June 6, 1967 E. B. BURNETT ET AL 3,323,395

FASTENER DRIVING TOOL

Filed Aug. 5, 1966

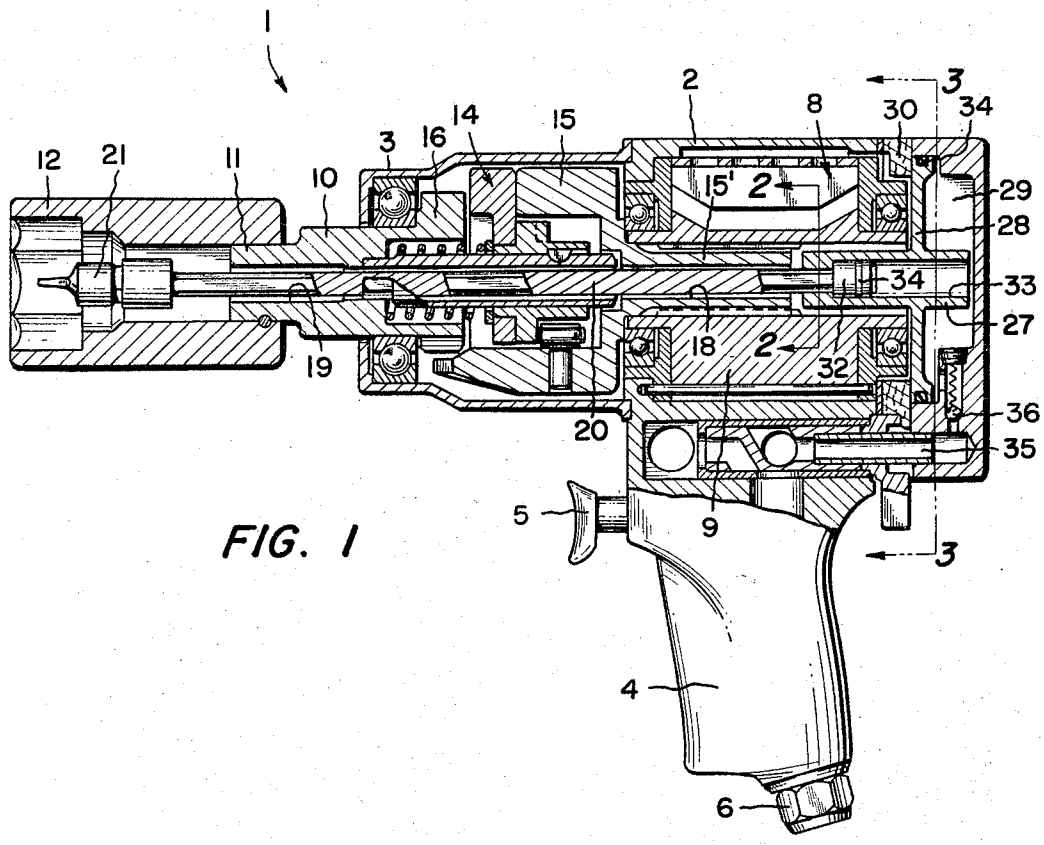


FIG. 1

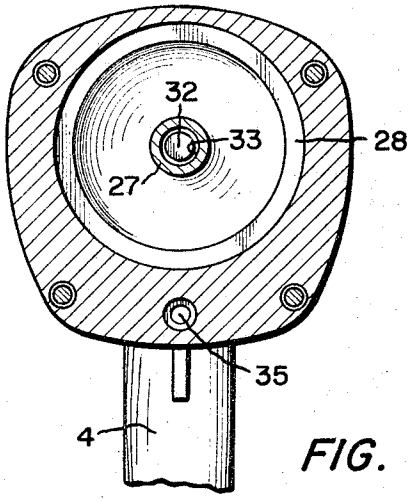


FIG. 3

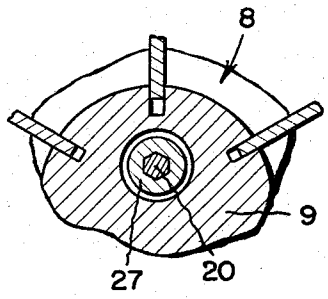


FIG. 2

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United States Patent Office 3,323,395
Patented June 6, 1967

3,323,395

FASTENER DRIVING TOOL

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Filed Aug. 5, 1966, Ser. No. 570,662
6 Claims. (Cl. 81—52.3)

This invention relates to a portable fastener driving power tool and particularly to rotary impact tools. This invention is an improvement over the U.S. application, Ser. No. 498,982, filed Oct. 20, 1965, by Kenneth R. Bangerter et al.

