Oct. 4, 1960 O. J. SWENSON 2,954,714

MANUALLY ACTUATED ROTARY IMPACT TOOL

Filed Nov. 12, 1958 2 Sheets-Sheet 1

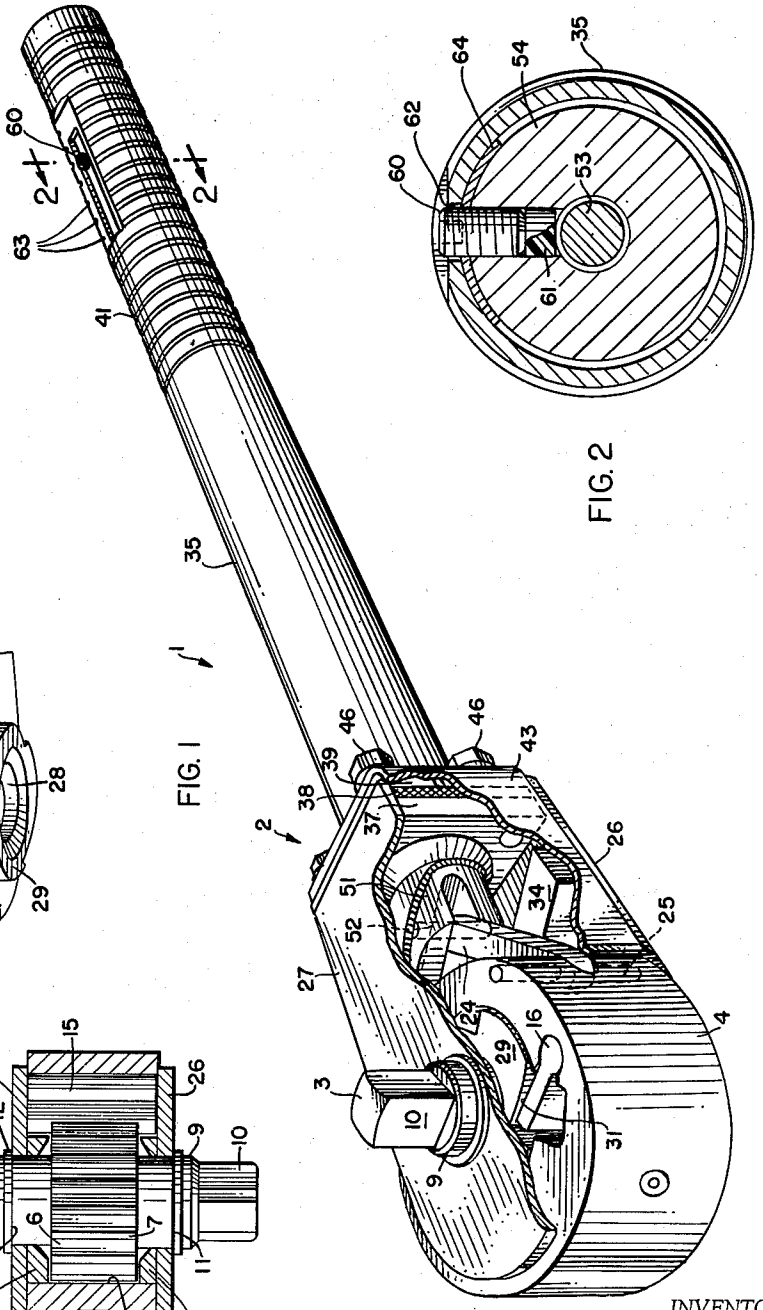


FIG. 1

FIG. 2

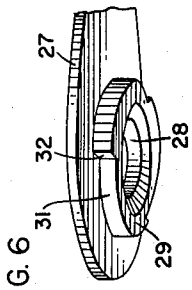


FIG. 6

FIG. 5

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MANUALLY ACTUATED ROTARY IMPACT TOOL

