July 8, 1969 R. G. MOORES, JR 3,454,284

BIT RETAINER FOR IMPACT TOOLS

Filed Sept. 14, 1966

FIG. 1

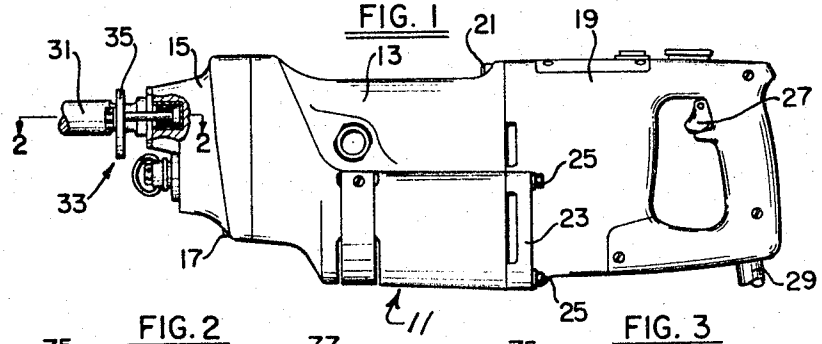


FIG. 2

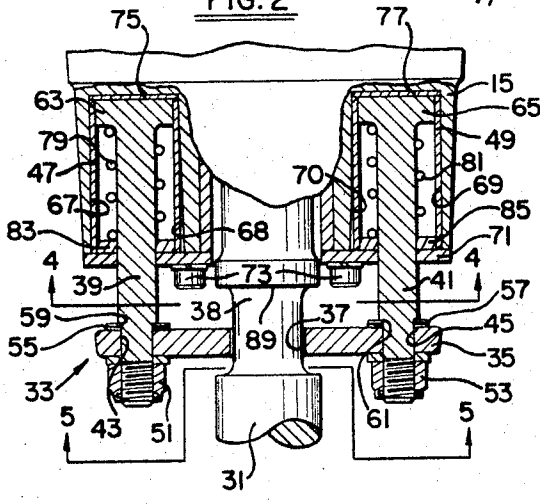


FIG. 3

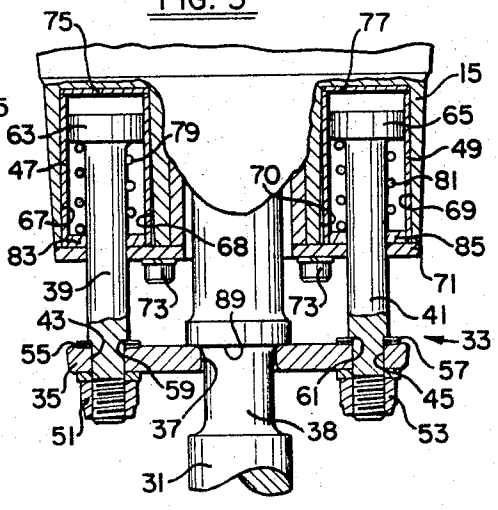


FIG. 5

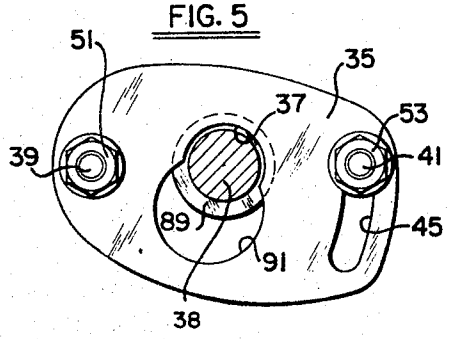


FIG. 4

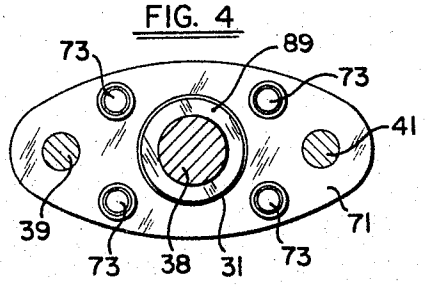
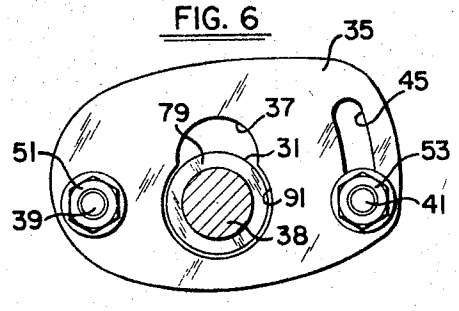


FIG. 6



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BIT RETAINER FOR IMPACT TOOLS

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U.S. Cl. 279—19.1 7 Claims

ABSTRACT OF THE DISCLOSURE

The device disclosed herein is a portable, power operated rotary hammer adapted to impart rotation and longitudinal reciprocation to a tool bit. A novel bit retainer construction is provided to prevent the bit from pulling out of the tool and prevent unintended tool bit and retainer recycling or flutter.

