

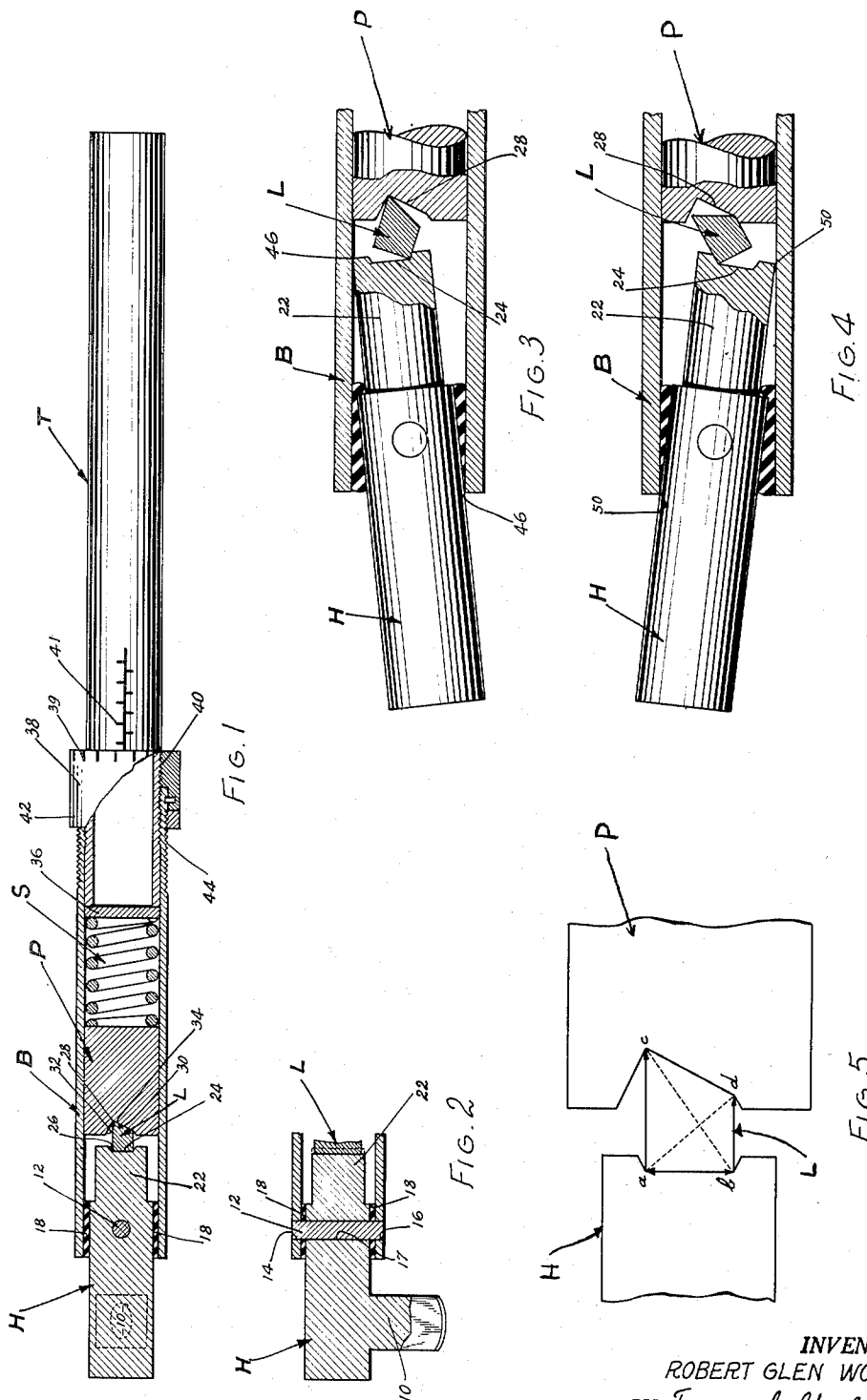
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R. G. WOODS

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TORQUE-LIMITING WRENCH

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INVENTOR.
ROBERT GLEN WOODS
BY Francis A. Utecht Jr.
ATTORNEY

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TORQUE-LIMITING WRENCH

Robert Glen Woods, South Gate, Calif., assignor to Jo-Line Tools Inc., South Gate, Calif., a corporation of California

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The present invention relates generally to wrenches and more particularly to a novel torque wrench.

Modernly, torque-limiting wrenches find wide application in many industries. Generally, these torque-limiting wrenches include a load-engaging member and a spring which resists the movement of the load-engaging member until the desired limited amount of torque is applied to the load thereby. The application of such limited amount of torque to the load through the load-engaging member causes the latter to undergo movement from its original position against the force of the spring. Such movement provides an indication that the desired limited amount of torque has been applied to the load. In certain industries it is desirable that a single torque wrench be capable of applying a first limited amount of torque when moved in one direction and a second limited amount of torque when moved in the opposite direction.