Filed Nov. 12, 1958 2 Sheets-Sheet 2

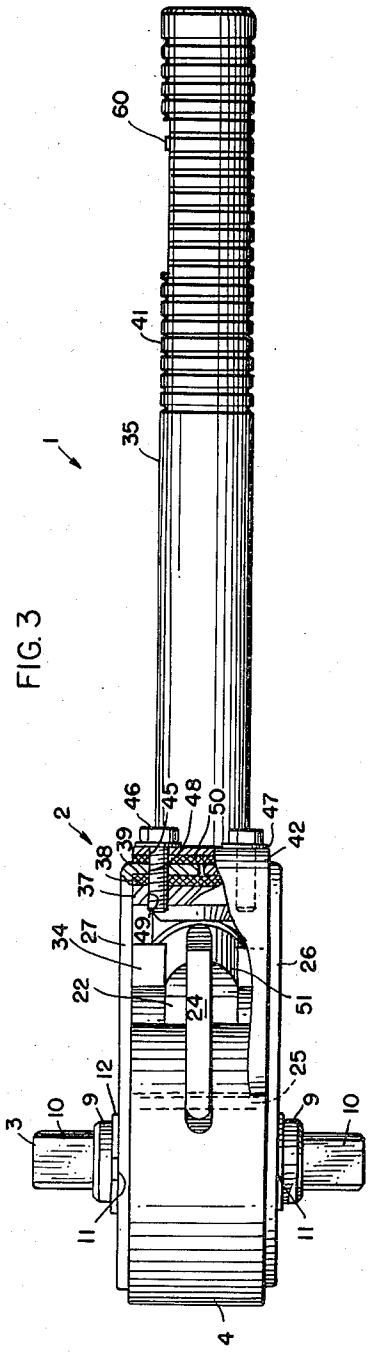


FIG. 3

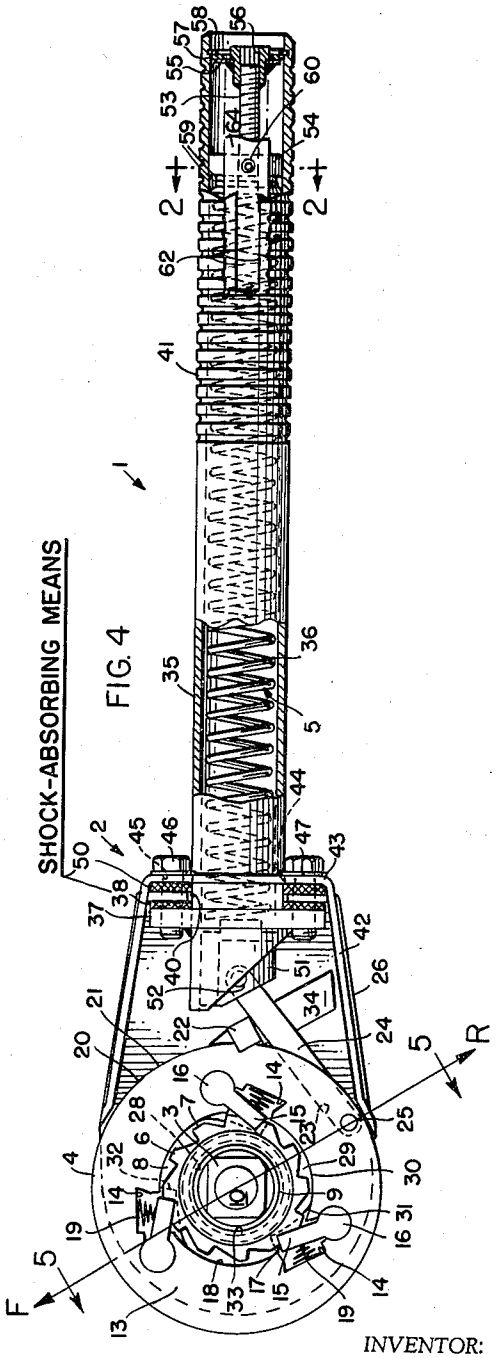


FIG. 4

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United States Patent Office

2,954,714

Patented Oct. 4, 1960

2,954,714

MANUALLY ACTUATED ROTARY IMPACT TOOL

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Filed Nov. 12, 1958, Ser. No. 773,229

8 Claims. (Cl. 81—52.3)

This invention relates to impact tools, and particularly to a manual or hand-operated tool for applying magnified force. The invention is more particularly directed to a ratchet type rotary impact tool for applying magnified torque force to threaded type fastenings.