This invention relates generally to power tools, and particularly to an improved bit retainer assembly for impact tools.

Important objects of the present invention are to provide an improved retainer assembly for use with impact tools which is adapted to cushion both forward and return movement of the retainer when struck by the tool bit to thereby prevent unintended tool bit and retainer recycling or flutter.

Additional objects of the present invention are to provide a tool bit retainer assembly of the above character which facilitates ready assembly and disassembly from its mounting as well as tool bit removal and replacement.

Further objects include the provision of a tool retainer assembly of the above character which is relatively inexpensive to manufacture, rugged in construction and reliable in use.

Other objects and advantages of the present invention will become more apparent from a consideration of the following detailed description taken in conjunction with the drawings in which:

FIGURE 1 is a side elevational view, partly in section, illustrating an impact tool embodying the present invention;

FIGURE 2 is an enlarged sectional view of FIGURE 1 taken along the line 2—2 thereof and showing the parts in a retracted position;

FIGURE 3 is a view similar to FIGURE 2 showing the parts in an extended position;

FIGURE 4 is a sectional view of FIGURE 2 taken along the line 4—4 thereof;

FIGURE 5 is a sectional view of FIGURE 2 taken along the line 5—5 thereof showing the retainer plate positioned for normal tool bit use; and

FIGURE 6 is a view similar to FIGURE 5 showing the retainer plate positioned for tool withdrawal.

Broadly described, the present invention includes, in a power operated rotary tool, a housing, a reciprocable tool bit extending outwardly of said housing, retainer plate means embracing said tool bit, means supporting said retainer plate upon said housing for movement toward and away from said housing, said supporting means including closed cylinder means having piston means slidably disposed wholly therewithin, said piston and closed cylinder means movable relative to each other in a direction parallel to the path of movement of said tool bit, said piston means including rod means extending slidably through one end of said closed cylinder means and adapted to displace air within said cylinder means during movement relative thereto in both directions, one of said piston and closed cylinder means being fixed to said retainer plate means and the other being fixed to said housing and means normally biasing said retainer plate means toward said housing.

Referring now more particularly to the drawings, a rotary hammer, which is one type of tool with which the retainer assembly of the present invention finds use, is illustrated generally at 11 in FIGURE 1. The rotary hammer 11 is seen to include a case housing 13 having an end housing 15 secured thereto by screws 17. An end handle and gear case 19 is fixed to the case housing 13 by screws 21 and has lateral flanges 23 (only one of which is shown) fixed to the case housing 13 by screws 25. The handle and gear case 19 has a conventional trigger switch 27 and line cord 29, and the handle 19 together with the housings 13, 17 may be constructed from a die cast aluminum alloy or molded using a suitable glass fiber material as is customary in the art.

The rotary hammer is provided with a suitable power source, for example, an electric motor (not shown), positioned within the case housing 13 which is adapted to impart longitudinal reciprocating movement to a tool bit 31, and, in the case of a rotary hammer, rotation about its longitudinal axis as well. Thus, the electric motor (not shown) may have field windings and a rotating armature connected to a piston and floating ram by a gear and crank transmission to reciprocate the piston and ram and hammer on the tool bit 31. For example, a construction of this type is illustrated and described in detail in U.S. Patent No. 3,203,490, granted Aug. 31, 1965 to G. W. McCarty et al. and owned by the assignee of the present application and for a better understanding thereof reference may be made thereto.

As described above, the tool bit 31 may be rotated about its longitudinal axis. To this end the electric motor armature (not shown) has an armature shaft (not shown) drivingly interconnected with the tool bit 31 through a transmission (not shown).

The tool bit 31 is adapted for rotation upon energization of the electric motor (not shown) or other power source by being keyed to a gear or shaft rotated by the power source. For example, the tool bit 31 may have an integral hexagonal shank slidably received in a complimentary hexagonal socket opening in a driven gear supported within the end housing 15 as illustrated and described in the McCarty et al. patent referred to above. In addition, if desired, a slip clutch device may be integrated with the transmission to prevent undue shock and possible injury to the tool operator and/or the transmission components.