It is a major object of the present invention to provide a novel torque wrench which will apply a first limited amount of torque when moved in one direction and a second limited amount of torque when moved in the opposite direction.

Another object is to provide a torque wrench of the aforescribed nature wherein the amount of torque applied by said wrench when moved in either direction may be adjusted.

A further object is to provide a torque wrench which is very accurate.

An additional object is to provide a torque wrench of compact size and light weight that is economical of construction.

Yet a further object of the invention is to provide a torque wrench that is simple of design and rugged of construction whereby it may afford a long service life.

These and other objects and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof, when taken in conjunction with the appended drawings wherein:

Figure 1 is a top view of a torque wrench embodying the present invention, which view is partly broken away in horizontal section;

Figure 2 is a fragmentary, central vertical sectional view of the front portion of said wrench;

Figure 3 and 4 are enlarged fragmentary horizontal sectional views showing the mode of operation of said wrench; and

Figure 5 is a diagrammatic view showing the force conditions arising during operation of said torque wrench.

Referring to the drawings, the preferred form of torque wrench embodying the present invention broadly comprises a head H; a tubular body B extending away from the rear of the head; a tubular handle T extending away from the rear of the body; a plunger P longitudinally slidably disposed within the front portion of the body B; a spring S that constantly biases the plunger forwardly toward the head; and a short pivot L interposed between

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the rear of the head and the front of the plunger. The front portion of the head H is formed with a load-engaging member 10. Torque may be applied to an object through the load-engaging member 10 by moving the handle T in either a clockwise or a counter-clockwise direction from its position of Figure 1.

More particularly, the head H is pivotally connected to the front of the body B by a vertical pivot pin 12 having its ends disposed within aligned bores 14 and 16 formed in the body and its intermediate portion disposed within a bore 17 that extends through the head. A rubber sealing ring 18 is positioned in the annular space between the outer periphery of the head and the inner periphery of the body B. The load-engaging member 10 may be integral with the front of the head and depends therefrom for engaging a socket of an object to which a load is to be applied (not shown). The load-engaging member 10 is shown as being rectangular in cross-section. It will be understood, however, that this load-engaging member may assume other forms without departing from the spirit of the present invention. It should be further understood that although the load-engaging member 10 is shown disposed axially forwardly of the pivot pin 12, it is possible to arrange this member in alignment with the pivot pin without departing from the spirit of the present invention.

The rear portion of the head H is integrally formed with a hinge element 22 that may be smaller in diameter than the main portion of the head. The rear end of this hinge element 22 is centrally formed with a forwardly extending depression 24, the sides of which are beveled as indicated at 26. The front end of the pivot L is disposed within the depression 24 of the hinge element 22. The plunger P is of circular cross-section having an outside diameter somewhat smaller than the inside diameter of the body B. The front end of this plunger is centrally formed with a rearwardly extending depression 28. This depression 28 is generally triangular in plan view having a long side 30 and a shorter side 32. The rear end 34 of the pivot L is beveled relative to its sides and normally abuts the longer side 30 of the depression 28, as shown in Figure 1.

The spring S is of the helical compression type and its rear end abuts a circular plug 36. This plug 36 in turn abuts the front of the handle T. A locking sleeve 38 is suitably journaled by the rear end of the body B, which locking sleeve is threadably engaged with threads 40 formed on the front portion of the handle T. A lock ring 42 is threadably engaged with threads 44 formed on the rear portion of the body B. With this arrangement, the handle T may be adjusted longitudinally relative to the body B and the forwardly directed force exerted on the spring S against the rear of the plunger P may thereby be adjusted. The handle T may be locked relative to the body B by tightening the lock ring 42 against the front of the locking sleeve 38. In order to provide a visual indication of the relative positions of the handle T and the body B, the locking sleeve 38 may be marked with scalar markings 39 adapted to be utilized in conjunction with complementary scalar markings 41 formed on the handle. These markings 39 and 41 may constitute vernier graduations reading in foot-pounds or inch-pounds and should be so coordinated with the spring rate of the spring S and the geometry of the wrench as to provide an indication of the amount of torque applied by the load-engaging member 10.

In operation, referring to Figures 1 and 3, and assuming that the load-engaging member 10 has been connected with a load, the rear end of the handle T is moved in a clockwise direction. During such movement the tendency of the head H to pivot in a counter-clockwise direction relative to the body B will be resisted by the spring S, such resistance being applied through the plunger P and

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the pivot L. When, however, the torque being applied by the load-engaging member reaches a predetermined limited magnitude the head H will "break" or pivot in a counterclockwise direction about the pivot pin 12, the pivot L pivoting within the depressions 24 and 28 as shown in Figure 3. The abutment of the hinge element 22 with the interior of the body B at points 46 may limit the amount of pivotal movement which may be undergone by the head. It should be noted that the pivot L pivots on a knife edge when the head "breaks" and accordingly only a minimum amount of friction will be developed between the front and rear ends of the pivot L and the hinge and plunger elements.

