March 13, 1951 O. E. SZEKELY 2,544,736

ROTARY IMPACT HAND TOOL

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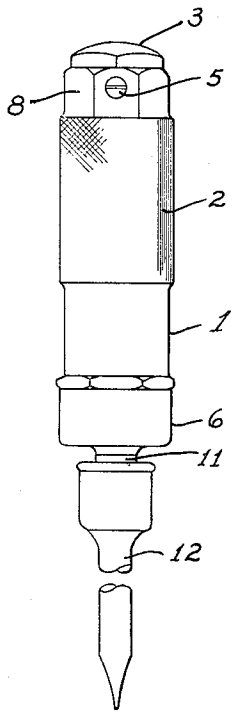


Fig. 1

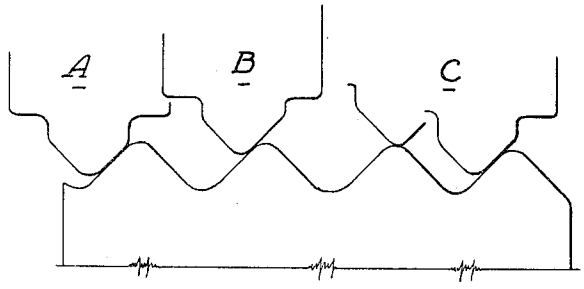


Fig. 3

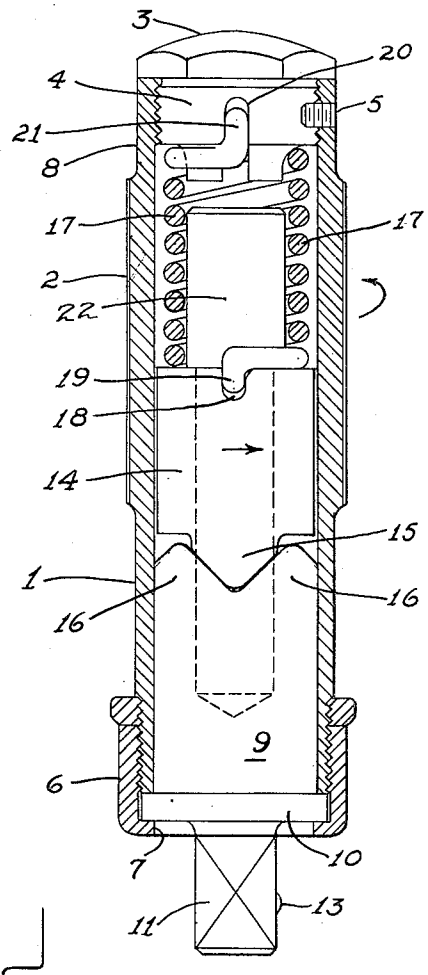


Fig. 2

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ROTARY IMPACT HAND TOOL

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1 Claim. (Cl. 81—52.3)

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This invention relates to new and useful improvements in hand tools and the like, and more particularly to hand tools for inserting and removing fastening devices such as screws, bolts and the like.

When removing screws, bolts and like fastening devices by the use of screw-drivers, wrenches and like hand tools, considerable difficulty often is encountered in intially freeing the screw or bolt from the object in which it is inserted, and in some cases, for example where the screw or bolt has become rusted or otherwise "frozen" to the object, it is quite often impossible to free the screw or bolt by the use of such a hand tool, thereby causing delay and loss of valuable working time.

With the foregoing in mind, the principal object of the present invention is to provide a hand tool for screws, bolts and like fasteners which embodies novel features of construction and arrangement operable to intially free and loosen such a fastener that is too tightly secured in or "frozen" to the object to be withdrawn therefrom by conventional hand tools employed in the usual manner.

Another object of the present invention is to provide a novel hand tool of the character set forth wherein means are provided to impart one or more sharp hammer-like blows to a fastener in one direction to free the same initially from the object in which inserted so that such fastener may be withdrawn in the conventional manner by the tool, or in the opposite direction so that such a fastener may be tightened and secured in an object to a substantially greater degree than is possible by the use of hand tools employed in the customary manner.

A further object of the invention is to provide a novel hand tool having the characteristics and features described which is of relatively simplified construction, comparatively inexpensive to manufacture and highly efficient in use.

These and other objects of the invention and the various features and details of the construction and operation thereof are hereinafter fully set forth and described with reference to the accompanying drawing; in which:

Fig. 1 is an elevational view of a hand tool embodying the present invention.

Fig. 2 is an enlarged sectional view vertically through the hand tool shown in Fig. 1; and

Fig. 3 is a diagrammatic view illustrating a particular feature of the construction and operation of a hand tool made according to the invention.

