

[54] POWER TOOLS

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3,463,246 8/1969 Bronnert..... 173/111 X
3,650,336 3/1972 Koehler..... 173/110

FOREIGN PATENTS OR APPLICATIONS

195,868 7/1957 Austria..... 173/109

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[58] Field of Search..... 173/47, 48, 104, 109, 110,
173/111, 116, 117; 64/29

[56] References Cited

UNITED STATES PATENTS

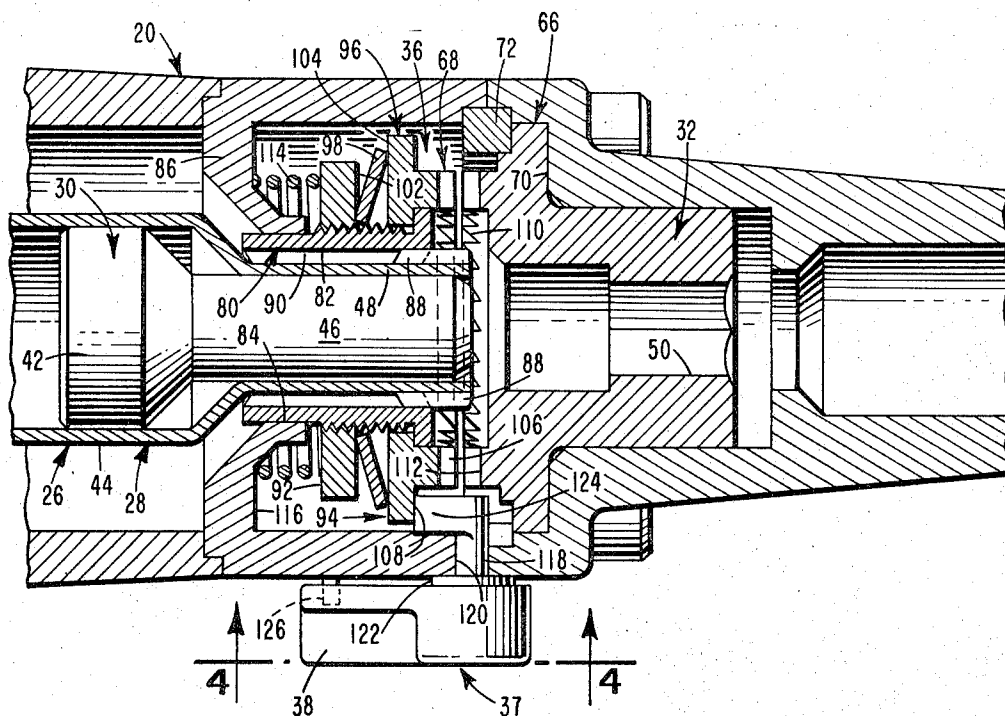
875,869 1/1908 Trott..... 173/111 X

[57]

ABSTRACT

Power driven devices in which a tool is axially impacted by a driver mounted in a reciprocably driven piston. The tool can be intermittently rotated or not, as desired.