Referring now to Figure 4 if it is desired to apply a limited amount of torque in the opposite direction, the rear end of the handle T is moved in a counter-clockwise direction. When the torque being applied by the load-engaging member 10 reaches a second predetermined limited magnitude, the head H will "break" or pivot in a clockwise direction about the pivot pin 12, the pivot L pivoting within the depressions 24 and 28, as shown in Figure 4. In this case the abutment of the hinge element 22 with the interior of the body at points 50 may be utilized to limit the amount of pivotal movement which may be undergone by the head H.

It should be particularly observed that the limited amount of torque required to cause the head H to break to its position of Figure 3 is of a smaller magnitude than that required to cause it to break to its position of Figure 4. The reason for this will become apparent from examination of Figure 5, which figure is a diagrammatic or vectorial representation of the forces involved in the pivotal movement of the head H relative to the other elements of the wrench. In Figure 5, the line *a-b* represents a base line followed by the rear end of the head H as it "breaks" in either direction. It likewise represents the amount of force available at the rear end of the head during a breaking movement for urging the plunger P rearwardly against the force of the spring S. The line *b-c* represents the direction of the force being transferred from the head H to the plunger P during clockwise rotation of the handle T about the pivot 12. Likewise, the line *a-d* represents the direction of the force actually transferred from the head H to the plunger P during a counter-clockwise rotation of the handle T about the pivot 12. The actual magnitude of the rearwardly acting force exerted by the head H upon the plunger P during clockwise and counter-clockwise, respectively, movements of the handle T is represented by lines *a-c* and *b-d*, respectively. Inasmuch as line *a-c* is longer than line *b-d*, the magnitude of the rearward force exerted against the plunger P by the head H during said clockwise rotation is greater than that exerted against the plunger during said counter-clockwise rotation for any given force directed along line *a-b*. Accordingly, since the forwardly acting force applied by the spring S against the plunger P is constant, the limited amount of torque required to be exerted by the wrench upon a load in order to cause the head H to break to its position of Figure 3 is less than that required to cause the head to break to its position of Figure 4.

While there has been shown and described hereinbefore what is presently considered the preferred embodiment of the present invention, it will be apparent that various modifications and changes may be made thereto without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. A torque-limiting wrench, comprising: an elongated handle; a head member pivotally secured to the front portion of said handle, said head being formed with load-engaging means; a plunger member axially slidably carried by said handle rearwardly of said head and axially spaced therefrom; resilient means interposed between said handle and said plunger member for constantly urging 75

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the latter forwardly toward said head; and, a pivot element interposed between the rear of said head member and the front of said plunger member, one end of said pivot element being beveled relative to its sides and the member adjacent said beveled end being formed with a complementary depression for receiving said beveled end.

2. A wrench as set forth in claim 1 where said resilient means includes spring means.

3. A wrench as set forth in claim 2 which includes means for adjusting the effective force exerted by said spring means.

4. A torque-limiting wrench, comprising: an elongated handle; a head member pivotally secured to the front portion of said handle, said head being formed with load-engaging means; a plunger member axially slidably carried by said handle rearwardly of said head and axially spaced therefrom; and, a pivot element interposed between the rear of said head member and the front of said plunger member, the rear end of said pivot element being beveled relative to its sides and the front of said plunger member being formed with a complementary triangular depression for receiving the rear end of said pivot.

5. A torque-limiting wrench, comprising: a tubular body; a head member pivotally secured to the front portion of said body, said head member being formed with load-engaging means; a plunger member axially slidably disposed within said body rearwardly of said head member and axially spaced therefrom; spring means in said body rearwardly of said plunger member for biasing the latter forwardly toward said head; a handle extending from the rear of said body; and, a pivot element interposed between the rear of said head member and the front of said plunger member, the rear end of said pivot element being beveled relative to its sides, the front of said plunger member being formed with a complementary triangular rearwardly extending depression for receiving the rear end of said pivot element, and the rear of said head member being formed with a forwardly extending depression for receiving the front end of said pivot element.

6. A torque-limiting wrench, comprising: a tubular body; a head member pivotally secured to the front portion of said body, said head member being formed with load-engaging means; a plunger member axially slidably disposed within said body rearwardly of said head member and axially spaced therefrom; a tubular handle telescopically extending from the rear of said body; a circular plug at the front end of said handle; a helical compression spring interposed between said plug and the rear of said plunger member; threads formed on the outer rear surface of said body and the outer front surface of said handle; a locking sleeve journaled by the rear of said body and formed with threads that are engaged with the threads of said handle; a lock ring disposed forwardly of said locking sleeve and formed with threads that are engaged with the threads of said body; and, a pivot element interposed between the rear of said head member and the front of said plunger member, the rear end of said pivot element being beveled relative to its sides, the front of said plunger member being formed with a complementary triangular rearwardly extending depression for receiving the rear end of said pivot element, and the rear of said head member being formed with a forwardly extending depression for receiving the front end of said pivot element.

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