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RATCHET WRENCH

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Fig: 1

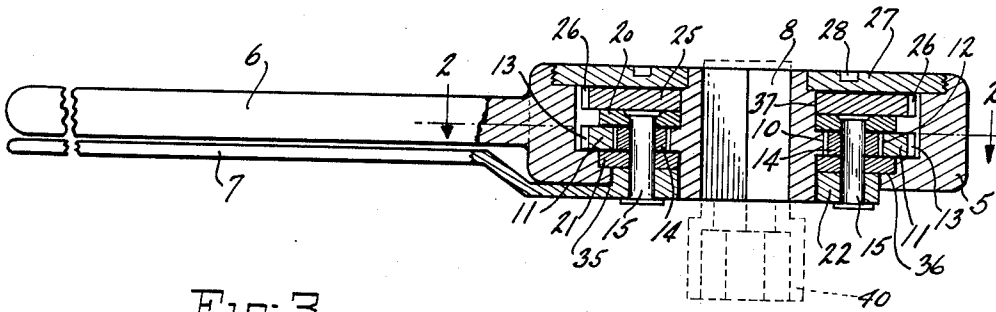


Fig: 3

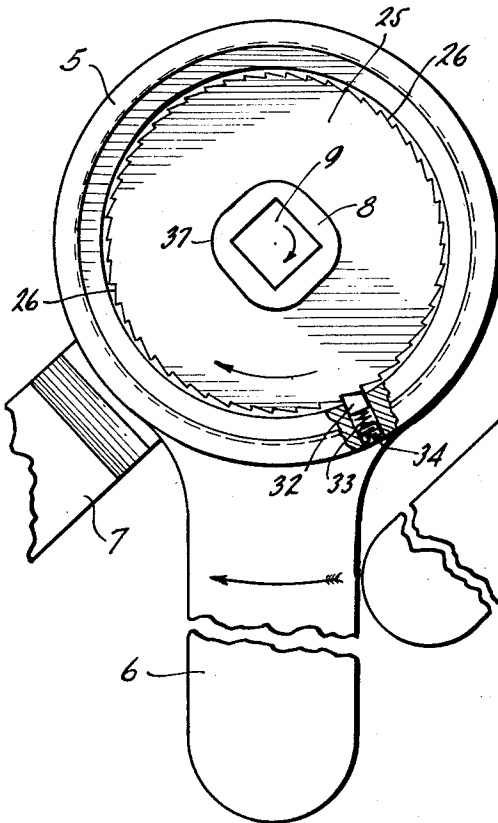
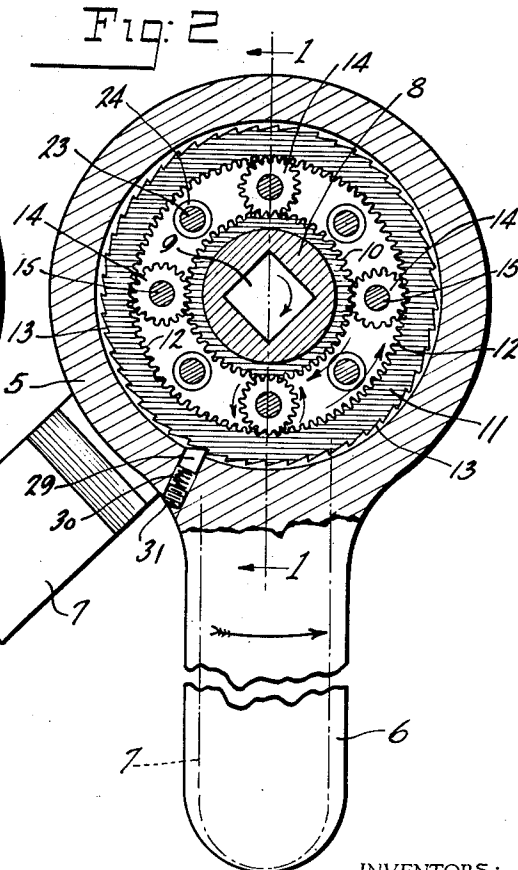


Fig: 2



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RATCHET WRENCH

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3 Claims. (Cl. 74-143)

1

This invention relates in general to socket wrenches but more particularly to socket wrenches of the ratchet type and the principal object of the invention is to design a new and improved ratchet wrench which facilitates the screwing on of nuts or bolts and the like.

