Aug. 15, 1939. H. W. ZIMMERMAN 2,169,673

TORQUE MEASURING WRENCH

Filed April 12, 1937 2 Sheets-Sheet 1

Fig. 1.

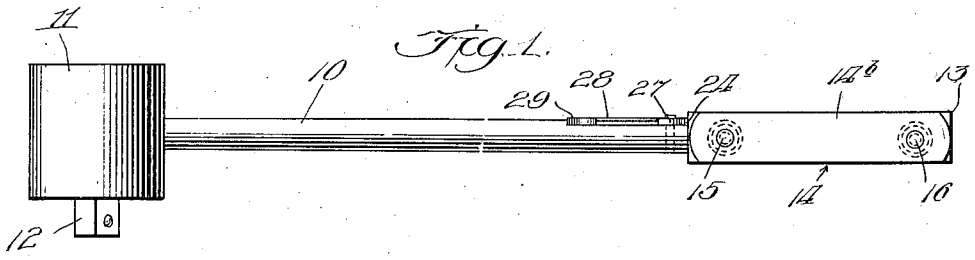


Fig. 2.

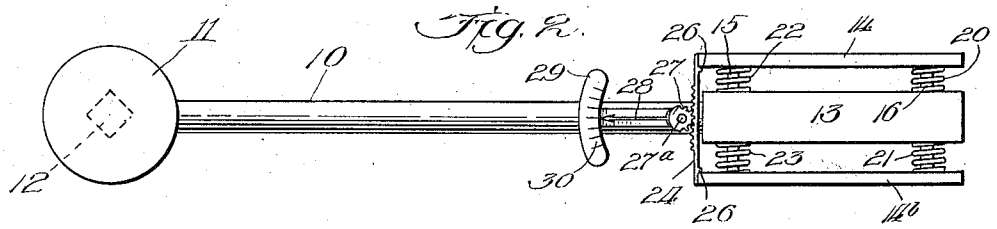


Fig. 3.

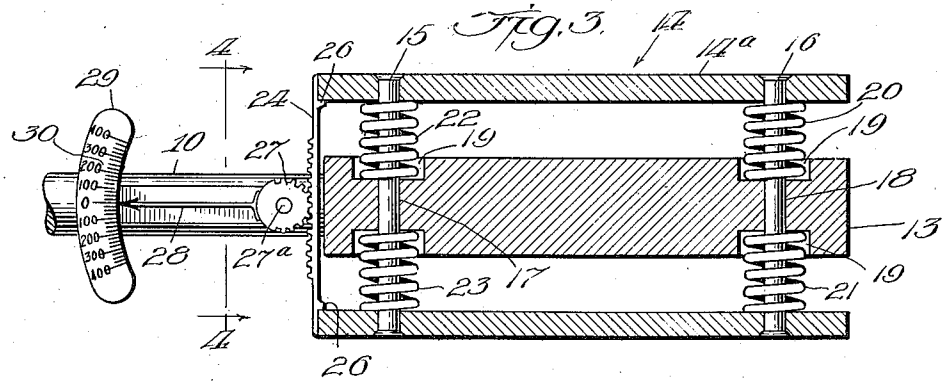
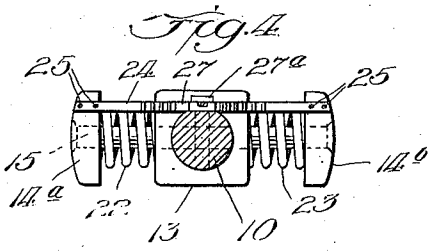