5 Claims, 4 Drawing Figures



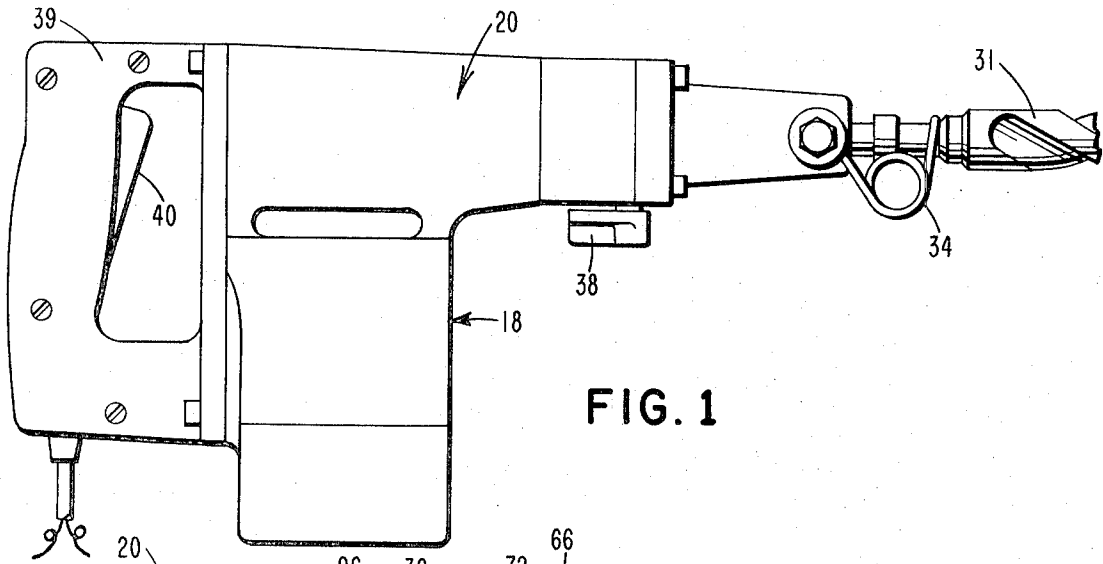


FIG. 1

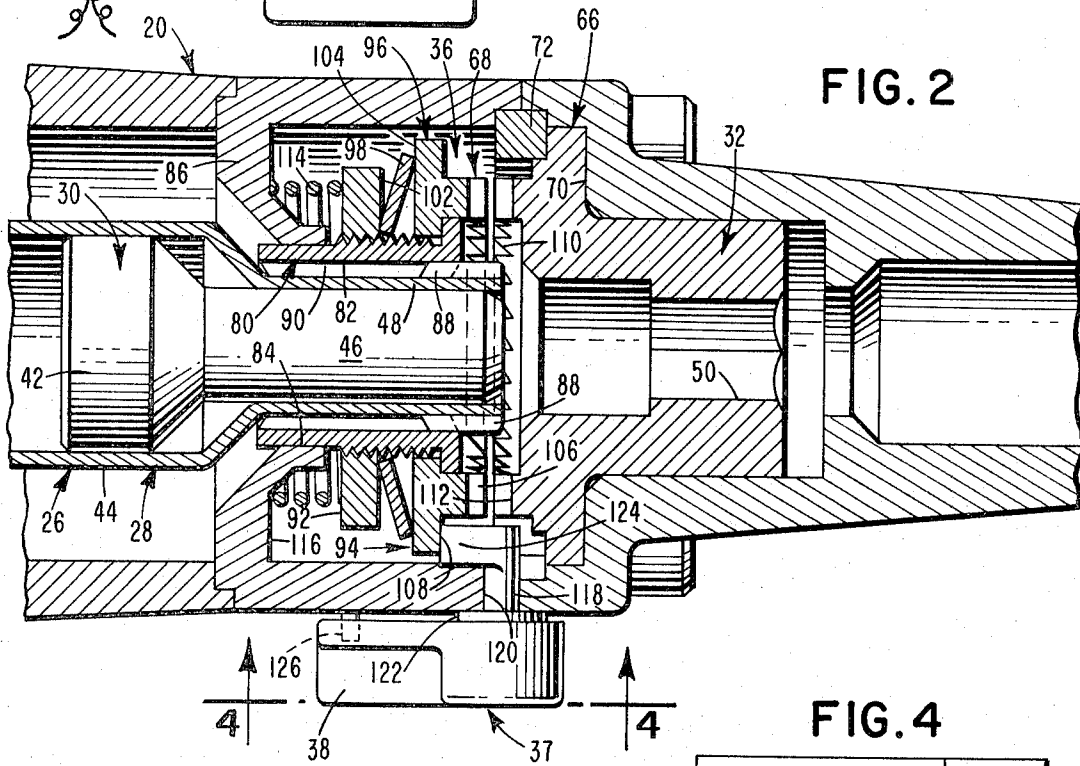


FIG. 2

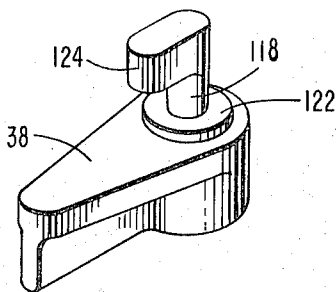


FIG. 3

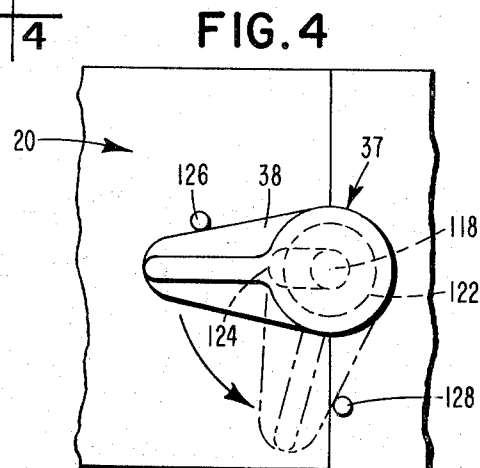


FIG. 4

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POWER TOOLS

The present invention relates to power driven devices and, more particularly, to power driven devices for drilling holes in or otherwise working concrete, masonry, and the like by axially impacting a tool against the workpiece, either with or without intermittent rotation of the tool, depending upon the task and the material involved.

One primary object of the present invention resides in the provision of novel, improved power driven devices of the type just described. Such devices are commonly referred to as power hammers or power driven hammers; and this terminology will, accordingly, be employed herein with the understanding that it is intended to be only descriptive and not limiting.

In power hammers as heretofore proposed, tools with one shank configuration are employed if rotation of the tool is wanted; and tools with a different shank configuration are used if axial impact only is desired. This has the disadvantages of requiring two sets of tools, of necessitating a change of tools to shift from one operating mode to the other, etc.

I have now invented novel power driven hammers which are free of the above enumerated and other disadvantages. In brief, these hammers include a mechanism of the character described in U.S. Pat. No. 3,650,336 issued Mar. 21, 1972, to Heinrich P. Koehler for POWER DRIVEN DEVICE for impacting a tool and a ratchet mechanism of the character therein disclosed for imparting intermittent rotation to the tool. In the devices described and illustrated in this patent, the motor of the device is connected through a rotary-to-reciprocating motion converting mechanism to the impact producing mechanism, which consists of a reciprocable piston in which a free-floating, driver is slidably mounted. Controlled flow of air into and out of the piston on opposite sides of the drive produces positive forces for propelling the driver through its working stroke, in which it imparts a blow to the tool, and through its return stroke and also provides cushions which prevent the driver from striking the ends of the piston as it moves back-and-forth therein.