Referring now to the drawing, and particularly

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to Figs. 1 and 2 thereof, a hand tool made according to the present invention may comprise an open ended tubular casing structure 1 having on the exterior thereof a knurled or otherwise friction surfaced hand-grip portion 2. The upper end of the casing 1, with reference to the drawing, is provided with a suitable closure cap 3 having a portion 4 thereof threaded internally of said casing, and secured by means of a set screw or like fastening device 5. The other or lower end of the casing 1 has threaded externally thereon an annular cap member 6 which is provided with an inturned flange portion 7, and the construction and arrangement of said cap member 6 is such that when the latter is screwed tightly on to the lower end of the casing 1 the inturned flange 7 thereof is predeterminedly spaced outwardly from the adjacent end face of the casing 1. For a purpose hereinafter described the exterior upper end portion of the casing may be provided with a hexagonal or other polygonal shape as indicated at 8.

Mounted for rotation within the casing 1 in the lower end portion thereof is a cylindrical driver member 9 having a radial flange portion 10 of greater diameter that is adapted to be received and retained in the previously mentioned space provided between the lower end face of the casing 1 and the inturned flange portion 7 of the annular cap member 6. It is to be noted that the spacing of the flange 7 of cap member 6 from the adjacent end face of the casing 1 is such that the flange 10 of the driver member 9 is received therein so as to permit relative rotation of the casing 1 with respect to member 9 under circumstances and conditions hereinafter more fully described.

Projecting coaxially endwise from the member 9 and outwardly through the opening defined by the annular cap member 6 is a lug or shank 11. This lug or shank 11 is constructed or arranged to detachably and interchangeably receive thereon the socket portion of a tool element such as, for example, a screwdriver 12, or of a socket type wrench element (not shown). Preferably the shank 11 is provided with a conventional ball and spring snap 13 for engagement with a detent in the socket portion of the selected tool element so as to detachably retain the latter thereon.

Also mounted for relative movement rotationally and axially within the casing 1 is a cylindrical hammer member 14. According to the present invention the adjacent end faces of the hammer member 14 and the driver member 9 are pro-

vided, respectively, with correspondingly shaped projecting cam portions 15 and 16 that are relatively tapered in a direction circumferentially of said members 14 and 9 so that their side faces are angularly disposed and arranged for cooperative interengagement with one another in the relationship shown in Fig. 2 of the drawing.

In the illustrated embodiment of the invention the hammer member 14 is provided with two such cam portions 15 and these are arranged in diametrically spaced relation circumferentially of the end face of said member 14. On the other hand, the driver member 9 has four such cam portions 16 arranged circumferentially of the end face thereof and spaced substantially 90° apart. The angular disposition of the side faces of both sets of the cam portions 15 and 16, and the dimensions and shape thereof, are substantially the same and such that the cam portions 15 and 16 nicely interfit in the relation shown.

Positioned coaxially within the upper portion of the casing 1 is a relatively stiff coil spring 17. One end of the spring 17 is anchored to the adjacent end face of the hammer member 14, for example, by providing therein a groove 18 for reception of the adjacent end portion 19 of said spring, and the other end of the spring 17 may be anchored to the closure cap 3 in a similar manner by providing in the portion 4 thereof a groove 20 for reception therein of the end portion 21 of the spring 17. If found desirable or necessary the spring 17, hammer member 14 and driven member 9 may be supported substantially in coaxial alignment relative to one another within the casing 1 by means of a guide pin or like element 22 extending axially therein.

The construction and arrangement of the spring 17, and the stiffness thereof, are such that in normal use and operation of the tool to insert and withdraw a screw or bolt fastener, the said spring 17 maintains the cam portions 15 and 16 of the members 14 and 9, respectively, in the relatively interfitting or engaged position shown in Fig. 2 of the drawing, and prevents relative rotation between the hammer member 14 and the member 9.

However, when using the tool, for example, to withdraw a screw or bolt fastener from an object in the customary manner of using such hand tools, should the driver member 9 be restrained or prevented from rotating with the remainder of the tool by reason of engagement of the tool element with a threaded fastener that is too tightly secured in or "frozen" to the object to be withdrawn therefrom by the maximum turning force that is capable of being applied manually to the tool, the spring 17 is not too stiff to prevent a person using the tool from applying sufficient turning force manually to the casing 1 to turn the latter in the indicated direction thereby tending to twist spring 17 which is sufficiently stiff to carry with it the hammer member 14 which rotates in the same direction relatively with respect to the member 9 that is restrained or held against rotation as previously described. Relative rotation of the hammer member 14 with respect to the member 9 causes the cam portions 15 on the hammer element 14 to ride upwardly or outwardly upon the adjacent cam portions 16 of the stationary member 9, as indicated at A in Fig. 3 of the drawing, thus producing a relative axial separation of the hammer member 14 with respect to the member 9 and effecting an axial compression of the spring 17.