Fig. 4



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TORQUE MEASURING WRENCH

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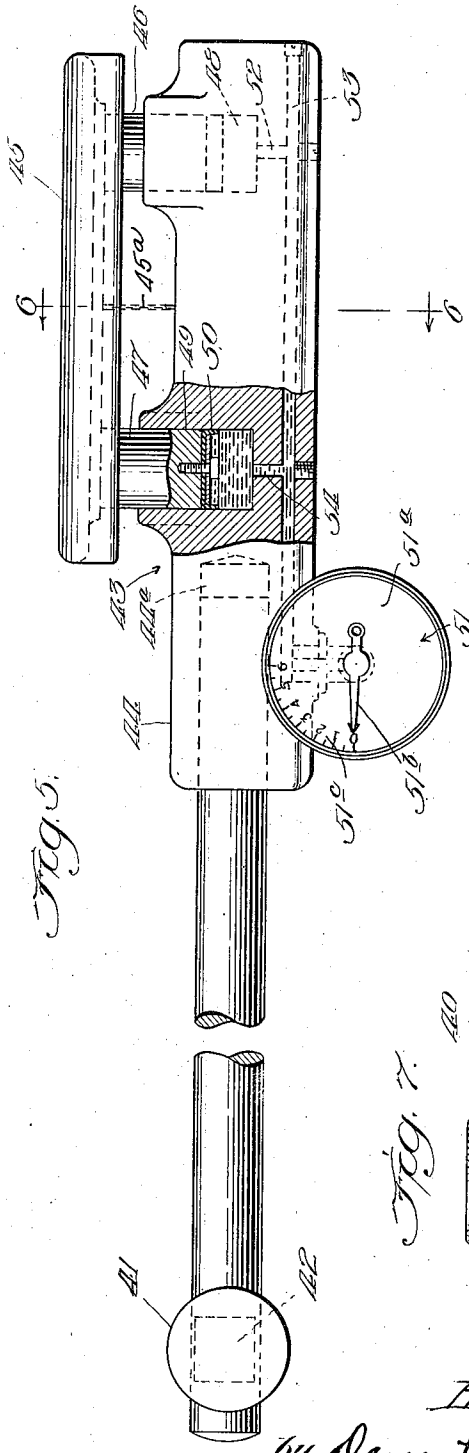


Fig. 5.

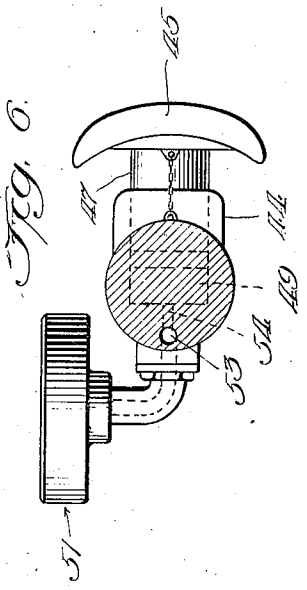


Fig. 6.

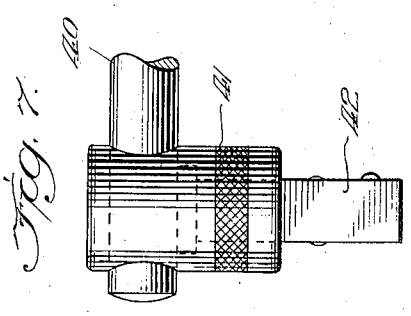


Fig. 7.

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UNITED STATES PATENT OFFICE

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TORQUE MEASURING WRENCH

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Application April 12, 1937, Serial No. 136,307

8 Claims. (Cl. 265—1)

My invention relates to wrenches, and it has to do more particularly with a wrench for measuring the force or torque applied thereto in tightening or loosening nuts, bolts, studs, and the like.

One of the objects of my invention is to provide an improved torque measuring wrench which is of simple and inexpensive construction and is adapted to operate efficiently at all times.

Another object is to provide a torque measuring wrench having a hand grip unit embodying means through which the torque measuring function is performed.

A further and more specific object is to provide a wrench of the foregoing character embodying a handle movably supporting a grip member, means opposing movement of the grip member relative to the handle and which is adapted to give way permitting such relative movement when the resistance offered by the work becomes such as to require the application of a predetermined amount of force or torque to overcome the same, and means for measuring the extent of relative movement of the grip member.

Other objects and advantages will become apparent as this description progresses, and by reference to the drawings wherein—

Figure 1 is a side elevational view of one form of wrench structure embodying my invention;

Fig. 2 is a top plan view of the structure of Fig. 1;

Fig. 3 is an enlarged top plan view partially in section of the hand-grip-end portion of the structure of Fig. 2;

Fig. 4 is a section taken substantially on the line 4—4 of Fig. 3;

Fig. 5 is a top plan view, partially in section, of another form of wrench structure embodying my invention;

Fig. 6 is a view taken substantially on the line 6—6 of Fig. 5; and

Fig. 7 is an enlarged side elevational view of the work-engaging-end portion of the structure of Fig. 5.

Referring to the structure shown in Figs. 1 to 4, inclusive, it includes a handle 10 having, at its forward end, a cylindrical head 11 fixedly supporting an adapter element 12 which is suitably constructed and arranged for support of any suitable adapter device, (not shown) for engaging various kinds of work (nuts, bolts, studs and the like devices). The handle 10 further supports, at its rear end, a hand grip unit embodying my invention, and this unit is adapted to be grasped by the operator in using the wrench to tighten or loosen the work.