During each cycle of the impact imparting mechanism, the tool socket and the tool mounted therein are rotatably advanced through an angle of preselected magnitude by a novel motion transmitting mechanism driven by the piston. This mechanism is also torque responsive and interrupts the rotary drive connection between the piston and tool socket if the tool binds or sticks.

The rotary motion producing mechanism includes a drive member which is connected to the reciprocable piston by helical splines so that the drive member rotates back-and-forth as the piston reciprocates. This motion of the drive member is converted to intermittent, unidirectional, rotary motion by a ratchet arrangement which has an input rotatable with the drive member just described. The output member of the ratchet arrangement and consequently, the tool holder and the tool mounted therein rotate or advance only as the drive member rotates in one of its two opposite directions.

In addition to the components just described, our power driven hammers include a novel selector mechanism with an actuator accessible from the exterior of the casing for moving the input and output members of

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the ratchet mechanism out of engagement when axial impacting of the tool without rotation is wanted. Thus, by simply moving the actuator from one to the other of two positions, axial hammering alone or axial hammering plus intermittent rotary advance of the tool can be provided.

The novel arrangement just described increases to a maximum the speed and ease with which power driven hammers can be shifted between the two modes of operation. And it also eliminates the need for two sets of tools with different shank configurations to produce the two modes of operation. At the same time the selector mechanism we employ is relatively inexpensive to incorporate in a power hammer and to maintain.