It is an object of the invention to provide improvements in an impact tool of the type disclosed in my U.S. Patent Numbers 2,661,647, December 8, 1953, and 2,844,982, July 29, 1958.

The tool disclosed in my aforesaid patents has proven to be very advantageous in the application by hand of controllable magnified torque force to fastenings and the like. With increasing sizes of this tool corresponding to increasing loads, it has been found that the forces and stresses which are produced approach or might exceed the limits of the prior constructions over an extended period of use. It is therefore an object of the present invention to provide a tool characterized by increased structural strength and durability, and particularly, which better withstands the impact shocks.

In the prior construction exemplified in Patent No. 2,844,982, the resistance to shock of the stop pin 51 is necessarily limited by the construction. This pin is impacted against the shoulder 25 of the recessed portion 24 in the rotor when the rotor and the ratchet move together more than the prescribed amount on impact, when the wrench is employed as a ratchet, or when an impact is not completed and the spring action causes the pin to return.

It has also been found that in the construction of Patent No. 2,844,982, the reaction against the cam-bearing 34 when the rotor is stopped by the pin 51 is located in the area of a recessed cam surface 40, which results in increased unit pressure on the bearing surface.

It has further been found that in the prior tool sizes, substantial stresses in the parts are encountered when the rotor is brought to a stop by the wrench parts rather than entirely by the resistance of an engaged nut or bolt. The problem is noted especially in the larger tools whose longer handles have correspondingly increased inertia.

It has also been found to be desirable to improve the spring construction and housing, and to more completely enclose the parts of the tool.

It is therefore a further object of the invention to provide improvements supplying additional utility in the prior tools and overcoming disadvantages thereof, especially as encountered in the larger sizes.

A particular object is to provide a more rugged construction for stopping the rotor.

Another object is to provide a construction in which the reaction on the cam-bearing occurs at a central bearing area and the force is absorbed directly under the load.

A further object is to reduce the shock transmitted to the remainder of the construction when the rotor is brought to a sudden stop by the wrench parts.

An additional object is to provide a spring construction characterized by uniform loading of the spring and simple adjustment of the spring tension.

A further object is to provide a closed construction having increased safety in operation and which assists in maintaining the cleanliness and lubrication of the parts.

These and other objects, advantages and functions of the invention will be apparent on reference to the specification and to the attached drawings, in which like parts are identified by like reference characters in each of the views and in which

Figure 1 is a top perspective view of a preferred embodiment of the invention, with parts broken away;

Figure 2 is a cross-section on line 2—2 of Figure 4;

Figure 3 is a side elevation with parts broken away of the preferred embodiment;

Figure 4 is a plan view of the embodiment with a handle plate removed and parts broken away;

Figure 5 is a transverse sectional view taken through the rotor of the tool, and substantially along line 5—5 of Figure 4; and

Figure 6 is a fragmentary perspective view of the underside of the plate on the handle to illustrate the annular cam.

The invention provides a new combination and arrangement of parts in a manually operable impact tool whose impact blows are delivered from energy stored in and released from spring means. Improvements are provided in a tool or wrench which includes a rotatable tool head, a rotor surrounding the tool head, driving connections between the rotor and tool head, an operating handle, spring means for storing energy coupling the handle and the rotor, means for disengaging the driving connections and releasing stored energy, and means for reengaging the driving connections to produce impact blows on the tool head. The operating handle is movable relative to the rotor, and the spring means store energy from relative movement of the handle, which stored energy is converted to kinetic energy of rotor movement and in turn converted to impact force on the tool head upon reengagement of the driving connections. Cam means are preferably provided on the handle for disengaging the driving connections, and the cam means preferably provides a bearing surface for the rotor. The construction also includes interengaging stop members on the handle and rotor, respectively, for stopping the rotor by the wrench parts.

The tool head is adapted for engaging a threaded type fastening, the head engaging in a socket in the fastening or interposed socket member. The driving connections are preferably a ratchet and interengaging pawl members, and it is further preferred to employ at least three pawl members distributed at equal angles around the tool head. In the preferred construction, the tool head is constructed as a ratchet and the pawl members are mounted on the rotor.