When using conventional tools to turn a nut onto a bolt, it is necessary for the bolt to be held or locked against turning. If the bolt is not locked rigidly to the work piece by an anchoring means, the bolt is frequently held against turning by a second workman grasping the bolt head with a wrench located on the opposite side of the work piece from the operator driving the nut. In the latter case, each bolt-tightening operation requires the services of two workmen, one holding the power tool and the other one holding a wrench grasping the bolt head.

The above noted U.S. patent application of Kenneth R. Bangerter describes a power tool which simultaneously holds a fastener against turning while tightening a nut on the fastener. The invention in this application relates to a similar type of power tool.

The principal object of this invention is to provide an improved power tool of the foregoing type.

Other important objects of this invention are: to provide a power tool of the above type which is lighter in weight and smaller in size; to provide a power tool of the above type including a fastener holding member which is yieldably urged forward by a pressure fluid; to provide a power tool of the above type having a pressure fluid actuated brake for restraining the fastener holding member against turning; and to provide a power tool of the above type having a common chamber for containing pressure fluid which simultaneously actuates the brake for the fastener holding member and yieldably urges the member forwardly.

In brief, the objects of this invention are attained in a tool including a tool casing, a drive means including a hollow drive shaft mounted in the casing, a hollow spindle mounted in the casing in axial alignment with the drive shaft for holding a wrench socket, means contained in the casing connecting the drive shaft and the spindle for torque transmission therebetween, a fastener holding member extending axially through the hollow drive shaft in the hollow spindle with its front end projecting from the spindle and provided with locking surfaces such as flats for engaging corresponding surfaces on a fastener to prevent the fastener from rotating, said holding member being slidably mounted in the spindle to enable the retraction of said member rearwardly into the spindle, fluid pressure means urging the member forwardly to cause it to normally project from the spindle, and a fluid pressure actuated brake means for restricting said member from turning relative to the casing when the torque load on the member is below a predetermined torque load.

The invention is described in connection with the accompanying drawings wherein:

FIG. 1 is an elevational view with portions being cut away and shown in section of a rotary impact tool forming an embodiment of the subject invention;

FIG. 2 is a section taken along the line 2—2 of FIG. 1; and

FIG. 3 is a section taken along the line 3—3 of FIG. 1.

The impact tool 1 shown in FIG. 1 includes a conventional tool casing 2 having a front nose 3 at its forward end and a pistol-like handle 4 near its rear end. The handle 4 is shown with a conventional throttle or trigger 5 and an inlet fitting 6 adapted to be connected to an air line (not shown) for supplying fluid pressure to the tool 1. All of the foregoing structure is conventional in air-powered portable tools.

The casing 2 contains a conventional air motor 8 having a hollow rotor 9. The tool further includes a hollow spindle 10 rotatively mounted in the casing nose 3 and having a front end provided with flats 11 adapted to receive a conventional wrench socket 12. Normally, the front end of the spindle 10 will have a square cross section for keying it in the rear end of the wrench socket 12.

The rotor 9 is interconnected to the spindle 10 by a conventional rotary impact tool mechanism 14 which includes a hammer 15 having a drive shaft 15' splined in the hollow rotor 9 and an anvil 16 fixed on the rear end of the spindle 10. Since the particular form of impact mechanism 14 forms no part of this invention, it will not be specifically described. A detailed description of the impact mechanism 14 is found in Patent No. 3,174,559, issued to J. S. Vaughn on Mar. 23, 1965.

The impact mechanism 14 contains an axial bore 18 which is axially aligned with an axial bore 19 provided in the spindle 10. An elongated fastener holding member or bar 20 is slidably mounted in the bores 18 and 19 in the impact mechanism 14 and spindle 10, as shown in FIG. 1. The front end of the bar 20 is provided with a detachable bit 21 shaped like a screwdriver tongue and adapted to fit in the kerf provided in the end of the stem of a bolt for holding the bolt against turning while a nut is tightened on the bolt. This special type of bolt is described in the earlier mentioned U.S. patent application of Kenneth R. Bangerter et al.

The rear portion of the bar 20 is slidably received in the front end of a hollow sleeve 27 and is keyed therein by having a hexagonal cross section engaging a corresponding hexagonal bore provided in the front end of the hollow sleeve 27. The hollow sleeve 27 includes an integral brake flange 28 forming its periphery and is located in a chamber 29 disposed at the rear of the motor 8. A friction disc 30 circles the tool casing immediately forward of the brake flange 28. The sleeve 27 is slidably mounted in the chamber 29 whereby the brake flange 28 can be pressed against the friction disc 30 by fluid pressure admitted to the chamber 29 behind the sleeve 27. As a result, fluid pressure in the chamber 29 forces the sleeve 27 forward until its brake flange 28 is tightly engaged with the friction disc 30 thus serving to prevent the sleeve 27 from turning under low torques. Since the sleeve 27 is keyed to the bar 20, the turning of the bar 20 is controlled by the sleeve 27.

