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3,024,682

TOOL ATTACHMENT HAVING AN ADJUSTABLE TORQUE RELEASE

Filed Aug. 29, 1960

2 Sheets-Sheet 1

FIG. 1.

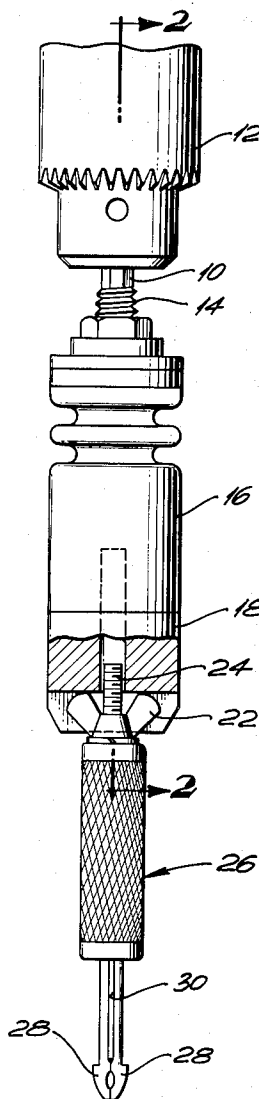


FIG. 2.

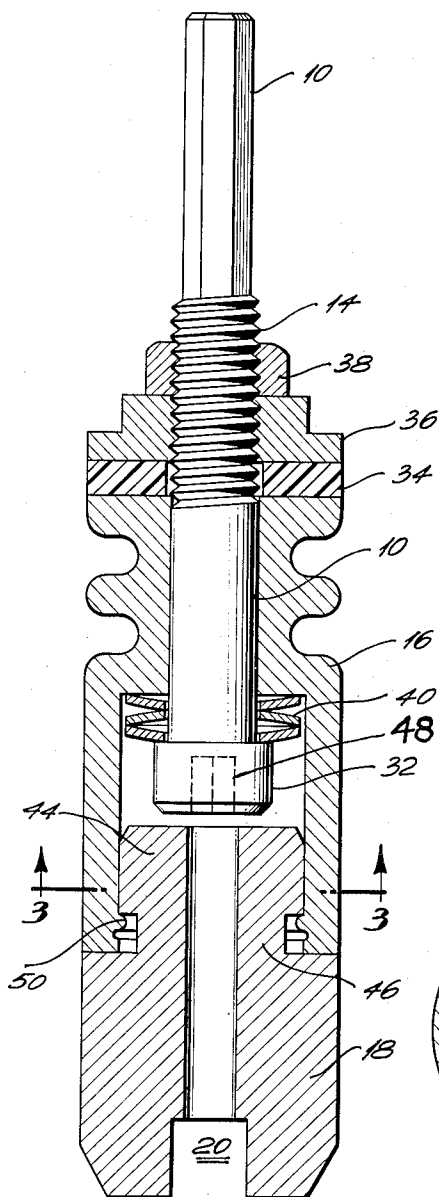
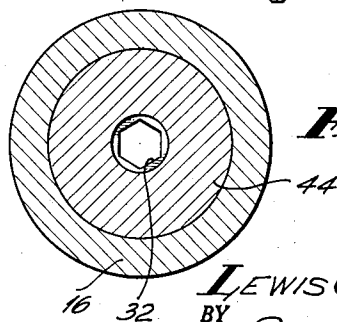


FIG. 3.



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FIG. 5.