Simultaneously a substantial twist force component is built up in the spring 17 by reason of the turning force manually applied to the casing 1 against the resistance to rotation of hammer member 14 afforded by the spring and the relatively interengaging projections 15 and 16 of the members 14 and 9, respectively and, as hammer member 14 continues to move rotationally relative to the member 9, the cam portions 15 thereof continue to ride upwardly or outwardly upon the portions 16 of the member 9, as indicated at B in Fig. 3, thereby progressively increasing the twist and compression forces in the spring 17. This action continues with relative rotation of the hammer member 14 until these twist and compression forces reach a maximum as the peaks of the cam portions 15 ride onto the peaks of the cam portions 16 of the member 9. As the peaks of the cam portions 16 clear the peaks of the cam portions 15 the substantial twist and compression forces built up and stored in the spring 17 are released instantaneously thereby thrusting the hammer member 14 downwardly substantially in the direction of the resultant of the lateral twist and axial compression forces in the spring 17 with the result that the angular faces of the cam portions 15 of the hammer member 14 are caused to impinge upon the angular faces of the succeeding cam portions 16 of the member 9 with the full force and impact of the resultant of the lateral twist and axial compression forces in the spring 17, as shown at C in Fig. 3, thereby imparting to the driver member 9 hammerlike blows which are transmitted thereby through the tool element to the "frozen" fastener thus serving to "unfreeze" and loosen the latter to permit it to be withdrawn from the object in the usual manner by the hand tool.

It will be obvious, of course, that as many hammerlike blows as required or desired may be imparted to the driver member 9 in the manner described by the application of sufficient turning force to the tool casing 1 to effect continued relative rotation thereof and of the hammer member 14 with respect to the driver member 9 which is restrained or held against rotation and, as previously stated, the exterior upper end portion of the casing 1 may be hexagonally or otherwise shaped as indicated at 8 to receive a suitable wrench or like device to provide leverage for the application of forces sufficient to loosen and withdraw threaded bolt type fasteners by the use of a socket wrench type of tool element (not shown) applied to the shank 11 of the tool as previously described.

It will be apparent that a hand tool constructed and arranged as herein described also may be employed and operated in a similar manner to impart sharp, hammerlike blows to threaded fasteners being inserted into an object so that the same may be tightened and secured therein to a substantially greater degree than is possible by the use of conventional hand tools employed in the customary manner. In this event the rotational movements of the casing 1 and hammer member 14 will take place in a direction opposite that indicated by the arrows in Fig. 2, and the direction of movement of the cam portions 15 of the hammer member 14 relative to the cam portions 16 of the driver member will be in a leftward direction with reference to Fig. 3 rather than toward the right as there illustrated.

From the foregoing it will be observed that the present invention provides a novel hand tool for screws, bolts and like threaded fasteners which may be operated effectively both to initially free

or loosen threaded fasteners that are too tightly secured in or "frozen" to the object so that they cannot be withdrawn by conventional hand tools employed in the customary manner, and to secure a threaded fastener in an object to a considerably tighter degree than is otherwise possible with conventional hand tools. The invention also provides a novel hand tool of the stated character having means operable to impart a succession of sharp, hammerlike blows to a fastener either to free and loosen the same initially with respect to the object in which inserted, or to tighten the same therein. The invention further provides a novel hand tool having the characteristics and features described which is of relatively simple construction, comparatively inexpensive to manufacture, and which is fool-proof and efficient in use.

While a particular embodiment of the present invention has been illustrated and described therein, it is not intended to limit the invention to such disclosure, and it is contemplated that changes and modifications therein and thereto, as well as in the general form and design of the tool, may be made within the scope of the claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

In a hand tool for imparting rotational movement in either direction to threaded fasteners, a casing providing a hand grip and adapted to be rotated about its axis, a driver member in said casing extending from one end thereof, a hammer member rotationally and axially movable

within said casing, a plurality of cooperatively engaged rounded sawtooth shaped cam portions on the adjacent circumferential end faces of said driver and hammer members, and a spring within said casing secured thereto by one end and secured by the other end to said hammer member, said spring operable to resiliently restrain movement axially and rotationally of said hammer member relative to said casing and thereby to transmit rotational movement of said casing through the engaged cam portions to said driver member until external restraint of rotational movement of said driver member restrains cooperative movement of said hammer member and applies torsional force to said spring whereupon said spring is distorted and compressed to the extent that the engaged cam portions disengage and reengage upon succeeding cam portions to impart rotational blows on said driver member due to the rotational force momentarily stored in said spring.

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