The hand grip unit includes an enlarged integral (preferably but not necessarily rectangular) body portion 13 at the rear end of the handle, and it slidably supports a two-way grip member 14 for movement toward and from the axis of the handle 10. Specifically, the grip member includes a pair of grip elements 14^a and 14^b connected together in opposed, spaced relation by a pair of longitudinally spaced slide-stud members 15 and 16. These slide studs, as shown in Figs. 1 and 2, extend through the body portion 13 at right angles to the axis of the handle in a plane at right angles to the axis of the head 11 and the work; whereby the forces applied to the grip elements are exerted normally and completely in a rotary direction upon the work. The outer surfaces of the grip elements 14^a and 14^b are slightly rounded or otherwise shaped to permit the same to be conveniently grasped by the hand of the operator. The body portion 13 is provided with openings 17 and 18 through which the slide studs 15 and 16, respectively, pass for guided movement of the grip elements 14^a and 14^b relative to the handle portion 13.

Movement of the hand grip unit 14 relative to the handle in both directions is opposed by spring means of such character that a predetermined initial force or torque must be applied to the grip elements in order to initially overcome the spring means to effect relative movement of the grip unit and handle. To this end, the body 13 is provided with opposed pairs of recesses 19 axially aligned with the slide studs 15 and 16, and coil springs 20, 21 and 22, 23, all preferably of like construction, are seated in the recesses 19. The springs 20 to 23, inclusive, are of such length as to be confined between the hand grip elements 14^a and 14^b and the body 13, either under slight compression or so arranged that the grip elements 14^a and 14^b are held in a balanced or central or equally spaced position relative to the axis of the handle. With this arrangement, when the wrench is applied to the work in an upright condition and it is rotated in clockwise direction (as viewed in Fig. 2) to tighten the work, the springs 20 and 22 oppose relative movement between the grip unit 14^a and the body 13 of the handle 10. However, as soon as the work offers sufficient resistance to overcome the initial tension of the springs 20 and 22, such springs will begin to compress, and to an extent dependent upon the amount of force or torque applied, and movement of the grip ele-

ment 14a relative to and toward the body 13 will take place. Assuming that the wrench is applied to the work in the same upright position and is moved in the opposite direction to loosen the work, the springs 21 and 23 function similarly to the springs 20 and 22 and movement of the grip element 14b toward and relative to the body 13 will take place so long as the work offers a resistance sufficient to overcome the initial tension of the spring.

It will be seen from the foregoing that a certain amount of force or torque must be applied to the work through the grip unit in order to initially compress either the springs 20, 22 or 21, 23, and that the extent of compression of such springs and, in turn, the extent of relative movement of the grip elements 14a and 14b depends upon the amount of force or torque applied to the work. In carrying out my invention, I provide means for measuring the extent of movement of the grip unit 14 in either direction in terms of inch-pounds pressure so that the operator may readily determine when any particular piece of work is tightened to a desired extent, and also when a series of pieces of work are tightened to a uniform extent.

In carrying out the foregoing, the forward ends of the grip elements 14a and 14b are bridged by a rack member 24. The ends of this rack are secured to the ends of the grip elements 14a and 14b by fastening devices 25 and such rack is provided with shoulder elements 26 at its opposite ends that engage the inner faces of the grip elements 14a and 14b so as to brace the rack against torsional strains and stresses that may be imposed thereon during operation. The slide studs 15 and 16 may be so connected to the hand grip elements 14a and 14b as to fixedly hold them in a predetermined spaced relation, or the springs 20 to 23, inclusive, together with the rack 24, may serve this purpose.

The rack 24 operatively engages a pinion 27 which is rotatably mounted on the handle 10 by a shaft-like pin 27a. The pinion 27 supports a gage hand 28 which is movable, through the movement of the rack and pinion structure, relative to an elongated scale member 29 fixedly secured to the handle 10 in a plane substantially parallel to the plane of the movement of the pinion 27 and gage hand 28. The member 29 is provided with a scale 30 calibrated to register inch-pounds pressure. In the operation of this structure, relative movement of the grip element 14a toward the handle 10 actuates the gage hand 28, through the rack and pinion structure, in clockwise direction as viewed in Fig. 3. The gage hand is moved in the opposite direction when the grip element 14 is moved toward the handle. In both instances, the extent of movement of the gage hand away from the zero mark of the scale 30 indicates, in terms of inch-pounds pressure, the force or torque applied to the work through the grip unit 14.