The invention is characterized in a preferred embodiment by the combination with stop means on the outer periphery of the rotor, and a stop block connected to the handle and engaging or engageable with the stop means on the rotor. In a further preferred construction, wherein the cam means provides a bearing surface for the rotor, the stop means and the stop block are oriented with respect to the cam means to direct the reaction force of the rotor against a central or uninterrupted bearing area of the cam means.

An embodiment of the invention which is especially important in the larger tools comprises the provision in the combination, of shock absorbing means between the handle grip and the rotor. In a preferred construction, a resilient gasket is interposed between parts of the handle.

The preferred construction includes a coil compression

spring housed in a tubular handle part and actuating the rotor through an interposed pivotal link. The handle assembly or handle is completed by a handle plate bearing cam means and the stop block for engaging and stopping the rotor, and a resilient gasket is preferably interposed between the handle plate and the handle tube. The connections between the handle tube and the rotor are closed by the handle plate construction, and also by a side plate.

Referring to the drawings, a ratchet type, manually actuated, rotary impact tool 1 is illustrated which includes as its main components a handle assembly 2, a tool head 3, a rotor 4, and a spring assembly 5. The tool or wrench 1 is designed for engagement with a threaded type fastening, for either tightening or loosening it, in the manner described in my aforementioned prior patents. The tool operates initially in the manner of the common wrench, tightening the fastening merely by rotation of the tool in engagement therewith. The tool also includes ratchet and pawl members, for oscillating or reciprocating the tool to tighten or loosen the fastening, with no necessity for rotation in a complete circle or repeated removal of the tool. The tool includes construction for utilizing the ratchet and pawl members as anvil and hammer members, respectively, for operation as a hand impact tool, to provide magnified torque force for driving threaded type fastenings, such as nuts, bolts, screws and the like.

The tool head 3 is arranged transversely of the tool and includes a central cylindrical ratchet wheel 6 having a series of peripheral teeth 7, there being twelve in the embodiment illustrated, which have impact surfaces 8. Fastened to or integral with the ratchet wheel 6, on opposite surfaces, are axially extending shaft portions 9 terminating at opposite ends in square shaft extensions 10, for engagement with a threaded type fastening or socket having a complementary opening or recess. The shaft extensions 10 may have any desired configuration for engaging corresponding openings or recesses in the driven member. Circumferential slots 11 are provided on the tool head shaft portions 9 on opposite sides of the ratchet wheel, and they are engaged by retaining or confining split rings 12 for securing the tool assembly.

The tool head 3 and the ratchet wheel 6 thereof are surrounded by or enclosed within the rotor 4. The rotor includes an annular body 13 provided with three recesses or slots 14, recessed from the inner wall of the body, which extend in the direction of the axis of the body and which are spaced at equal angles therearound. Three pawls 15 are pivotally mounted in the recesses, by means of integral cylindrical end portions 16 journalled in corresponding cylindrical recessed areas in the principal recesses 14. The pawls 15 are mounted for pivotal oscillatory or reciprocatory motion from within the recesses 14 to a position in which their leading or innermost ends 17, nearest the rotor axis, extend out of the recesses in a direction somewhat tangential to the inner wall 18 of the body 13. The pawls are pressed by compression springs 19 into normally inwardly protruding positions as illustrated, which springs are seated in the recesses 14 and bear against the radially outer sides of the pawls.

The ratchet teeth 7, the pawls 15, and the springs 19 constitute driving connections between the rotor 4 and the tool head 3. The driving connections are thus arranged for engagement to prevent relative movement of the rotor and head in one direction, corresponding to clockwise rotation of the rotor as viewed in Figure 4. The ratchet and pawl members are also arranged to allow relative movement in the opposite direction, corresponding to counterclockwise movement of the rotor relative to the tool head. In the following description and unless otherwise specified, reference to the direction of rotation contemplates the direction as viewed on the drawing in Figure 4.

The inner side 20 of the outer periphery 21 of the rotor body 13 is provided with stop means 22 preferably constituting a bar welded or otherwise secured to the periphery and providing a shoulder thereon for stopping the rotor. The inner side 20 of the rotor body is also provided with an elongated recess 23 accommodating a pivotal link 24. The link is pivotally secured to the rotor body 13 by means of a pin 25.