Another object of the invention is the production of a new and improved ratchet wrench which will screw on a nut or the like in both directions of the reciprocating movement of the wrench handle, thereby speeding up this operation.

A further object resides in the provision of a ratchet wrench which will screw on a nut or the like by a forward movement of the wrench handle at one speed, and then with a reverse movement of the handle increase the speed of turning of the nut.

A particular feature resides in the provision of a planetary gear arrangement cooperating with a pawl and ratchet mechanism for causing a nut turning socket to rotate in a continuous forward rotary direction by reciprocation of the wrench handle.

The foregoing objects and features together with others including the arrangement, construction and operation of the various parts and elements which will hereinafter be apparent, are disclosed in the accompanying drawings which together with the description constitute a preferred embodiment of the invention.

Referring more specifically to the drawings:

Fig. 1 illustrates a cross-sectional side view of the improved ratchet wrench taken along the line 1-1 of Fig. 2;

Fig. 2 is a cross-sectional top view taken along the line 2-2 of Fig. 1; while

Fig. 3 is a top view of the wrench with the cover plate unscrewed.

The improved ratchet wrench includes a metal head portion 5 suitably machined in the round form as shown being hollowed out and having an operating handle 6 preferably integral therewith extending from the side thereof and of somewhat substantial construction. A secondary or stationary handle 7 of less substantial construction which may be of the same length as operating handle 6 extends from the bottom side of head portion 5 but is not attached thereto. Arranged axially within the hollow head portion 5 is a socket supporting member 8 having a square opening 9 therein for the accommodation of the usual socket 40 or other attachment for screwing on nuts and the like, as indicated in dotted lines in Fig. 1. The socket supporting member 8 and opening 9 therein extends the full depth of

2

the head portion 5 so that either side of the head portion 5 can be placed over the socket 40 for screwing nuts on or off as will be pointed out hereinafter.

Approximately midway of the length of socket member 8 there is a peripheral socket gear 10 formed integral therewith which is arranged in spaced relation to an outer ring gear 11 having similar gear teeth 12 on its inner periphery. The outer periphery of ring gear 11 is provided with ratchet teeth 13 arranged closely adjacent the inner edge of the hollow head portion 5 as shown in Fig. 2. A series of four intermediate gears 14 are preferably equally spaced in said head portion and are meshed with the gear teeth 10 and 12 of the socket member 8 and outer ring 11 respectively. The entire gear set specified constitutes a planetary gear arrangement and operates as such. Intermediate gears 14 are preferably of the same thickness as ring gear 11 and are pivoted for rotary motion upon individual pins or bearings 15. A pair of flat plates or spacers 20 and 21 are placed on opposite sides of intermediate gears 14, 10 and 11 and are held apart by four sleeves 24 on bearing pins 23 as seen in Fig. 2. These sleeves 24 are arranged between the gears 14 and are slightly longer than the thickness of gears 10, 11 and 14 so that no appreciable friction will be placed upon the sides of gears 14, 10 and 11 to interfere with their rotation. A flat plate 22 extending through the bottom opening 35 of the hollow head portion 5 supports the bearing pins 15 as by riveting them thereto, while the upper end of the bearing pins 15 are riveted to top plate 20. Bottom plate 22 is formed integral with the secondary handle 7 as shown, and the head portion 5 is adapted for rotation around the periphery of plate 22 in opening 35 as will be pointed out. The flat plate or spacer 21 rests on a bearing ledge 36 formed inside the hollow head portion and thereby holds the assembly in the hollow body 5.

Also arranged within the hollow head portion on top of spacing plate 20 is a ratchet wheel 25 having peripheral ratchet teeth 26. This ratchet wheel 25 is of the same diameter as ring gear 11 and both have slidable engagement with opposite sides of spacing plate 20. Ratchet wheel 25 is also keyed as shown at 37 in Fig. 3 directly with socket member 8 and is arranged to effect turning action of the same. A pawl 29 is normally urged by spring 30 into engagement with ratchet teeth 13 of ring gear 11 and is held in place adjustably as by a set screw 31. A similar pawl 32 is urged into normal engagement with ratchet

teeth 26 of gear 25 and held in place by set screw 34. The pawls 29 and 32 enable only one-way rotation of their associates ratchet wheels.