In Figs. 5 to 7, inclusive, I have shown another form of structure well adapted for carrying out my invention. This structure is somewhat similar to that previously described, except that movement of the grip unit toward the handle is opposed by hydraulic means instead of spring means. Specifically, this structure (Fig. 5) includes a handle 40 supporting at its forward end a wrench head 41. This wrench head is provided with an adapter element 42 to which any suitable adapter device may be attached for engagement with the particular work to be tightened. The rear end of the handle 40 supports a hydraulic grip unit 43 which will now be described.

The grip unit 43 includes a body portion 44 having a recess 44a, in which the rear end of the handle 40 is secured. The grip unit 43 further includes a grip element 45 shaped similarly to the grip elements 14a and 14b. The grip element 45 is provided with a pair of longitudinally spaced, piston-like supports 46 and 47 which are snugly and slidably received in aligned piston chambers 48 and 49 formed in the body portion 44 of the grip unit. The forward ends of the piston supports 46 and 47 are provided with packing means 50 such as may be required for a hydraulic operation. The chamber 48 is connected with a hydraulic gage structure 51 of any well-known form, such as the Bourdon tube type, by the passages 52 and 53 in the body 44. The chamber 50 is likewise connected to the gage 51 by a passage 54 and the passage 53. The chambers 48 and 49 and passages 52, 53 and 54 are filled with oil, or other hydraulic-operating fluid, to an extent sufficient to operate the gage 51 which includes a dial 51a, a rotatable gage hand 51b and a scale 51c with respect to which the hand 51b is movable. This structure is so arranged that displacement of the fluid in the chambers 48 and 49 will cause movement of the gage hand clockwise relative to the scale 51c, and the extent of this movement depends upon the extent of displacement of the fluid. The fluid in the chambers 48 and 49 is displaced by movement of the grip element 45 toward the axis of the handle 40, and the arrangement is such, hydraulically, that a predetermined initial pressure must be exerted on the grip element 45 in order to effect an initial displacement of the fluid to actuate the gage. The gage 51, as in the previously-described structure, is calibrated to indicate fluid displacement in terms of inch-pounds pressure applied to the grip element 45 to effect such displacement. The grip element 45 is retained on the body 44 by a chain 45a (Fig. 5) connected at one end to the grip element and at the other end to the body 44. This chain limits the outward displacement movement of the piston-like supports 46 and 47 and, in turn, the outermost or normal, at-rest position of the grip element 45. Other than above described, the structure and operation of this form of my invention is substantially the same as the first-described form. That is, when the wrench is applied to the work and is moved clockwise (Fig. 5) to tighten the work, and the work offers sufficient resistance to effect a displacement of the fluid in chambers 48 and 49, the grip element 45 will move toward the handle displacing the fluid, and the extent of this displacement will depend upon the amount of force or torque applied through the wrench.

It is believed that the operation and advantages of my invention will be well understood from the foregoing. A wrench of this character has utility in tightening or loosening various kinds of nuts, bolts, studs and the like to the desired extents. It also has utility, by providing suitable adapter devices (not shown), in measuring the amount of torque required to rotate any object in its bearing, for example, a crank shaft or a spindle, or the like, thereby determining whether or not the rotating parts are initially properly fitted together.

It is to be understood that, although I have shown and described two forms of structure em-

bodying my invention, other changes in details and arrangements of parts may be resorted to without departing from the scope of my invention as defined by the claims that follow. For example, if desired, the grip unit may be arranged so as to be detachably connected, as a unit, to the wrench handle so that the wrench may be used with or without the torque measuring function. In other words, the grip unit may take the form of a wrench accessory which may be readily applied to wrench structures already in use.

I claim:

1. A torque measuring wrench comprising a handle, means associated with one end of said handle and adapted to engage the work, a hand grip unit on said handle at a point removed from said means, said unit including a grip element, means for mounting said grip element on said handle for movement toward and from the axis of said handle including spaced apart members secured to said element and slidably engaged with said handle at substantially right angles to the axis of the latter, and means associated with said members for opposing movement of the grip element toward said handle and adapted to give way upon the application of pressure to the grip element and permit movement of said element toward said handle, and means for measuring the extent of movement of said grip element in terms of pressure applied to the wrench through said grip element.