In impact tools of this type, one of the problem areas lies in controlling movement of the tool bit 31 should the bit be withdrawn from contact with the work before the tool is turned off. It is customary in the art to provide a spring loaded bit retainer for preventing the tool bit from pulling out of the tool housing. The bit normally operates free from contact with the retainer; but if the bit is withdrawn from the work, an abutment on the bit strikes the retainer and prevents the bit from flying out of the housing. When the bit abutment strikes the retainer, the bit and retainer move together until loading of the retainer springs overcomes the inertia force of the bit and returns the bit back into the tool housing and the retainer to its normal retracted position. If desired, the tool operating ram is caught and held by a collet within the housing if the bit is allowed to move outwardly sufficiently far to strike the retainer. In the past, the retracting action of the retainer springs was unimpeded so that if the ram struck the bit with sufficient force on a stroke after the bit was withdrawn from the work, the loaded retainer springs threw the bit back into the tool housing to knock

the ram from its collet. The ram then strikes the piston and rebounds against the tool bit causing it to recycle and strike the retainer. This, in turn, causes the retainer and its springs to vibrate or "flutter" with reinforced vibration all of which results in premature spring failure.

In addition to these vibrational stresses, the retainer springs are subject to high shock forces during initial contact between the tool bit and the retainer plate which also, if left uncontrolled, results in premature spring failure.

According to the present invention, the aforementioned problems have been obviated by providing a novel retainer assembly which employs a mechanical spring return integrated with an air spring construction functioning conjointly both to absorb the primary shock imposed on the retainer by the tool bit **31** during initial striking contact therebetween as well as to cushion return movement of the retainer and tool bit **31** to prevent recycling of the parts after power source deenergization as described above.

Turning now to FIGURES 2–6, the retainer assembly is shown generally at **33** and is seen to include a retainer plate **35** provided with a central opening **37** embracing a reduced diameter portion **38** of the tool bit **31**. The relative diameters and axial lengths of the plate opening **37** and the tool bit portion **38** allows free rotation of the tool bit **31** and axial hammering reciprocation thereof when the bit is engaged with work without moving the retainer plate **35**.

The retainer plate **35** is supported from the end housing **15** by a pair of retainer rods **39, 41** having their outer ends extending through an opening **43** and an arcuately elongated slot **45** in the plate **35** and the rod inner ends are slidable in sleeve-like cylinders **47, 49**, respectively, in the end housing **15**. The outer ends of the rods **39, 41** are threaded and receive retaining nuts **51, 53**. A pair of opposed Belleville washers **55, 57** are positioned between the plate **35** and shoulders **59, 61** on the rods **39, 41**, respectively, and the plate **35** is held against each pair of washers **55, 57** by the nuts **51, 53**.

The inner ends of the retainer rods **39, 41** are fashioned after pistons having enlarged heads **63, 65** slidably received in the sleeve cylinders **47, 49**, respectively. The sleeve cylinders **47, 49** in turn are positioned in bores **67, 69** formed in the outer end of the end housing **15**, which bores may be tapered at their outer ends at **68, 70** to facilitate easy insertion and removal of the sleeve cylinders **47, 49**. These sleeve cylinders are held in place by a cover plate **71** fixed to the end housing **15** by screws **73**, which plate also serves to substantially close the outer ends of the sleeve cylinders **47, 49**. The retainer rods **39, 41** are normally retracted within the sleeve cylinders **47, 49** and seated against wafer-like seals **75, 77** by compression springs **79, 81** caged between the enlarged heads **63, 65** and retainer rod guides **83, 85**, respectively.

In use, the tool bit **31** is hammered on by the reciprocating ram (not shown) with tool bit positioned substantially as shown in FIGURE 2. Tool bit **31** is reciprocated longitudinally with a relatively small amplitude and when engaged with the work does not contact the retainer plate **35**. When the hammer is retracted from work, however, the tool bit **31** can move longitudinally forward by force of gravity or, as is more likely, the force of the last blow struck by the reciprocating ram. The tool bit **31** initially travels substantially free of movement of the retainer plate **35** even after the hammer is retracted from the work owing to the fact that the tool bit reduced diameter portion **38** has a substantially greater axial length than the thickness of the retainer plate **35**. However, when a shoulder **79** at the inner end of the reduced diameter portion **38** of the tool bit **31** strikes the retainer plate **35**, the latter thereafter moves with the tool bit **31** to substantially the position shown in FIGURE 3 and compresses the springs **79, 81**. By this time the ram has contacted a split steel collet (not shown) which is provided to resiliently hold the ram stopping the hammering action thereof until operator pressure on the bit **31** forces ram out of the holding collet and allows reciprocation of ram to resume. When the force of the loaded compression springs **79, 81** is sufficient to overcome the inertia force of the traveling bit **31**, the springs retract the retainer plate **35** until the enlarged piston-like portions **63, 65** of the rods **39, 41** bottom in the cylinder sleeves **47, 49** as shown in FIGURE 2.