The complete mechanism encased within the hollow portion of the body head 5 is preferably packed with suitable lubricant and the body closed off by a cover plate 27 having special wrench recesses 28 therein whereby the plate may be removably screwed into the top of the head portion.

In describing the operation of the ratchet wrench assume for example that the device is to be used for turning a nut onto a bolt. The shank of socket 40 indicated in Fig. 1 is placed within the opening 9 of the socket turning member 8 in the usual manner and thereby keyed therewith for turning action of the nut which the socket 40 is to operate upon. The operator then grasps the movable handle 6 in one hand and the stationary handle 7 in the other hand, while the handle 6 is manipulated back and forth in a reciprocating manner to turn the nut on. At the same time handle 7 is held stationary. Assume now that the first motion of the operator is to pull the handle 6 to the left towards stationary handle 7 as shown by the arrow in the handle 6 of Fig. 3. This action causes pawl 32 to engage a ratchet tooth 26 and rotate ratchet wheel 25 in a clockwise direction as indicated. Since this ratchet wheel 25 is directly keyed at 37 to socket supporting member 8, a turning action of the socket 40 is effected.

Referring now to Fig. 2, while the left hand or clockwise movement of handle 6 is taking place, pawl 29 rides over the ratchet teeth 13 and therefore no rotation of the ring gear 11 can take place. However, the socket member 8 does effect an axial rotation of all intermediate gears 14 but because their bearing pins 15 are held stationary by virtue of the stationary handle 7 to which they are attached, the ring gear 11 is given a counter-clockwise rotation and its ratchet teeth 13 slide past the pawl 29 at an accelerated rate. The ratio of the turning movement of handle 6 to the socket 40 as described, is therefore on the order of one to one when the handle 6 is moved to the left.

The operator next rotates the handle 6 in the opposite or right hand direction as viewed in Fig. 2 while still holding handle 7 stationary with the other hand. This action results in pawl 29 engaging one of the ratchet teeth 13 causing a counter-clockwise rotation of ring gear 11 and this in turn rotates all four intermediate gears 14. Since the bearing pins 15 are held stationary by handle 7 gears 14 effect a clockwise rotation of gear 10 of the socket supporting member 8, thereby rotating the socket 40 in the same continuous forward clockwise direction that it was rotated when the handle 6 was moved to the left. During the foregoing action the pawl 32 in Fig. 3 idly rides over ratchet teeth 26 without producing any results.

The planetary gear arrangement is such that the diameter of the gear portion 12 of ring gear 11 is greater than that of the gear 10, and this coupled with the diameter of the intermediate gears 14 results in an amplification of movement of the socket member 8 when only a small movement of the handle 6 is made. Therefore by a proper selection of gear ratios and size of gears any desired acceleration or amplification of turning movement of the socket can take place by the same movement of lever 6. In the arrangement shown for example, a complete counter-clock-

wise rotation of lever 6 will result in a rotation of about one and two-thirds revolution of socket member 8.

From the foregoing operation it is seen that movement of handle 6 in a left hand direction results in a direct one to one ratio of rotation of the socket turning the nut, while a right hand movement produces a higher turning ratio. In each instance the handle 7 is held stationary. The nut is therefore screwed onto the bolt in a continuous forward direction by both forward and backward movements of the handle 6 with the result that work of any nature requiring the use of nuts or bolts or other attachments is greatly accelerated. This is of particular advantage in progressive assembly lines of various types of equipment such as automotive, and for use in repair shops for such equipment.

