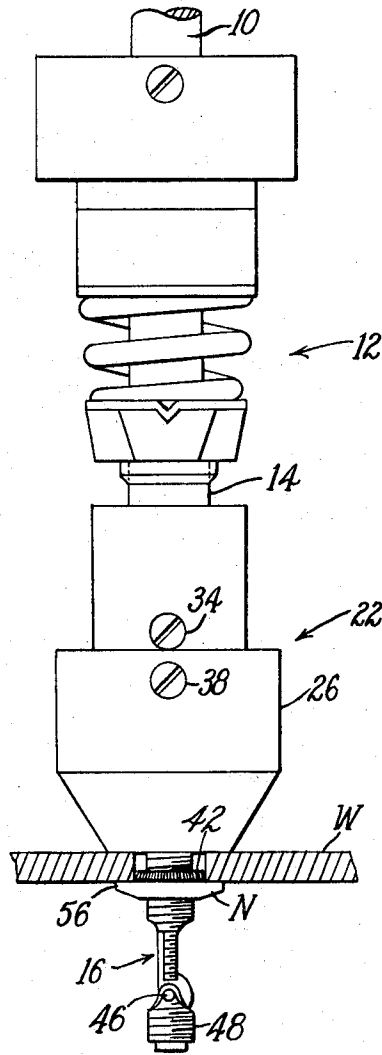
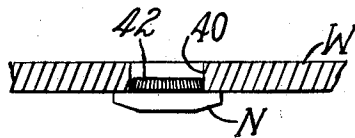


Fig. 5



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POWER TOOLS FOR SETTING BLIND FASTENERS

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4 Claims. (Cl. 72-114)

ABSTRACT OF THE DISCLOSURE

A setting tool for exerting increased axial pull to set a blind threaded fastener in a work piece which minimizes torque between the drive means and the work piece during the setting operation. The tool is provided with means for pivotally supporting the threaded fastener during insertion into the work piece opening.

This invention relates to fastener inserting devices, and more especially to the provision of improved power tools for installing a threaded fastener in an aperture of a structure from its inaccessible side. The invention is herein illustrated as applied to the setting of blind collar nuts, for instance of the type disclosed in my copending application Ser. No. 434,332, filed Feb. 23, 1965, now Patent No. 3,348,596, granted Oct. 24, 1967, but it will be understood that the invention is not thus limited in use, nor is it restricted to the embodiment shown by way of example.

In my copending application, Ser. No. 437,240, filed Mar. 4, 1965, now Patent No. 3,290,768, granted Dec. 13, 1966 there is disclosed a tool which is manually operable for installing blind nuts of the type mentioned, the tool being adapted tiltably and releasably to carry a nut through a hole in a work piece and then retract the nut therein for mounting athwart the blind side. While that tool is satisfactory for many purposes, the retractive or installing force which it can exert is limited due to the necessarily small sectional size of its inserting stem in relation to that of the threaded portion of the nut, and hence mountings permitting full holding strength of the fasteners are not readily attained.

In view of the foregoing it is a primary object of this invention to provide an improved blind fastener setting tool capable of exerting increased axial pull with fairly low torque whereby the fastener is more securely anchored.

In accordance with this object a feature of the invention resides in the provision, in a pull-to-set type tool for installing threaded blind fasteners, of a threaded inserting head for pivotally supporting a fastener to be mounted in a hole in a work piece, power means for reversibly rotating the inserting head as it is threaded axially relatively to the fastener in the work piece hole, axial stress balancing means engageable with the accessible side of the work piece in the course of installation, and clutch means operable to permit the stress balancing means to be in static engagement with said accessible side while permitting rotation of the head in an installing direction by the power means and thereafter in opposite direction for axial removal of the head from the installed fastener.

The above and other features of the invention together with various novel details in construction will now be more particularly described in connection with an illustrative embodiment thereof, and with reference to the accompanying drawings in which:

FIG. 1 is a view in elevation and largely in longitudinal section of a blind nut setting tool, its handle and power source (such as an electric motor) being omitted, and showing a nut being initially inserted through a work piece hole wherein the nut is to be secured;

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FIG. 1A is a plan view of the collar type nut shown in FIG. 1, it being noted that other threaded fasteners not shown, and collar nuts having different configuration as illustrated in other figures, may be mounted by similar operation of the tool;

FIG. 2 is an enlarged detail view of the inserting head shown in FIG. 1 while passing a nut endwise through a mounting hole;

FIG. 3 is a view showing the relative positions of tool parts shown in FIG. 1 and at a later stage of the installation;

FIG. 4 is a view in elevation corresponding to FIG. 1 but at a later stage in the operating cycle; and

FIG. 5 is a section illustrating the fastener with its collar securely inserted and the tool withdrawn.