The bar 20 is urged axially forward by a piston 32 sliding in a bore 33 in the sleeve 27. The rear end of the bore 33 opens into the chamber 29 so that fluid pressure in the chamber 29 jointly actuates the sleeve brake flange 28 and the piston 32. Both the piston 32 and the sleeve 27 carry circumferential seals 34 for reducing the leakage of fluid pressure from the chamber 29.

The chamber 29 receives fluid pressure from a motor supply passage 35 through a check valve 36 which prevents the chamber 29 from being exhausted into the passage 35 when the trigger 5 is closed. As is conventional in pneumatic wrenches, pneumatic pressure is admitted to the motor supply passage 35 by the depression of the trigger 5 and exhausted from the passage 35 when the trigger 5 is released. The details of the valve operated by the trigger 5 are conventional and are not shown in the drawings.

Operation

In operating the tool **1**, it is first manipulated to place the socket **12** over a nut which has been previously started on a special bolt located in a suitable work piece. The bolt and nut are not shown in the drawing, since they are shown in the earlier mentioned Bangerter et al. application. The threaded end of the bolt contains a screwdriver kerf. Thereafter the tool trigger **5** is operated to start the motor **8**, causing the impact tool to begin turning the socket **12**. At the same time the bit **21** of the bar **20** is pressed against the front end of the bolt stem as a result of the air pressure in the chamber **29**. As the bolt begins to turn, the kerf in the bolt stem is brought into alignment with the bit **21** which then drops into the kerf. Thereafter, as the nut is run down on the bolt, the bolt is held against rotating by the bar **20** which restrains it by means of yieldable brake composed of the brake flange **28**, the friction disc **30** and the air pressure in the chamber **29** holding the sleeve **27** against the friction disc **30**.

Ultimately, the run-down phase of the bolt turning operation comes to an end, and the nut is tightened on the bolt by a series of impact blows. As the torque load on the bolt-holding member **20** rises, it is arranged to rotate relative to the tool casing **2** by the slipping of the brake flange **28** at the rear end of the tool. In many cases, the member **20** will not slip because the bolt is sufficiently tight in the work piece for it to anchor itself without applying sufficient torque to the bar **20** to cause it to slip in the tool casing. As the nut is run down and the bolt stem projects progressively into the depth of the socket **12**, the bar **20** is forced rearwardly in the tool casing. This rearward movement is provided by the bar **20** slipping and retracting into the hollow sleeve **27**.

After the operator stops the tool **1** by releasing the trigger **5**, air pressure remains in the chamber **29** for a substantial time due to the check valve **36** sealing the chamber **29** from the motor supply passage **35**. Accordingly the yieldable force on the piston **32** urging the bar **20** forward continues to exist while the operator is placing the tool over another fastener.

Although a single embodiment of the invention is illustrated and described in detail, it will be understood that the invention is not limited simply to this embodiment, but contemplates other embodiments and variations which utilize the concepts and teachings of this invention.

Having described our invention, we claim:

1. A rotary power tool comprising:

a tool casing;

drive means including a hollow drive shaft mounted in said casing;

a hollow spindle mounted in said casing in axial alignment with said drive shaft for holding a wrench socket;

a mechanism contained in said casing interconnecting said drive shaft and said spindle for transmitting torque to said spindle;

a fastener holding member extending axially through said hollow drive shaft and said hollow spindle;

said member having its front end projecting from said spindle and provided with means for engaging a fastener to prevent the fastener from rotating relative to said member;

said member being slidably mounted in said spindle to enable the retraction of said member rearwardly into said spindle;

fluid pressure means urging said member forwardly to cause it to normally project from said spindle; and

yieldable means connecting said member to said casing for restricting said member from turning relative to said casing when the torque load on said member is below a predetermined torque load.

2. The rotary power tool of claim **1** wherein:

said yieldable means includes a friction brake actuated by fluid pressure which allows said member to rotate relative to said casing when the torque load on said member rises to said predetermined torque load.

3. The rotary power tool of claim **2** wherein:

said fluid pressure means for urging said member forwardly includes a piston engaging said member and acted on by fluid pressure.

4. The rotary power tool of claim **3** including:

a chamber in said tool casing containing both said piston and said friction brake means and adapted to receive fluid pressure from a fluid pressure line for acting simultaneously on both said friction brake and said piston.

5. The rotary power tool of claim **4** including:

a check valve interconnecting said chamber to said fluid pressure line and arranged to prevent fluid pressure from flowing from said chamber into said fluid pressure line when said fluid pressure line is exhausted.

6. The rotary power tool of claim **1** wherein:

said mechanism is an impact mechanism for delivering a series of rotary impacts to said spindle.

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