It will be appreciated that when the retainer rods **39, 41** move from the FIGURE 2 position upon the retainer plate **35** being engaged by the bit shoulder **89**, a volume of air, which is a function of the cross-sectional area of the heads **63, 65** less the cross-sectional area of the rods **39, 41**, is displaced. This displaced air leaks past the heads **63, 65** and serves to cushion and absorb the primary shock caused by the bit shoulder **89** striking the retainer plate **35** so that the mechanical springs **79, 81** are not subjected to these severe forces.

When the tool bit and retainer plate **35** begin their retracting movement, a volume of air, which is a function of the cross-sectional area of the rod heads **63, 65**, is displaced thereby and leaks back past these heads **63, 65**. This prevents the energy of the compression loaded springs **79, 81** from throwing the tool bit **31** back against the ram and causing recycling and reinforced vibration fluttering of the retainer plate **35**. This, in turn, alleviates severe stresses on the mechanical springs **79, 81** and prevents premature failure thereof as described above.

Although the component sizes and spring strengths for the retainer assembly of the present invention can vary from one installation to another, in one particular practical application, given for purposes of illustration only, very satisfactory results have been achieved using mechanical springs **79, 81** having a compressive force of about 20 lbs. per inch and constructing the retainer rods **39, 41** so that their heads **63, 65** each has a total cross-sectional area of about 0.440 sq. in. and a differential cross-sectional area of about 0.330 sq. in. and wherein the clearance between the heads **63, 65** and the sleeve cylinders **47, 49** is from about 0.001 to about 0.002 in.

To remove the tool bit **31**, the retainer plate **35** must be moved from the position shown in FIGURE 5 to the position shown in FIGURE 6. The retainer plate **35** is frictionally held in position by the Belleville spring washers **55, 57** but a suitable blow with a soft hammer or similar means will change the retainer plate position. In the latter position, the tool bit **31** is positioned in a somewhat larger opening **91** than the opening **37** and which is larger than the diameter of the tool bit shoulder **89**. In this position of the parts, the tool bit **31** is easily removable and replaceable and does not necessitate dismantling or removing the retainer plate.

By the foregoing, there has been disclosed an improved impact tool retainer assembly calculated to fulfill the inventive objects hereinabove set forth, and while a preferred embodiment of the present invention has been illustrated and described in detail, various additions, substitutions, modifications and omissions may be made thereto without departing from the spirit of the invention as encompassed by the appended claims.

I claim:

1. In a power operated rotary tool, a housing, a reciprocable tool bit extending outwardly of said housing, retainer plate means embracing said tool bit, means supporting said retainer plate means upon said housing for movement toward and away from said housing, said supporting means including closed cylinder means having piston means slidably disposed wholly therewithin, said piston and closed cylinder means movable relative to each other in a direction parallel to the path of movement of said tool bit, said piston means including rod means extending slidably through one end of said closed cylinder means and adapted to displace air within said cylinder means during movement relative thereto in both directions, one

of said piston and closed cylinder means being fixed to said retainer plate means and the other being fixed to said housing, and means normally biasing said retainer plate means toward said housing.

2. A device as defined in claim 1 wherein said piston means is fixed to said plate means and said closed cylinder means is carried by said housing.

3. A device as defined in claim 1 wherein said piston and closed cylinder means includes a pair of slidably disposed piston and closed cylinder means, one on either side of said tool bit.

4. A device as defined in claim 1 wherein said biasing means includes spring means disposed within said closed cylinder means and engaging said piston means.

5. A device as defined in claim 2 wherein said closed cylinder means includes cylindrical sleeve means disposed in an opening in said housing and said piston means includes rod means fixed to said retainer plate and having an enlarged head slidable in said cylindrical sleeve means.

6. A device as defined in claim 2 wherein said one end of said closed cylinder means includes a cover plate removably secured to said housing and having opening means therethrough slidably receiving said rod means.

7. A device as defined in claim 3 wherein said tool bit has a reduced diameter portion, said retainer plate means

comprising a plate having a first slot slightly larger than and embracing said tool bit reduced diameter portion, a second slot in said retainer plate communicated with said first slot and adapted to permit free axial movement of said tool bit therethrough when aligned therewith, said retainer plate being movable to selectively align said first and second slots and said tool bit.

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