When a nut is to be unscrewed from a bolt it is only necessary to remove the wrench from the socket 40 and reverse it, inserting the socket into the top end of the wrench as viewed in Fig. 1. This will result in a similar action as described by turning off the nut with both motions of the handle 6. In the event that the wrench is used in close quarters or where it is not practical to hold handle 7 stationary, both handles may be grasped in one hand and both moved together as shown by the dotted lines in Fig. 2. In this case, however, since the intermediate gears 14 and their bearings 15 are also rotated with handle 7, the gears 14 merely roll around the gear teeth 10 when the handles are rotated to the right. However, due to the rotation of the intermediate gears 14 and the counter-clockwise rotation of pins 15, ring gear 11 is moved in the same direction at an accelerated rate causing the ratchet teeth to slip by pawl 29 at an accelerated rate. When both the handles are rotated to the left pawl 32 engages ratchet 26 and effects a direct turning action of socket member 8.

It is well known that with ordinary one-way ratchet wrenches of the conventional type, when a nut is first placed upon a bolt it is very loose and must be spun down by hand, because the ratchet wrench if placed upon it, would have no effect whatever. This is so because the pawl cannot ride over the ratchet teeth due to the loose nut and the nut would merely rotate back and forth. The present invention avoids this difficulty and is therefore an advantage in for example, inaccessible locations which cannot be reached by the hand. The stationary handle 7 in this case positively prevents reverse action of the loose nut, and the handle 6 can turn it down quickly by its back and forth movement. This wrench is also easier to move about from one nut to the next due to the fact that the operator has two handles with which to manipulate the placement of the socket.

When the nut being operated upon is tightened by handle 6 as far as possible, it may be driven "home" more tightly if the handle 6 is held firmly and then handle 7, which had been held stationary, is given a thrust in the left hand direction. This is possible because of the direct connection between the handle 6, pawl 32, and socket member 8.

It will be obvious that the present invention has many other uses from that illustrated, for example, the principals involved may be utilized in threading and tapping operations, drilling, boring, offset drill, screw driver, and various other turning operations. It is therefore to be understood that this invention is not to be limited to the

5

exact embodiment disclosed but only to the extent of the scope of the appended claims.

What is claimed is:

1. In a ratchet wrench, a head portion, gear means in said portion comprising a ring gear and a secondary gear having socket supporting means therein, a plurality of planetary gear means between said ring gear and said secondary gear, a stationary handle and a movable handle, pawl and ratchet mechanism interconnecting one of said handles with said ring gear and with said intermediate gear means, said planetary gear means being effective to cause rotary motion of said socket supporting means responsive to manual reciprocating motion of said movable handle while said stationary handle is restrained, and also when both of said handles are reciprocated together, spacing plates between all of said gears, supporting pins on said stationary handle for said spacing plates, all of said gears and spacing plates being encased in said head portion, said supporting pins being spaced between said first and second ratchet gears and between each of said planetary gears in order to reduce friction against the sides of all of said gears from said spacing plates.

2. In a ratchet wrench, a head portion, a movable handle attached to said head portion, a socket receiving member arranged axially in said head portion, a first ratchet gear secured to said socket member, a stationary handle, a second ratchet gear, separate pawls on said head portion for actuating each of said ratchet gears, and a plurality of planetary gear means interconnecting said second ratchet gear and said second ratchet gear whereby a reciprocating movement of said movable handle, while said stationary handle is held, causes said socket member to be continuously rotated in a single axial direction,

6

and also when both of said handles are reciprocated together, spacing plates between all of said gears, supporting pins on said stationary handle for said spacing plates, all of said gears and spacing plates being encased in said head portion, said supporting pins being spaced between said first and second ratchet gears and between each of said planetary gears in order to reduce friction against the sides of all of said gears from said spacing plates.

3. In a ratchet wrench, a head portion having a hollow body, a socket supporting member in said body having a concentric gear thereon, a ring gear arranged concentrically of said socket gear, a plurality of intermediate gears arranged concentrically between said socket gear and said ring gear, a stationary handle having means for attachment to said intermediate gears extending into said hollow body, spacer plates arranged on opposite sides of all of said gears to hold them in the same plane, a movable handle attached to said head portion, pawl and ratchet mechanism interconnecting said movable handle with said socket gear, other pawl and ratchet mechanism interconnecting said movable handle with said ring gear, and a cover plate for said hollow head portion enclosing said mechanism and gears.

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