The operating handle 2 includes as component parts, two parallel elongated plates 26 and 27, which cover the driving connections between the rotor and tool head and which are secured on opposite sides thereof by the split rings 12. Each of the mounting plates is provided with a circular tool head mounting opening or hole 28, in which the tool head 3 and the shaft portions 9 thereof are journalled. The tool head 3 and the rotor 4 are thus mounted on the handle 2, and these members rotate about a common axis.

Annular cams or cam bearings 29 depend or extend inwardly from the inner surfaces of the mounting plates 26 and 27, their central openings registering with the tool head mounting openings 28 of the plates. The cams are secured to the mounting plates 26 and 27 by rivets, welding or other suitable means. Each cam is provided with three peripheral bearing surfaces 30, and the same number of cam surfaces 31 and recesses 32, each at equal angles around the periphery of the cams, corresponding to the disposition of the rotor body recesses 14 and the pawls 15 mounted therein.

The rotor body 13 and the inner wall 18 thereof are supported on the bearing surfaces 30 of the cams for relative rotation of the body and the cams. The inner walls 33 of the cams 29 also provide bearings for the shaft portions 9 of the tool head. The pawls 15 normally lie in the recessed portions 32 of the cams, with the leading ends 17 of the pawls contacting the impact or engaging surfaces 8 of the ratchet teeth 7.

When the operating handle 2 is rotated in a clockwise direction, the rotor 4 and the tool head 3 initially also rotate in the same direction, by the action of the spring means 5 and interposed pivotal link 24, as described in greater detail hereinafter, and by engagement of the pawls 15 with the ratchet teeth 7. Eventually the resistance of the fastening to further rotation reaches the predetermined force required to hold the tool head 3, and the rotor 4 through the pawls 15, against the impetus of the spring means. At this time, the handle 2 and the cams 29 which are movable in the clockwise direction relative to the rotor and tool head, continue to rotate. The cam surfaces 31 cause the pawls 15 to be pressed into the recesses 14 of the rotor body, ultimately camming the pawls out of engagement with the ratchet teeth 7. Then, the rotor is free to rotate in the clockwise direction relative to the ratchet wheel 6. Rotation continues until the pawls 15 strike the next succeeding set of ratchet teeth 7, upon whose impact surfaces 8 the pawls impact and transmit the kinetic energy of motion of the rotor 4, imparted thereto by the spring means 5.

On the inner side of each handle plate 26 and 27, a stop block 34 is secured as by welding, brazing or other suitable means. The stop blocks engage or are engageable with the stop bar 22 secured to the periphery of the rotor, and they are spaced apart in the assembly to accommodate the pivotal link 24 connecting the rotor 4 and the spring means 5.

The stop blocks 34 engage the stop bar 22 to prevent the rotor from rotating relative to the handle under the normal compression of the spring means 5. These stop means also cooperate in the ratchet function of the tool. When the handle 2 is rotated in a counterclockwise direction, the stop means cause the rotor to rotate in the same direction. With the tool head 3 engaging a threaded fastening, counterclockwise rotation causes the pawls 15 to slide resiliently over the ratchet teeth 7 when the fastening offers sufficient resistance to hold the tool head.

The stop blocks 34 and the stop bar 22 may impact on

each other forcibly when upon clockwise rotation of the handle followed by an impact, the rotor 4 and the tool head 3 move together more than the selected value of 7° due to the impact. In this case, the construction will be subjected to substantial shock, the effects of which are mitigated in the new construction of stop means and in the shock absorbing construction, described hereinafter. Another condition which results in a substantial impact of the stop and stop bar is where the handle is rotated clockwise relative to the rotor 4 not far enough to cam the pawls out of the ratchet teeth and cause an impact, and then the handle is released under action of the spring means 5.

The reaction of the rotor 4 upon being stopped by engagement of the stop 34 and the stop bar 22 is along a line through the center of the rotor and parallel to the longitudinal axis of the stop 34, corresponding to the line F—R illustrated in Figure 4 of the drawings. The arrow F represents the direction of the rotor reaction force, and the arrow R at 180° thereto represents the reaction of the cam-bearing 29. It will be seen that the reaction of the bearing takes place at a central or uninterrupted area of the bearing, where it completely contacts the inner wall 18 of the rotor body 13. The cam-bearing is thus directly under the load or line of force, which reduces the unit pressure on the bearing to a minimum.