One selector mechanism for a power driven impact device which affords a choice between axial impacting alone and axial impacting plus rotation has heretofore been disclosed in U.S. Pat. No. 3,334,694 issued Aug. 8, 1967, to J. L. Schnettler for ROTARY HAMMER. However, the Schnettler mechanism is quite different from that we have invented and could not be used in power driven hammers which employ impacting mechanisms and drives for producing intermittent rotary advance of a tool of the character described above.

Aside from those just discussed, the novel power hammers of the present invention have the advantages of being compact and relatively light and of having good balance due to the manner in which the motor is positioned with respect to the rotary-to-reciprocating motion converting mechanism. They are also rugged, providing a long service life, and uncomplicated, making them comparatively inexpensive to manufacture and maintain.

Furthermore, the novel power hammers of the present invention are highly effective in drilling and like operations because of the intermittent rotation imparted to the tool in conjunction with axial impacts.

One primary object of the present invention was identified above.

Another primary object of the present invention resides in the provision of power hammers with novel, improved mechanisms for providing a choice between axial hammering alone or axial hammering plus intermittent rotation of the tool.

Other important, but more specific objects of the present invention reside in the provision of novel, improved power driven hammers:

1. with a selector mechanism for shifting between different modes of operation which eliminates the need for employing tools with different shank configurations in these modes.

2. with a selector mechanism for shifting between different modes of operation which includes an actuator accessible from the exterior of the tool.

3. with a selector mechanism for shifting between different modes of operation which is simple and rugged and, therefore, relatively inexpensive to manufacture and maintain and which can be added to existing designs without major modifications in them.

4. which are particularly effective for drilling holes in concrete, masonry, rock, and the like.

5. which are compact and relatively light and well balanced.

6. which, apart from the selector mechanism, are rugged and uncomplicated, and, therefore, have a long service life and are relatively inexpensive to manufacture and service.

7. which are versatile.

8. which have various combinations of the desirable attributes just described.

Other objects and features and additional advantages of the invention will become apparent from the appended claims and as the ensuing detailed description and discussion proceeds in conjunction with the accompanying drawings, in which:

FIG. 1 is a side view of a power driven hammer constructed in accord with the principles of the present invention and equipped with a selector mechanism in accord with that invention for providing a choice between axial hammering and intermittent rotary advance of a tool and axial hammering alone;

FIG. 2 is a longitudinal section through the front end of the power driven hammer of FIG. 1;

FIG. 3 is a pictorial view of an actuator component of the selector mechanism, and

FIG. 4 is a fragmentary view of the hammer looking in the direction of arrows 4—4 in FIG. 2.

Referring now to the drawing, FIG. 1 depicts a power driven hammer 18 constructed in accord with the principles of the present invention. As best shown in FIG. 2, the major components of hammer 18 include a casing 20 housing a motor drive-connected through a rotary-to-reciprocable motion converting mechanism (neither shown) to the piston 26 of an impact imparting mechanism 28 which also includes a free floating driver 30 slidably mounted in the piston. Driver 30 is adapted to periodically strike and impart an impact to a tool 31 mounted in an open-type tool holder 32 and secured in place by a conventional spring type retainer 34. The tool may also be intermittently rotated or advanced during each working stroke by the piston, which is drive-connected to tool holder 32 through a reciprocable to intermittent, unidirectional, rotary motion converting drive mechanism 36. Drive mechanism 36 is also designed to serve an overload function; i.e., to interrupt the drive connection between piston 26 and tool holder 32 if the rotation resisting torque exerted by the tool on the tool holder rises above a predetermined magnitude.

Hammer 18 also includes a novel selector mechanism 37 having an actuator 38 (see FIG. 3) accessible from the exterior of casing 20. With the actuator in one of the two positions shown in FIG. 4, drive mechanism 36 is operable to incrementally advance the tool 31 in tool holder 32. With the actuator in its other position, continuity in the drive mechanism is interrupted; and the tool is, therefore, axially impacted but not rotated.

Hammer 18 also has a pistol grip 39 supporting a switch 40 for controlling the operation of its motor. The details of these components are not part of the present invention and will, accordingly, not be described herein.

Referring still to FIG. 2, piston 26 is supported for reciprocable, rectilinear movement in casing 20 by a piston guide which has not been shown because it is not part of the present invention and because it is described in detail in U.S. Pat. No. 3,650,336.

Free-floating driver 30, the other component of the axial impact producing mechanism, has a head 42 dimensioned for a sliding fit in the main body portion 44 of piston 26 and a smaller diameter stem 46 dimensioned for a sliding fit in the necked down forward portion 48 of the piston. Driver 30 is extendible from one end of the piston into impacting engagement with the

tool 31 mounted in tool holder 32 as piston 26 moves forwardly (i.e., toward the nose end of the hammer) and is displaced toward the rear end of the piston during the return stroke of the latter by the controlled egress of air into piston 26 on opposite sides of driver head 42 and the controlled egress of air therefrom. The details of how the impact imparting mechanism operates are, again, described in U.S. Pat. No. 3,650,336 to which the reader may refer, if desired.

Tool holder 32 has a socket 50 into which the tool extends to connect it to the tool for rotation therewith and is an integral part of the output or driven member 66 of a ratchet type, intermittent rotary motion producing mechanism 68 incorporated in motion converting drive mechanism 36. Output member 66 is rotatably mounted in casing 20, but is fixed against axial movement by an annular ledge 70 in the casing and by a retainer 72 fitted therein.

Motion converting mechanism 36 also includes a motion converting component or drive member 80 having an internal bore 82 through which the forward end portion 48 of piston 26 extends. Member 80 is rotatably and axially movable in a bore 84 through an annular boss 86 in casing 20.

Helical external splines 88 are formed on the forward end portion 48 of piston 26; and cooperating, internal, helical splines 90 are formed in the bore 82 of driven member 80. Accordingly, as piston 26 is reciprocated, it effects an oscillatory or to-and-fro rocking movement of drive member 80 through an angle determined by the configuration of cooperating splines 88 and 90.

The cylindrical input member 92 of friction clutch 94 is journaled on and fixed to member 80 for rotation therewith. The output member 96 of clutch 94 is similarly journaled on member 80, but is free to rotate relative to this member. Clutch output member 96 is also the input or drive member of ratchet mechanism 68.

Clutch members 92 and 96 are frictionally drive connected by a Belleville washer 98 journaled on motion converting drive component 80 between the clutch elements and frictionally engaging the forward face 102 of input member 92 and the rear face 104 of output member 96. Belleville washer 98 allows friction clutch output member 96 to slip relative to input member 92 when the tool sticks or is otherwise subjected to a restraining torque of more than a predetermined magnitude.

Ratchet teeth 106 are formed on the forward face 108 of clutch output/ratchet input member 96, and cooperating ratchet teeth 110 are formed on the rear face 112 of ratchet output member 66. Clutch output member 96 and ratchet output member 66 are biased into driving relationship by a compression spring 114 having one end which abuts friction clutch input member 92. The other, rear end of this spring engages an annular ledge 116 in casing 20.

With teeth 106 and 110 engaged, clutch member 96 drives ratchet output member 66 when motion converting component 80 is oscillated or rotated by piston 26 in one direction. However, when output-input member 96 is rotated in the opposite direction by component 80, teeth 106 slide over the teeth 110; and no rotary motion is imparted to output member 66.

The rotary advance is transmitted to tool holder 32 as it is integral with ratchet output member 66. The incremental advance is in turn transmitted to the tool 31 mounted in the tool socket by employing matching

configurations in the tool socket and on the shank of the tool to connect them for concomitant rotary movement.

When axial hammering only of the tool is wanted, the actuator 38 of selector 37 is shifted to the second of its two positions. This moves clutch output/ratchet input member 96 toward the rear of hammer 18 against the bias exerted by spring 114 and holds it there, thereby disengaging the ratchet members. Accordingly, although input member 96 continues to be rocked or oscillated by motion converting member 80, this rotary motion is not transmitted to tool holder 32 or tool 31 although the tool continues to be impacted by driver 30 as piston 26 moves back-and-forth through its impacting and return strokes.

Selector mechanism 37 includes a shaft or stem 118 supported in an aperture 120 in casing 20 for rotation about an axis extending at right angles to the path along which ratchet input member 96 moves relative to ratchet output member 66. The externally accessible actuator 38 is fixed to stem 118 with a washer 122 between it and casing 20.

Also fixed to or integral with stem 118 is a cam 124. This cam extends at right angles from the inner end of stem 118 and is positioned to engage the forward face 108 of ratchet mechanism input member 96 radially beyond the teeth 106 formed therein.

With actuator 38 positioned against stop 126 as shown in FIG. 4, compression spring 114 can bias ratchet input member 96 forwardly to engage the teeth 106 on it with the ratchet teeth 110 on output member 66. Thus, with the actuator so positioned, the tool in tool holder 32 is subjected to axial impacts and intermittently advanced.

To eliminate rotation of the tool and provide axial impact only, actuator 38 is turned to the position shown in dotted lines in FIG. 4 in which it engages stop 128, rotating cam 124 to a position aligned with the actuator. As actuator 38 is turned, cam 124 forces ratchet input member 96 toward the rear of the tool against the force exerted by compression spring 114. This moves the teeth 106 on the ratchet input member out of engagement with the teeth 110 on the ratchet output member to interrupt the rotary drive connection and keep rotary movement from being imparted to the tool holder. This relationship is maintained until actuator 38 is turned back to the position shown in full lines in FIG. 4, allowing spring 114 to re-engage the ratchet members.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is:

1. A power driven device, comprising: a casing; a tool holder rotatably mounted in said casing; means which can be cycled through impacting and return strokes for imparting axial impacts to a tool mounted in said tool

holder; means including a driving member and a driven member having means providing a drive connection therebetween for so connecting said impact imparting mechanism to said tool holder that said mechanism rotatably indexes said tool holder and the tool mounted therein during one of the strokes in each cycle thereof but does not effect rotation of the tool holder in the other of said strokes; and means selectively operable to effect a relative displacement between said driving and driven members which will interrupt the drive connection therebetween so that said tool can be axially impacted without rotating it, the last-mentioned means including a shaft rotatable in said casing about an axis normal to the path of relative movement between the driving member and the driven member, cam means extending from said shaft which is engageable with one of said driving and driven members, and an actuator located externally of the casing and rotatable with said shaft for turning said shaft and causing the cam means to displace the member engageable thereby relative to the other of said driving and driven members.

2. The power driven device of claim 1, wherein said tool holder is integral with said driven member, wherein said driven member is fixed against axial movement relative to said casing, wherein the means for connecting the impact imparting mechanism to said tool holder includes means biasing said driving member toward said driven member to complete the drive connection therebetween, and wherein said cam is arranged to move said driving member away from said driven member against the force exerted by said biasing means.

3. The power driven device of claim 1, wherein the means for drive connecting the impact imparting mechanism to the tool holder includes a frictional indexing connection providing means capable of transmitting only forces up to a selected maximum magnitude operatively connected between said impact imparting mechanism and the driving member, whereby the drive connection between the impact imparting mechanism and the tool holder is effectively interrupted while there is a rotation restraining force on said tool holder which exceeds the magnitude of the force which said frictional drive connection is capable of transmitting.

4. The power driven device of claim 1, wherein the means for drive connecting the impact imparting mechanism to the tool holder includes a ratchet means having said driving member as an input and said driven member as an output and means for rotating said driving member back and forth as said impact imparting mechanism moves through its impacting and return strokes, there being cooperating first and second means on said driving and driven members engageable when said driving member is rotated in one direction only to rotatably advance said driven member and said tool holder.

5. The power driven device of claim 1, wherein said impact imparting mechanism includes a cylindrical piston and a driver slidable in said piston and extendible therefrom into impacting relationship with a tool socketed in said tool holder as the impact imparting mechanism moves through its impacting stroke.

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