2. A torque measuring wrench comprising a handle, means associated with one end of said handle and adapted to engage the work, a hand grip unit on said handle at a point removed from said means, said unit including grip elements on diametrically opposite sides of the axis of said handle, means for mounting said grip elements on said handle for movement toward and from the axis of said handle including spaced apart members connected to both said elements and passing through said handle at substantially right angles to the axis thereof in a plane at substantially right angles to the axis of the work, and means opposing movement of the grip elements toward said handle and adapted to give way upon the application of pressure to the grip elements, and means for measuring the extent of movement of said grip elements in terms of pressure applied to the wrench through the grip elements.

3. A torque measuring wrench comprising a handle, means associated with one end of said handle and adapted to engage the work, a hand grip unit at the other end of said handle, said unit including a body portion carried by said handle, a grip member, means for mounting said grip member on said body portion for movement toward and from the axis of said body portion including spaced apart support members secured to said grip member and slidably passing through said body portion at substantially right angles to the axis of said handle, and means carried by said body portion opposing slide movement of said support members to move said grip member toward the axis of said body portion and adapted to give way upon the application of pressure to said grip member, and means for measuring the extent of movement of said grip member and adapted to register in terms of pressure the force or torque applied to the wrench through the grip member.

4. A torque measuring wrench comprising a handle, means associated with one end of said handle and adapted to engage the work, a hand grip unit on said handle at a point removed from said means, said unit including a body member, a grip member, means for mounting said grip member on said body member for movement toward and from the axis of said handle including a support member mounted for slide movement in said body member and at substantially right angles to the axis of said handle, and a spring disposed between said grip member and said body member yieldably opposing movement of the grip member toward said body member and adapted to be compressed upon the application of pressure to the grip member, and means for measuring the extent of movement of said grip member as permitted by said spring in terms of pressure applied to the wrench through said grip member.

5. A torque measuring wrench comprising a handle, means associated with one end of said handle and adapted to engage the work, a hand grip unit on said handle at a point removed from said means, said unit including a body member, a pair of diametrically opposed grip members, common means for mounting both of said grip members on said body member for movement toward and from the axis of said handle including a support member slidably engaged with said body member and secured at its opposite ends to said grip members, and a spring associated with said support member and disposed between each said grip member and said body member for yieldably opposing movement of each of said grip members toward said body member, and means for measuring the extent of movement of both said grip members toward said body member in terms of pressure applied to the wrench through said grip members to effect movement of said grip members.

6. A torque measuring wrench comprising a handle, means associated with one end of said handle and adapted to engage the work, a hand grip unit on said handle at a point removed from said means, said unit including grip members on opposite sides of the axis of said handle, means for mounting said grip members on said handle for slide movement toward and from the axis of said handle, and spring members disposed between said grip members and said handle on the opposite sides of the axis of the latter for opposing movement of said grip members toward said handle and adapted to be compressed upon application of pressure to move the grip members toward the handle, and gage means for measuring the extent of movement of said grip members in terms of pressure applied to the wrench rotatably in opposite directions through said grip members comprising a rack connected to said grip members preventing movement of the same toward each other, a pinion in engagement with said rack, a hand mounted on said pinion, and a scale member for indicating the extent of rotative movement of said hand.

7. A torque measuring wrench comprising a handle, means associated with one end of said handle and adapted to engage the work, a hand grip unit on said handle at a point removed from said means, said unit including a grip member, means for mounting said grip member on said handle for slide movement toward and from the axis of said handle including a piston member slidably engaged with said handle, and hydraulic means opposing slide movement of said piston member toward the axis of said handle and adapted to be displaced upon the application of pressure to the grip member, and means for

measuring the amount of displacement of said hydraulic means in terms of pressure applied to the wrench through the grip member.

8. A torque measuring wrench comprising a handle, means associated with one end of said handle and adapted to engage the work, a hand grip unit on said handle at a point removed from said means, said unit including a body portion having spaced piston chambers therein, a grip member, pistons on said grip member operatively engaged in said chambers for supporting said grip member for movement toward and from the axis of said handle, mechanism for registering the amount of displacement of fluid in terms of units of pressure, said body portion having passageways connecting said chambers and said registering mechanism, said chambers and said passageways being filled with a hydraulic-acting fluid adapted to be displaced by the application of pressure upon said grip member so as to actuate said registering mechanism.

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