The handle 2 is completed by a handle tube 35 which houses a coil compression spring 36 constituting a part of the actuating spring means 5. A rectangular flange 37 is welded or otherwise secured adjacent the inner end of the handle tube 35, for connecting the handle plates 26 and 27 to the handle tube through an interposed resilient gasket 38 constructed of rubber or other resilient shock absorbing means. The connection is further made by flanges 39 secured to or, in the embodiment illustrated, integral with and normal to the handle plates 26 and 27. The latter flanges 39 are preferably spaced slightly from each other (see Figure 3) and as indicated at 40 (see Figure 4), from the handle tube 35, to effect a shock absorbing connection between the handle plates and the handle tube. In this manner, shock absorbing means are provided between the grip of gripping portion 41 of the handle and the rotor 4, reducing the effects on the mechanism of a sudden stop of the rotor by the stop bar 22 and the stop blocks 34.

The preferred construction also includes a forked side plate 42 which closes the sides of the tool between the rotor and the handle tube and bridges and surrounds the handle tube at the base 43 of the plate. The base is provided with a central opening 44 loosely enclosing the handle tube 35, and with bolt holes 45 at the corners of the base. Four bolts 46 are inserted through lock washers 47, the side plate holes 45, aligned holes 48 in the handle plate flanges 39, and threaded holes 49 in the handle tube flange 37. A second resilient gasket 50 is inserted between the handle plate flanges 39 and the base 43 of the side plate, to complete the resilient shock absorbing mounting. The side plate 42 serves the dual function of providing a clamping surface for the outer gasket 50 and of completing the enclosure of the parts linking the rotor 4 and the spring assembly 5.

The coil compression spring 36 is connected to or engages at its inner end a crosshead 51 provided with a dowel pin 52 for pivotally securing the link 24 in the crosshead. The crosshead and the coil spring slide in the handle tube 35, compressing the power spring 36 when the handle 2 is rotated clockwise relative to the rotor 4. When the pawls 15 are cammed out of engagement with the ratchet teeth 7, and the rotor moves freely until impacted, the energy stored in the power spring is released, the spring expanded towards the rotor and driving the rotor through the link 24.

The parts are arranged so that as the spring 36 is compressed, the length of the radial moment arm on which the link 24 acts upon the rotor, becomes progressively shorter. The shortening of the moment arm compensates for the increasing spring pressure, resulting in a practically constant value of the moment applied to the rotor, and also in a corresponding constant force required to move the handle through its arc, rather than increasing force required of the operator.

The remainder of the spring assembly 5 comprises means for adjusting the initial compression of the power spring 36. These means include an adjusting screw 53 and an adjusting nut 54 threaded on the screw. The adjusting screw is provided with a lateral flange 55 for centering the screw in the handle tube 35, and a socket 56 at its outer end for receiving an adjusting tool such as a hexagonal wrench. The flange 55 of the adjusting screw bears against a thrust washer 57 which in turn bears again a retaining split ring 58.

The power spring 36 bears against spacing washers 59 provided adjacent the adjusting nut 54. The initial power spring compression is adjusted by turning the adjusting screw 53, which moves the adjusting nut 54 in either direction along the screw.

As illustrated in Figure 2, a set screw 60 is provided in a threaded opening through the adjusting nut 54, and a friction plug 61 of nylon or the like is inserted beneath the set screw and bears upon the threads of the adjusting screw 53 when the set screw is tightened. In this manner, the location of the adjusting nut 54 and the compression of the power spring 36 are secured to prevent any change in the settings during operation of the tool. The set screw 60 also projects through a longitudinal slot or opening 62 in the side of the handle tube 35, which regulates the travel of the set screw and adjusting nut, and thus the limits of power spring compression. The position of the adjusting nut 54 and thus the compression of the power spring are indicated, by reference to a scale 63 located on the tube along the slot. The slot 62 is covered on the inside by a thin cover plate 64 mounted on the adjusting nut 54 and which travels therewith, preventing entry of foreign material.