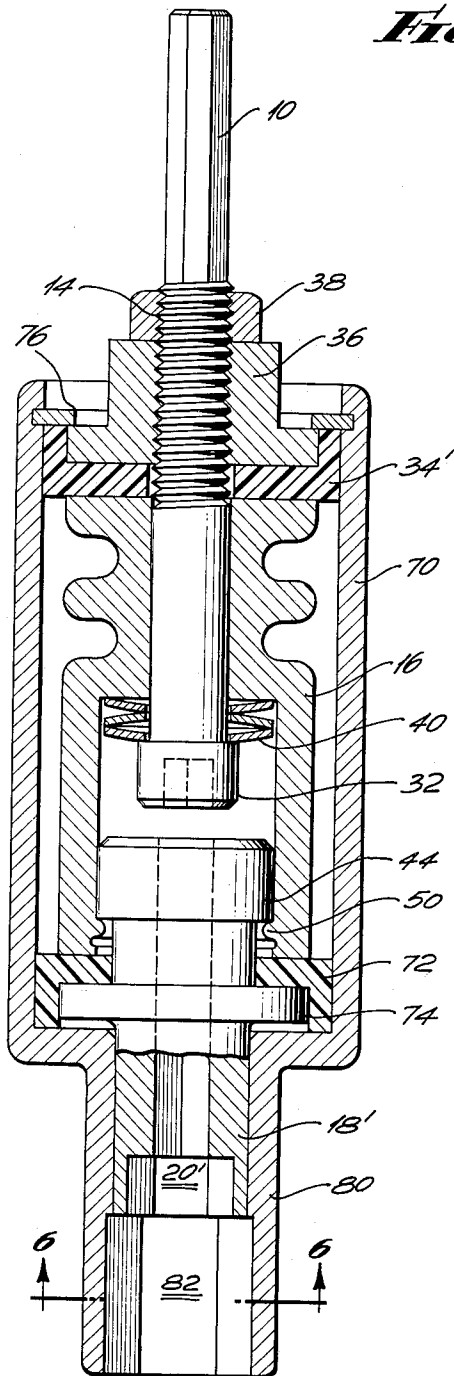


FIG. 4.

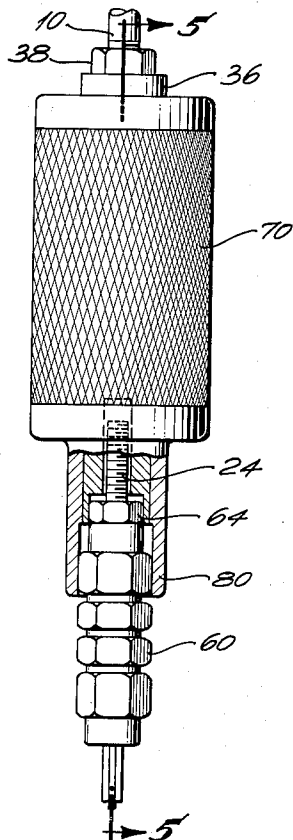
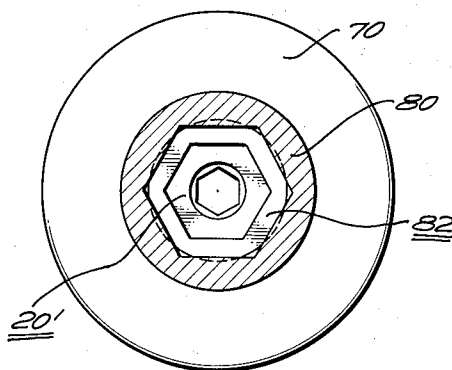


FIG. 6.



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3,024,682 TOOL ATTACHMENT HAVING AN ADJUSTABLE TORQUE RELEASE

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8 Claims. (Cl. 81—52.4)

The present invention relates to an improved tool or attachment which may be used as a nut runner for tightening nuts and the like; with a preset maximum torque being applied to the nut so as to prevent damage to the workpiece or to the fastening elements with which the attachment may be used.

There are presently available temporary fasteners which are capable of firmly locking together two or more sheets of metal, or other material. These temporary fasteners extend through holes in the sheets, and they ensure perfect alignment of riveting holes so as to facilitate rapid and accurate assembly and fabrication. One type of fastener for this purpose includes a pair of formed wires and these wires are inserted down through the corresponding hole in each of the metal sheets. A wing-nut may be provided on the fastener, for example, and the wing nut is turned to draw the wires upwardly. A spreader forces the wires apart causing them to grip the edges of the holes in the sheet to lock the sheets tightly together.

Another type of temporary fastener, also presently available, includes a body having a hexagonal configuration to receive a wrench which serves to hold the body from turning, and which includes a second hexagonal nut which when turned causes the formed wires to move upwardly.

The embodiments of the present invention which are illustrated herein, and which will be described in detail, are particularly suited for use with the types of temporary fasteners described in the preceding paragraphs. However, it will become evident as the description proceeds that the invention has general utility.

As mentioned above, the nut runner attachment of the present invention is well suited for use with fasteners of the type described in the preceding paragraphs. When so used, the maximum torque to be applied to the nuts of the fasteners is preset in the attachment itself. In each instance, a driver member included in the attachment is set over the nut of the temporary fastener, and also over the body portion in the case of the second type of fastener, and a drive shaft in the attachment is then driven until the nut is tightened to a predetermined tightness, at which point slippage occurs in the attachment. This action assures that excessive torque will not be applied to the nuts of the temporary fasteners, which would cause the heads of the formed wires to be pulled through the sheets of material, or otherwise damage the material or the fasteners.

When the tool of the present invention is used in the particular environment described in the preceding paragraphs, it has been found that the temporary fasteners can be installed in any particular workpiece with a time saving of the order of 10:1, for example. In addition, it has been found that when tools constructed in accordance with the concepts of the present invention are used, the incidence of damaged parts is materially decreased.

Although well suited for the application described above, the improved attachment of the present invention, as noted, is not limited in its use to temporary fasteners of the above described type. Indeed, the fastener can be used in any application in which a turning moment is to be applied to a particular element,

but in which the maximum torque to be applied to the element must not exceed a predetermined maximum. In fact, the driver head of the attachment of the invention may be shaped, not only to receive any nut configuration, but also to serve as a screw driver for either slotted or Phillips type screws, for example, or to mount drills, and so on.

It is, accordingly, an object of the present invention to provide an improved nut runner attachment, and the like, which is capable of exerting a torque upon a particular element, and which exhibits slippage when the exerted torque reaches a particular threshold so that the exerted torque cannot exceed that threshold.

A further object of the invention is to provide such an attachment which is constructed to be readily adjustable so that the slippage threshold can be pre-set at any desired level.

Yet another object of the invention is to provide such an improved attachment which can conveniently be mounted in the chuck of a hand drill, or of an electric drill press, for manual or automatic operation. It should be pointed out that in the latter respect, and unlike the prior art arrangement, the attachment of the invention does not require a special motor with internal expensive clutching mechanisms.

A still further object of the invention is to provide such an improved attachment which is relatively light in weight, inexpensive, smooth and noiseless in its operation, and which can be conveniently set to any particular torque threshold for slippage. This latter setting may easily be made, for example, by a usual torque wrench.

In the drawings:

FIGURE 1 is a side elevational view, partly in section, of one embodiment of the improved nut runner attachment of the present invention, the attachment being illustrated as mounted in a drill chuck, and as being used to tighten the wing-nut of a temporary fastener of the type referred to above;

FIGURE 2 is a sectional view substantially on the line 2—2 of FIGURE 1, and on an enlarged scale with respect to the view of FIGURE 1, the latter view illustrating the internal components of the embodiment of FIGURE 1;

FIGURE 3 is a cross-sectional view of the embodiment of the invention shown in FIGURE 2, taken substantially on the line 3—3;

FIGURE 4 is an elevational view, partly in section, of a second embodiment of the invention, the latter embodiment also being shown as used in conjunction with a temporary fastener of the type mentioned previously, the temporary fastener being of a type in which the body portion thereof may be held against rotation;

FIGURE 5 is a sectional view taken along the lines 5—5 in FIGURE 4, and on an enlarged scale with respect to the view of FIGURE 4; and

FIGURE 6 is a cross-sectional view of the assembly of FIGURE 5, taken substantially on the lines 6—6 in FIGURE 5.

The embodiment of the invention shown in FIGURES 1—3 includes a shaft 10. This shaft has a hexagonal (or round) configuration to enable it conveniently to be engaged by a chuck 12 of a hand drill, or of an electrically driven drill press. The shaft 10 has an intermediate threaded portion 14. A cylindrical shaped body portion 16 is rotatably mounted on the shaft 10 adjacent the threaded portion 14. A nut driver member 18 is mounted on the body member 16 in coaxial relationship with the body member to be rotated thereby.

The nut driver member 18 has an opening 20 terminating in a slot 21 at its forward end, and these recesses receive the nut 22 and the stud 24, for example, of a temporary fastener 26. As the nut driver 18 is rotated,

the wing-nut 22 is rotated on its stud 24. The temporary fastener 26 may be of the type described above, and may be used for the above described purpose. The fastener includes a pair of formed wires 28 and a spreader 30. When the wing-nut 22 is rotated, it causes the formed wires 28 to be drawn into the fastener and spread so the heads of the wires lock against the sides of the holes in the plates to be held by them.

The cylindrical-shaped body portion 16 of the attachment has a closed end through which the shaft 10 extends, and it has an open end. The body member 16 defines a recess or chamber, and the shaft 10 has a head 32 mounted on one end of the shaft and positioned in the chamber. The shaft 10 may, for example, be made from a socket head cap screw having a socket 48 slightly smaller than opening 20. A slip-clutch disc, or washer, 34 is rotatably mounted on the shaft 10 adjacent the closed end of the body member 16. This disc may be composed, for example, of Teflon, which is a material sold by the Du Pont Company of Delaware, under that trade name; alternately, the disc 34 may be composed of nylon. The dimensions of the disc 34 may, for example, be $\frac{3}{32}$ by 1 inch O.D. by .312 inch I.D. A clutch plate 36 is threaded to the threaded portion 14 of the shaft 10 adjacent the side of the slip-clutch disc 34 remote from the body member 16.

A jamb nut 38 is also threaded to the threaded portion 14 of the shaft to lock the clutch plate 36. The nut 38 may be a $\frac{3}{16}$ -18 hexagonal jamb nut. A resilient member 40 is mounted on the shaft 10 between the head 32 and the closed end of the chamber formed by the body member 16. This resilient member may, for example, be a leaf-type of compression clutch spring. The resilient member 40 serves to bias the end of the body member 16 against the disc 34, and to bias the disc 34 against the clutch plate 36.

The nut driver 18, or head portion of the attachment, is mounted in the open end of the body portion 16 to be rotatably driven by the body portion, as described above. As also described, the nut driver includes a slot 21 which can receive the wing-nut 22 of the temporary fastener 26, and an opening 20 which can receive the stud 24 on which the wing-nut is threaded.

The nut driver 18 has a head portion 44 which is formed integral with the remaining part of the nut driver, and which is joined to the remaining part by a neck section 46 of reduced diameter. The head portion 44 may have a beveled end, and it is forced into the chamber formed by the body member 16 through the open end of the body member in a press fit. The peripheral surface of the head portion 44 may have a longitudinally beveled surface, to firmly mount the nut driver 18 in the body 16 for rotational driving motion of the nut driver by the body member. The inner peripheral surface of the body member may be upset adjacent the open end thereof to form an annular, inwardly extending knurl or ridge 50, this ridge serving to retain the nut driver 18 in the open end of the body member 16. The above described manner of attaching the nut driver 18 to the body member 16 represents but one possible means of attaching these members. It is apparent that any other suitable means using, for example, threads or pins can be used.

It is evident, therefore, that when the shaft 10 is inserted in the chuck 12 so that rotational motion is translated to the shaft, this motion is transmitted through the body portion 16 to the nut driver 18, so long as the clutch disc 34 is not slipping. However, when the torque exerted by the nut driver 18 reaches an established threshold, the clutch plate 36 slips with respect to the disc 34, and no additional torque can be exerted by the attachment. This torque threshold can be adjusted, merely by loosening the jamb nut 38, and by turning the shaft 10 with respect to the clutch plate 36 to increase or decrease the force exerted by the spring 40 on the clutch assembly. The socket 48 formed in the end of the shaft 10, may

receive an Allen wrench so as to permit this adjustment to be made.

The embodiment of the invention shown in FIGURES 4-6 is generally similar to the embodiment of FIGURES 1-3, and like components in the two embodiments have been designated by the same numerals.

As mentioned above, the embodiment of the invention shown in FIGURES 4-6 is intended to be used with a temporary fastener 60 of the same general type as the fastener 26 referred to above. However, the body portion of the fastener 60 is hexagonal and the latter fastener includes a further hexagonal nut 64 which replaces the wing-nut 22 of FIGURE 1.

In the latter embodiment, the slip-clutch disc is designated 34', and that disc has a peripheral skirt section which serves as a journal bearing for a tubular member 70. A further bearing member 72, which may be of the same general shape as the member 34' and which also may be composed of nylon or Teflon, is mounted on the nut driver, which in the latter instance is designated 18'. The bearing member 72 is supported on the nut driver 18' by an annular collar 74, and this collar serves to retain the bearing member 72 against the open end of the body member 16. The members 34' and 72 serve to rotatably mount the tubular member 70 in coaxial relationship with the body member 16. The tubular member 70 has a cylindrical configuration in the illustrated embodiment, and it has a knurled outer surface to permit the member to be manually grasped so as to prevent it from turning. An annular lock ring 76 engages a groove in the peripheral surface of the member 70 at the right hand end of the member in FIGURE 5. The ring 76 engages the end of the member 34' to support the tubular member 70 on the assembly.

The tubular member 70 has a holder portion 80 formed integral with it, and this holder portion extends in coaxial relationship with the nut driver 18'. The holder portion has a hexagonal shaped body-receiving recess formed in its forward end, this body-receiving recess being designated 82 and being spaced axially from the nut-and-stud-receiving recess 20' in the nut driver 18. The nut-receiving portion of the recess 20' may have a hexagonal configuration for receiving the nut 64 of the fastener 60, whereas the head-receiving recess 82 in the holder 80 may have a hexagonal configuration for receiving the body of the hexagonal fastener 60.

When the embodiment of FIGURES 4, 5 and 6 is placed in operation, the tubular member 70 may be manually grasped to prevent it, and the holder portion 80 from turning. This causes the body of the fastener 60 to be held against rotation, while its nut 64 is being rotated by the driver 18'. As in the previous embodiment, when the limiting torque is reached, slippage occurs at clutch 34' so that damage is prevented.

The invention provides, therefore, an improved attachment for use, for example, in the chuck of a hand drill or electrically driven drill press. The improved attachment of the invention is advantageous in that it can be used to impart rotational motion to any desired instrumentality, and with a torque which will not exceed a pre-set and adjustable maximum threshold. The attachment of the invention is advantageous in that it is relatively easy and inexpensive to fabricate, and in that it is relatively light in weight and easy to handle and to install.

What is claimed as new and desired to secure by Letters Patent is:

1. An attachment including: a shaft, a head for said shaft mounted at one end thereof and having a tool-engaging recess, a body member rotatably mounted on said shaft and having a longitudinal recess in a first end thereof for receiving said head, a slip-clutch means mounted on said shaft to be engaged by a second end of said body member opposite to said first end thereof, resilient means interposed between said head and said body mem-

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ber for biasing said second end of said body member against said slip-clutch means, and a tubular drive member adapted for engaging a nut mounted on said first end of said body member in coaxial relationship therewith and to be rotatably driven thereby said tubular drive member having a passageway extending longitudinally therethrough and on an axis substantially coincident with the longitudinal axis of said shaft whereby said tool-engaging recess of said head is accessible through said passageway for engagement by a tool for adjusting the tension of said resilient means.

2. An attachment including: a shaft having a threaded portion at an intermediate position thereon, a head for said shaft mounted at one end thereof and having a tool-engaging recess, a body member rotatably mounted on said shaft and having a recess extending longitudinally in a first end thereof for receiving said head, a slip-clutch member rotatably mounted on said shaft adjacent a second end of said body member opposite to said first end thereof, means including a clutch plate threadably mounted on said threaded portion of said shaft on the opposite side of said slip-clutch member from said body member, resilient means interposed between said head and said body member for biasing said second end of said body member against said slip-clutch member and said slip-clutch member against said clutch plate, and a tubular drive member mounted on said first end of said body member in coaxial relationship therewith and enclosing the recess therein and to be rotatably driven thereby said tubular drive member having a passageway extending longitudinally therethrough and on an axis substantially coincident with the longitudinal axis of said shaft whereby said tool engaging recess of said head is accessible through said passageway for engagement by a tool for adjusting the tension of said resilient means.

3. The combination defined in claim 2 and in which said resilient means comprises compression spring means coaxially mounted on said shaft between said head and said body member.

4. The combination as defined in claim 2 including a lock nut threadably mounted on said threaded portion of said shaft for engaging said clutch plate on the opposite side thereof from said clutch disc.

5. The combination defined in claim 2 and in which said slip-clutch member is composed of a compressible material normally having a low co-efficient of friction.

6. A nut runner attachment including: a shaft having a threaded portion and an intermediate portion thereon, a head for said shaft mounted at one end thereof and having a tool-engaging recess, a cylindrical-shaped body member rotatably mounted on said shaft having a closed end and an open end and defining an inner chamber, a slip-clutch disc rotatably mounted on said shaft adjacent said closed end of said body portion, a clutch plate threadably mounted on said shaft on the opposite side of said slip-clutch disc from said body member, compression spring means mounted on said shaft in coaxial relationship therewith and interposed between said head and said closed end of said body member for biasing said closed end of said body member against said slip-clutch disc and said slip-clutch disc against said clutch plate, and a tubular nut driver member having an enlarged non-circular recess at one end thereof for non-rotatably receiving a nut and a passageway extending longitudinally therethrough for receiving a stud, said nut driver member being mounted on said open end of said body member

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in coaxial relationship therewith and enclosing the chamber formed thereby and to be rotatably driven thereby, said passageway of said driver member being on an axis substantially coincident with the longitudinal axis of said shaft whereby said tool-engaging recess of said head is accessible through said passageway for engagement by a tool for rotation thereof relative to said clutch plate for adjusting the tension of said compression spring means.

7. An attachment comprising: a shaft having a tool-engaging recess, a body member rotatably mounted on said shaft, a drive member mounted on said body member to be rotatably driven thereby, slip-clutch means for coupling said body member to said shaft, a tubular member having a non-circular recess, means for mounting said tubular member on said body member for rotation therewith, and in coaxial relationship thereto, and a holder member rotatably mounted on said tubular member in coaxial relationship with said driver member and having an outer end spaced axially with respect thereto, said outer end having a longitudinal non-circular passageway extending longitudinally therethrough and substantially larger than said non-circular recess of said tubular member and in substantially coaxial relationship thereto.

8. An attachment including: a shaft having a threaded portion at an intermediate position thereon, a head for said shaft mounted at one end thereof and having a tool-engaging recess, a body member rotatably mounted on said shaft and having a longitudinal recess in a first end thereof for receiving said head, a slip-clutch member rotatably mounted on said shaft adjacent a second end of said body member opposite to said first end thereof, means including a clutch plate threadably mounted on said threaded portion of said shaft on the opposite side of said slip-clutch member from said body member, resilient means interposed between said head and said body member for biasing said second end of said body member against said slip-clutch member and said slip-clutch member against said clutch plate, a driver member mounted on said first end of said body portion in coaxial relationship therewith and enclosing the recess therein and to be rotatably driven thereby said driver member having a passageway extending longitudinally therethrough, a tubular member having a holder portion formed at one end thereof, and means for rotatably mounting said tubular member on said body member in coaxial relationship therewith and with said holder portion thereof in coaxial relationship with said driver member and spaced axially with respect thereto, said passageway of said driver member being on an axis substantially coincident with the longitudinal axis of said shaft whereby said tool-engaging recess of said head is accessible through said passageway for engagement by a tool for rotation thereof for adjusting the tension of said resilient means.

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