The illustrative tool has an output shaft 10 (FIGS. 1 and 4) of suitable power source, for instance a reversible electric motor not shown. The shaft 10 operating through a conventional torque or slip clutch 12 adapted to slip at predetermined load rotatably drives in either direction a shaft extension 14 as directed by operator control. A hollow end of the extension 14 axially receives a detachable shank of a fastener inserting head generally designated 16 and shown enlarged in FIG. 2. By mounting a pivot pin 18 (FIG. 1) in any selected one of three transverse bores 20, formed in the shank of the head 16, the latter may be adjusted axially with respect to stress balancing means generally designated 22 next to be described and the tool adapted for operation on structures of different thickness.

The force balancing means 22 comprises a collar 24 on the head 16 bored to receive the opposite ends of the pin 18, a work-engageable pressure cap 26, and a ball bearing 28 having retaining rings 30, 32, the ring 30 engaging an end face of the collar 24, and the ring 32 being nested in an internal shoulder formed on the cap 26. It will be appreciated that the pin 18 acts to transmit torque between the inserting head 16 and the collar 24. For this purpose the collar 24 is releasably secured to the shaft extension 14 for rotation therewith by a setscrew 34 (FIGS. 1 and 4), and the pressure cap 26 is freely mounted for independent rotation on an annular flange 36 of the collar 24 by a plurality of pivot screws 38 the stems of which protrude inwardly to constrain the flange 36 against bearing ring 30. The construction accordingly is such that, when the pressure cap comes to rest in endwise engagement with a work piece W in the course of securing a collar 42 of a nut N in an aperture 40, axial pressure from the engagement is transmitted through the bearing 28, but the shaft extension 14 may be continuously rotated by the drive shaft 10 and the clutch 12 for purposes of nut installation as hereinafter noted.

The ring 30 also serves to retain the pin 18 in assembled relation with the inserting head 16, a free end of which projects beyond the cap 26. Demountable heads 16 respectively having shanks with different types or sizes of threads 44 as appropriate to the mating threads of particular fasteners N to be mounted may be employed, the diameters of the unthreaded or mounting portions of the shanks remaining constant. By means of a pin 46 (FIGS. 1-4) in the projecting end of the shank of the head 16, a draw bolt 48 may pivotally and threadedly carry the nut N to be installed. For enabling this nut to be thrust by the tool through the aperture 40 from one side of the work piece W, as shown in FIG. 1, the shank of the head 16 is longitudinally recessed on opposite sides as shown at 50, 52 (FIG. 2) leaving a narrow threaded portion 54 formed with threads which gradually are peripherally extended to merge or become continuous with full threads of the shank. The length of the recess 50 should be at least equal to the thickness of the work piece at its aperture 40. It will be understood that the

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threads of the bolt 48 correspond with, and in effect are continuous with, the shank threads of a given inserting head 16. Also it will be apparent, as shown in FIG. 1A, that the blind nut being installed endwise and to be mounted with its collar 42 secured in the aperture, has a base portion 56 with a dimension adequate, when the nut is pivoted to its position shown in FIG. 3, to span the aperture 40 and enable the base portion of the nut to abut the inaccessible side of the work piece. Diametrically opposed recesses 58, 58 (FIG. 2) in the inner end of the bolt 48 provide clearance for a semi-circular end portion of the head shank centrally receiving the pivot pin 46. Accordingly it is important in manufacture to insure that the diminishing threads on the draw bolt, which are shortest in the vicinity of the pin 46, be spaced in exact continuation of those on the portion 54.

Having thrust a tool-mounted nut N through the aperture 40 as shown in FIGS. 1 and 2, the bolt is rotated by the shaft 10 to tilt the nut and the bolt to the position shown in FIG. 3. Now the tool can be retracted bodily to cause the collar 42 of the nut to engage the margin of the aperture 40. This margin and the collar 42 will preferably have sizes and shapes facilitating their interengagement. When friction between the collar 42 and the work piece W prevents further rotation of the nut N, the rotating head 16 threads its draw bolt 48 and its portion 54 axially through the nut until the fully threaded shank portion is in 360° threaded engagement therewith as shown in FIG. 4 whereupon the end face of the pressure cap 26 engages the work piece W. Since the head 16 now can be no further moved axially in the tool, it exerts axial inserting pull on the nut N by the continued rotation of the fully threaded shank portion of the head thus forcibly setting the collar 42 into the aperture 40 and, if necessary, elastically or plastically deforming the work piece W. Axial seating of the collar 42 can be continued until the body portion 56 abuts the wall structure as shown in FIG. 4 whereupon the clutch 12 will automatically slip and the drive motor may ineffectually rotate the input shaft 10. By now reversing rotation of the shaft 10, the head 16 may be unthreaded and axially withdrawn from the mounted nut N.

Focusing again on the operation of the axial stress balancing means 22, in the course of installing the nut collar 42 the head 16 transmits through the pin 18 to the collar 24 both a torque and a substantial axial pull in one direction. At the same time this pull is substantially balanced or countered by oppositely acting force exerted on the cap 26, the opposed axial forces being absorbed by the bearing 28 and hence relieving the drive shaft 10 of axial thrust. This is particularly desirable since economical motor drives are not normally adapted to absorb such stress. Moreover, axial pull on the nut N is minimal as the head 16 is rotatably withdrawn and hence there is little tendency to unseat the nut in the work piece W. A further advantage of the construction described is that since the pressure cap 26 comes to rest on engaging the nut mounting structure, the latter will not be marred.

In reversely rotating the head 16 to retract it from the installed nut, it is probable that the asymmetric centrifugal forces will tend to cause the rotating draw bolt 48 to move from its axial position shown in FIG. 4 to one disposed transversely of the axis of the head 16. Such positioning would clamp the draw bolt in the nut and incur damage. However, the danger of this is minimized if not avoided by reason of the tapering recesses 58, 58 permitting increasing threaded engagement of the draw bolt threads so as to effect an axial aligning movement

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of the bolt. Only when the bolt 48 has been aligned to some extent by the recesses 58 do the shorter threads of the bolt engage the threads of the nut. The lengthening threads of the bolt completely align it axially so that its full threads can be readily drawn through the nut.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A power tool for inserting blind collar nuts in apertures of work pieces comprising a rotatably reversible input shaft, means for driving said shaft with torque not to exceed a predetermined value, an inserting head operatively connected to the shaft and including a cylindrical, threaded shank one portion of which is reduced in diameter and projects with threads which are in continuation of those on the cylindrical shank, a pivot pin in an end of the reduced, projecting portion of the shank, and a draw bolt pivotally supported on said pin and having a cylindrical portion for threadably receiving a collar nut to be mounted and a tapered portion carrying threads diminishing peripherally toward the pin but in continuation of those on said shank, a thrust bearing coaxial with the inserting head, and a member mounted on the bearing for free rotation coaxially of the shaft and having a face engageable with the work piece about its aperture when the inserting head is rotatably retracted relatively to the nut to pull its collar into said aperture.

2. In a pull-to-set type tool for installing a threaded blind collar nut through a hole in a work piece, an externally threaded inserting head having means for pivotally supporting the fastener during the insertion thereof through the work piece hole, power means for reversibly rotating said inserting head as it is threaded axially through the nut in the work piece hole, a slip clutch operatively connected between the power means and the inserting head, and an axial stress balancing means operatively connected with said head and in engagement with the access side of the work piece during operation of the tool to install a nut, said stress balancing means and said head being so connected that said stress balancing means remains in static engagement with the work piece during rotation of said head by said power means in a direction to install the nut, while rotation of said head by said power means in an opposite direction is effective to remove said head from the fastener and disengage said stress balancing means from the work piece.

3. A tool as set forth in claim 2 wherein the axial stress balancing means comprises a member secured to the head for rotation therewith, a pressure cap freely rotatable on the member and engageable with the work piece, and a bearing interposed between the member and the cap for absorbing axial thrust.

4. A tool as set forth in claim 3 wherein the member is a collar secured to the head and is formed with an external annular flange, and the cap is rotatably supported on said flange, the collar and the cap being respectively engageable with a ball retainer of the bearing.

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