The coil compression spring 36 provides a simple construction and each turn of the coil is uniformly loaded, resulting in a long life of the spring. The force of the spring is readily adjusted by loosening the set screw 60 and turning the adjusting screw 53. The handle tube 35 constitutes an economical and sturdy lever-handle, while providing a closed spring container.

Reference to "predetermined force" or "predetermined tension" herein contemplates the adjustable features of the spring assembly 5 in connection with the rotor 4 and the tool head 3. The coil compression spring 36 is adjusted to any desired initial compression for producing corresponding forces and overcoming or yielding to corresponding resistance. When the handle 2 is initially rotated clockwise for tightening a fastening, force corresponding to the spring tension is transmitted to the rotor 4 and through the driving connections to the tool head 3. Eventually, the resistance furnished by the threaded fastening increases to the point that the tool head 3 and rotor 4 are held by the force of the resistance against the power spring 36 tension. This resistance force is predetermined in accordance with the requirements of the job, and it is determined or fixed by the predetermined spring tension initially produced in the power spring.

When rotation of the handle 2 is continued from that point of resistance to movement of the tool head 3, the compression of the power spring 36 increases until the pawls 15 are disengaged and the rotor 4 is released from its connection with the tool head 3, and an impact follows as previously described. The force of this impact is determined by the tension produced in the power spring by this time, which in turn is a function of the aforementioned predetermined initial spring tension. The impact force increases with increasing initial spring tension (or compression), and vice versa.

To summarize the operation of the tool, it is inserted in a socket as provided in a threaded fastening or interposed socket member, and the handle 2 is rotated clockwise to tighten the fastening, assuming that the fastening has a right hand thread. Initially, the tension of the power spring 36 causes the handle 2, the rotor 4, the tool head 3, and the fastening to rotate together. The tool can be reciprocated as a ratchet wrench. Ultimately, the fastening becomes tight and the tool head and the rotor are restrained. At this time, the handle 2 and the cams 29 advance relative to the rotor and tool head, cocking the power spring 36, until the pawls 15 are cammed out of engagement with the ratchet teeth 7. The rotor is then free to rotate clockwise, the power spring expands and rotates the rotor to a position where each of the pawls 15 engages the next ratchet tooth 7 with the transmission of considerable impact force. Each 30° movement of the handle produces an impact, which normally rotates the tool head 3 and the fastening a distance within about 5° to 7°. This degree of rotation is preferred for conservation of energy, for design reasons, and for most satisfactory use. However, either a greater or lesser angle may be selected. Continued operation produces a series of impacts. To loosen the fastening, the tool is simply turned over, and the opposite shaft extension 10 is inserted in the fastening. The tool then operates in the same manner to loosen the fastening, except that with a tight fastening, the impacts occur first, until the fastening is sufficiently loose that it is removed by the tool in the manner of a ratchet wrench.

When the rotor 4 and the tool head 3 move together more than 7° upon impact, when the handle 2 returns counterclockwise relative to the rotor due to the tension of the power spring 36, or when the tool is operated as a ratchet, the stop bar 22 and the stop blocks 34 strike each other. Owing to the location and construction of these stop means, they provide the requisite durability for especially the larger size tools. Their construction and arrangement also enables orientation of the cam-bearing 29 so the force on the bearing from such contact is absorbed with the minimum unit pressure on the bearing. The shock absorbing construction including the connections of the handle plates 26 and 27 to the handle tube 35 through the gaskets 38 and 50 reduces the stresses on the parts of the tool when the stop means impact on each other. As regards the construction accomplishing these objects and advantages, it will be understood that the construction and arrangement of the stop means, the location and type of shock absorbing means, and the construction and arrangement of other parts may be varied while accomplishing the objects of the invention and falling within its scope.

The enclosed construction is characterized by increased safety and protection from foreign matter. The handle tube 35 completely encloses the spring assembly 5. The handle plates 26 and 27 cover and protect the driving connections, and these plates and the side plate 42 enclose the connections between the handle tube 35 and the rotor 4. The enclosing means prevent entry and catching or pinching a foreign member, such as between the stop means, in the path of the power spring, or in the spring itself. The initial compression of the power spring is readily adjusted at the end of the tool.

The improved tool is very rugged and long lasting under heavy duty, and the shock effects are reduced. It is readily assembled and disassembled. The maintenance requirements are exceedingly simple, involving only periodic lubrication.

The invention is hereby claimed as follows:

1. In a manually operable impact tool whose impact blows are delivered from energy stored in and released from a spring means, and including a rotatable tool head, a rotor surrounding said tool head, driving connections between said rotor and said tool head, an operating handle movable relative to said rotor, said spring means coupling said handle and said rotor for storing energy from said relative movement of the handle, cam means on said handle for disengaging said driving connections and releasing said energy, and means for re-engaging said driving connections to produce impact blows on said tool head, the combination with stop means on the outer periphery of said rotor, and a stop block depending from said handle and engaging said stop means.

2. An impact tool as defined in claim 1 in combination with shock absorbing means between the gripping portion of said handle and said rotor.

3. An impact tool as defined in claim 1 wherein said cam means provides a bearing surface for said rotor, and said stop means and said stop block are oriented with respect to said cam means to direct the reaction force of said rotor against a central bearing area of said cam means.

4. An impact tool as defined in claim 3 wherein said driving connections comprise a ratchet and at least three pawl members at equal angles around said tool head, and said cam means includes cam surfaces and bearing surfaces equal in number to said pawl members.

5. In a manually operable impact tool whose impact blows are delivered from energy stored in and released from a spring means, and including a rotatable tool head, a rotor surrounding said tool head, driving connections between said rotor and said tool head, an operating handle movable relative to said rotor, said spring means coupling said handle and said rotor for storing energy from said relative movement of the handle, cam means on said handle for disengaging said driving connections and releasing said energy, means for re-engaging said driving connections to produce impact blows on said tool head, and interengaging stop members on the handle and rotor, respectively, the combination with shock absorbing means between the gripping portion of said handle and said rotor.

6. An impact tool as defined in claim 5 including a resilient gasket interposed between the part of said gripping portion of said handle bearing said stop member and the handle.

7. In a manually operable impact tool whose impact blows are delivered from energy stored in and released from a spring, and including a rotatable tool head, a rotor surrounding said tool head, driving connections between said rotor and said tool head, an operating handle movable relative to said rotor, cam means on said handle for disengaging said driving connections and releasing said energy, and means for re-engaging said driving connections to produce impact blows on said tool head, the combination with a handle tube housing a coil compression spring, a pivotal link connecting said spring and said rotor, a handle plate bearing said cam means, stop means on the outer periphery of said rotor, a stop block depending from said handle plate and engaging said stop means, and a resilient gasket interposed between said handle plate and said handle tube.

8. In a manually operable impact tool including a rotary tool head, a rotor surrounding the tool head and an operating handle movable relative to the tool head and rotor about the axis of the tool head, the axis about which the tool head rotates extending perpendicular to the longitudinal axis of the handle, pawl and ratchet driving connections between the rotor and tool head circumferentially thereof, spring means coupling the handle and rotor and operating to store energy during and as a function of relative angular movements between the handle and rotor, an annular cam member rigid with the handle and having circumferentially spaced cam and bearing surfaces coaxial with the tool head, said cam surfaces being disposed for operation to disengage said driving connections and thereby release energy stored in

the spring means for production of impact blows on the tool head as a function of reengagement of the driving connections, bearing surfaces on said rotor mating with the bearing surfaces on said cam member, stop abutments on the handle and rotor respectively and angularly movable into abutting engagement in a direction to impose reaction forces diametrically of the tool head axis between said mating bearing surfaces of the rotor and the cam member, the bearing surfaces of the cam member being disposed between adjacent cam surfaces thereof and oriented with said direction of engagement of the abutments so that said reaction forces are concentrated in a region circumferentially between adjacent cam surfaces.

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CERTIFICATION OF CORRECTION

Patent No. 2,954,714 October 4, 1960

Oscar J. Swenson

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 9, after "stop", first occurrence, insert -- blocks --; lines 15 and 17, for "stop 34", each occurrence, read -- stop blocks 34 --; same column 5, line 42, for "of", first occurrence, read -- or --; column 8, lines 41 and 42, strike out "gripping portion of said" and insert the same after "the" in line 43, same column 8.

Signed and sealed this 20th day of June 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents