June 16, 1964 W. E. VAN HOOSE 3,137,187

TORQUE LIMITING WRENCH

Filed Jan. 31, 1963

FIG. 1.

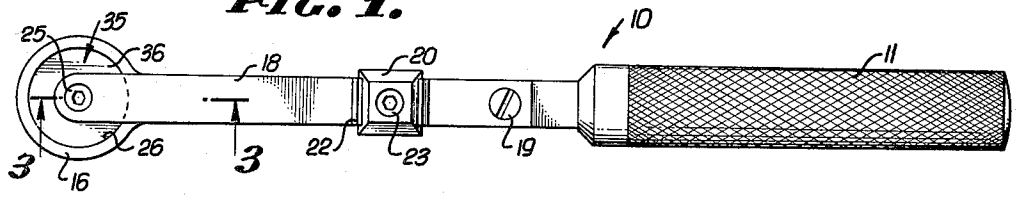


FIG. 2.

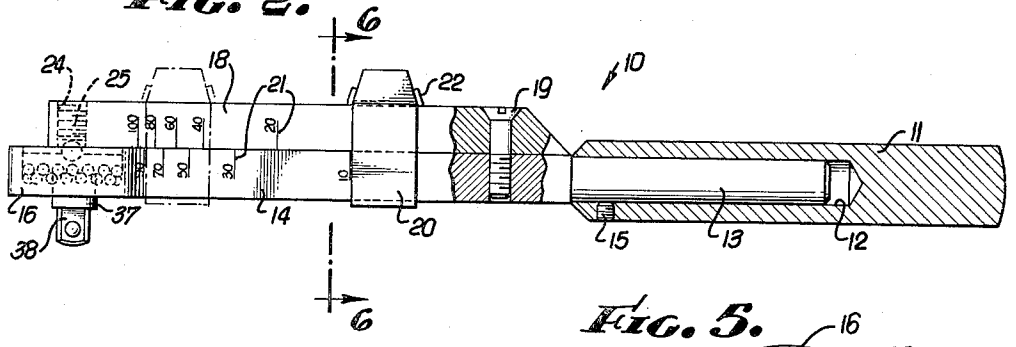


FIG. 3.

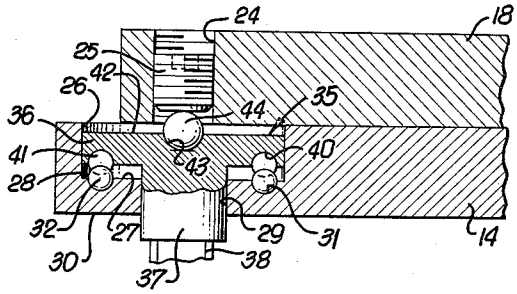


FIG. 5.

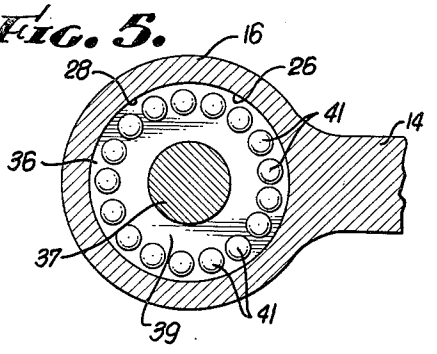


FIG. 4.

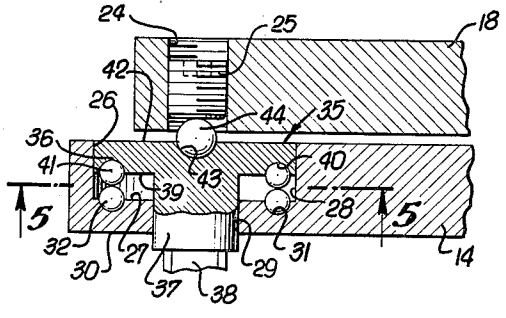
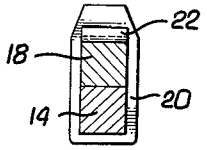


FIG. 6.



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TORQUE LIMITING WRENCH

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12 Claims. (Cl. 81—52.4)

This invention relates to a hand tool, and more particularly to a torque limiting wrench equipped with a torque transferring element to which can be fitted any conventional wrench head including those of the socket type or which includes a wrench.

The importance in industry of the torque wrench as a precision tool is well-known to persons familiar with the general art of mechanical fabrication and assembly. Every threaded fastener in today's industries must be torqued to proper tightness when it is manufactured, installed, repaired or inspected. More exacting specifications demand a greater accuracy in torqueing.

An object of this invention is to provide a torque limiting wrench which is adaptable for use in torqueing a number of different types of fasteners.

Another object of this invention is to provide a torque limiting wrench which is precisely calibrated to measure accurately the amount of torque pressure required to set a fastener.

Still another object is to provide a torque limiting wrench which may be used with equal precision in a clockwise or counterclockwise position.

A further object of this invention is to provide a torque limiting wrench including a handle portion, rotatable transmission means and a torsion bar means.

A more specific object of this invention is to provide a torque limiting wrench having an adjustable clamp means associated with the torsion bar means which can be set to a desired torque requirement visualized by a scale provided on the tool, which clamp will increase or decrease the effective length of torsion bar means.

Another object of this invention is to provide a torque limiting wrench which is inexpensive to construct, relatively easy to assemble, and easy to use.

With these and other objects in view, the invention consists of the construction, arrangement and combination of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, pointed out in the claims, and illustrated in the accompanying drawings, in which:

FIGURE 1 is a top elevational view of the torque limiting wrench;

FIGURE 2 is a side elevational view partly in cross section of the torque wrench;

FIGURE 3 is an enlarged, side elevational, cross sectional view of the ratchet head of the wrench;

FIGURE 4 is a view similar to FIGURE 3, illustrating the ratchet head in a slightly different position;

FIGURE 5 is a cross sectional view taken on line 5—5 of FIGURE 4, illustrating details of the ratchet head; and

FIGURE 6 is a cross sectional view of the clamp means taken on line 6—6 of FIGURE 2.

The invention generally comprises two complementary coaxial rotatable members, one of which members has a torque transferring element to receive a wrench to grip a fastener; the other member includes a manually operatable handle. When a predetermined amount of resistance occurs to the movement of a fastener, a camming or slipping action takes place between the members through thrust bearing means, and only one member will rotate at that point due to the slipping action, and the member with the torque transferring element will remain stationary.

The torque limiting wrench, generally designated **10**, includes a handle portion **11**, which may be knurled for

better gripping. The handle **11** is formed with a bore **12**, which receives the shank **13** of an elongated extension arm **14**. The arm **14** is generally square in cross section. A set screw **15** may be provided to hold the shank **13** within the bore **12**. The extension **14** includes a disk-shaped transmission head member **16**. There is additionally provided a resilient torsion bar means **18**, which is generally square in cross section and corresponds in cross section with the extension arm **14**. It extends from over the transmission head **16** to a position adjacent the handle **11**. The torsion bar means **18** is secured to the arm **14** by means of a set screw **19** at the end adjacent the handle **11**, the other end remote from the handle remaining free of securement to the arm **14**.

An adjustable clamp means **20** is formed around the torsion bar **18** and extension arm **14**, and is adapted to slide thereon to increase or decrease the effective length of the bar. To set the clamp **20** at a desired location, at a position illustrated on the visual scale **21**, a pressure plate **22** is positioned between the top of the clamp and the bar **18**, and a set screw **23** will be tightened to exert pressure on the plate **22**, forcing the bar **18** and the arm **14** together at that point.

The torsion bar **18** adjacent the end overhanging the head **16** is formed with a threaded bore **24**, directed toward the head **16**. A set screw **25** is threaded within the bore **24** and is adjustable to assist in setting the torque requirement of the device. Additionally, it may be utilized in adjusting the device should recalibration be necessary.

A circular recess **26** formed in the transmission head member **16** has a floor or thrust surface **27**, and a circular side wall **28**. Centrally located within the head **16** is a reduced bore **29** extending from the floor **27** to the bottom **30** of the head **16**. The floor **27** is formed with a plurality of dished recesses **31**, which are arranged in a spaced circular pattern between the wall **28** and the bore **29**. These recesses **31** receive ball bearings **32**.

Interfitted within the recess **26** and bore **29** and coaxial therewith is a rotatable thrust plate assembly **35**, which is generally T-shaped in cross section. The assembly member **35** includes a circular rotatable thrust plate **36** of a diameter slightly smaller than the recess **26**, and a circular shank extension **37** extending downward through the bore **29**. The shank extension **37** may be fitted with a torque transferring element or adaptor **38** of the type which can be utilized with the well-known socket wrench. However, the invention is not to be limited to this particular element, but could include any well-known conventional adaptor to accommodate a specific wrench or could be formed as a wrench per se.

The undersurface **39** of the plate **36** is formed with a plurality of dished recesses **40**, which correspond in number and are complementary with recesses **31**. The recesses **40** are fitted with ball bearings **41**, which correspond in size with the ball bearings **32**.

The top surface **42** of the plate **36** has a centrally located recess **43** which receives a single ball bearing **44**, which is generally larger in diameter than the bearings **32** and **41**. The ball bearing **44** is engaged by the set screw **25** to adjust torque requirement.

The material utilized in the construction of the parts is preferably aluminum for weight convenience; however, the invention is not to be so limited, and any material possessing a similar rigidity may be used.

With the parts assembled as set forth above, it can be seen that when the tool **10** is in an at-rest position, as best seen in FIGURE 3, the ball bearings **41** will be positioned between the ball bearings **32** in a mesh or locked

relationship. This position will be maintained by the torsion bar 18 through the set screw 26 against the bearing 44 and thrust plate assembly 35.

When torque is applied through the manually operated handle 11, the head 16 and the assembly 35 will cooperatively rotate, and the torque will be transferred to the element 38 and a socket or other wrench, not shown, to the fastener, not shown. In this way the fastener may be rotated up until a sufficient resistance occurs, as predetermined, by moving the clamp 20 to the desired inch-pounds, or foot-pounds on the scale 21.

When the resistance is greater than the desired torque, the downward pressure of the torsion bar 18 will be overcome, as best seen in FIGURE 4, and the ball bearings 41 will cam over the lower ball bearings 32, urging the assembly 35 upward in the recess 26 against the end of the torsion bar 18, and a slight separation will occur between the bar 18 and arm 14, thus rendering the ratchet plate assembly 35 inoperative.

As long as the resistance is greater than the torque, this camming or slipping will occur as the handle is turned.

It will thus be seen that as the clamp 20 is moved further from the screw 19, the effective length is decreased and the torque on a fastener will be increased, and greater resistance created between the transmission head 16 and thrust plate assembly 35 is achieved.

With the arrangement of the parts of this invention it will be seen that the tool will work equally well in either a clockwise or counterclockwise direction.

It is possible that after constant use of the wrench it would need recalibration. In such a case, the set screw 25 can be adjusted on the bearing 44 and plate 35 to assure complete accuracy with the scale 21.

While the invention illustrates and describes the use of ball bearings which act as the camming surfaces, it should be realized that the floor 27 and bottom 39 of plate 36 could be formed with protuberances which would achieve the same effect. Additionally, circular waffle springs, roller bearings or the like could be employed with equal effect.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures and devices.

I claim as my invention:

1. A torque wrench comprising a torque transferring element, a handle extending from said torque transferring elements, a torsion member affixed to said handle at a point remote from said torque transferring element, said torsion member overlying at least a portion of said handle and adapted for partial resilient separation therefrom, means clamping said handle and torsion member together and said clamp means being shiftable toward and away from said point of fixed connection to increase or decrease the effective length of the torsion member, a first thrust plate associated with said torsion member coaxially aligned with said torque transferring element, a second thrust plate mounted on said handle in axial alignment with said first thrust plate and said torque transferring element, said thrust plates having mutually facing surfaces and axially protruding means on said first plate and said second plate, said last named means of each plate extending into the plane of the other and adapted to interlock for imparting rotative movement of the handle to the torque transferring means, said protruding means being interlocked for torque transmitting purposes and being adapted to slide past each other by a relative camming action dependent upon the effective length and consequent flexibility of the torsion member.

2. A torque wrench as defined in claim 1 wherein said second thrust plate includes an anular recess which receives said first thrust plate in axial alignment therewith.

3. A torque wrench as defined in claim 1 wherein said axially protruding means includes a plurality of equally spaced apart recesses arranged in complementary relationship on each of said mutually facing surfaces, and each of said recesses fitted with a ball bearing having a portion projecting into the plane of a complementary ball bearing when in interlocked position.

4. A torque wrench as defined in claim 1 wherein said clamp means surrounds the torsion member and a portion of said handle and includes a fastener means to secure said clamp to said torsion member and said handle.

5. A torque wrench as defined in claim 1 wherein said torsion member is a resilient bar.

6. A tool for applying torsion to a fastener comprising a first rotatable thrust member including means for rotating said tool, a second rotatable thrust member coaxially aligned with said first thrust member and including torque transfer means, each of said thrust members having mutually facing surfaces, a resilient torsion member overlying a portion of said second thrust member and said means for rotating said tool and affixed at a point to said means for rotating said tool, adjustable means on said torsion member adapted to increase or decrease the effective length of said torsion member, transmission means interposed between said mutually facing surfaces capable of imparting simultaneous rotation to said first and second thrust members and capable of releasing said second thrust member from rotation dependent upon the effective length and consequent flexibility of the torsion member.

7. A torque limiting wrench comprising a pair of rotatable coaxial members including a first member having torque transfer adapter means, and a second member having a handle portion adapted to rotate the member about the common axis, said first member being shiftable along the common axis, bearing cam lock means interposed between said members whereby the two members may be interlocked for simultaneous rotative movement and cammingly disengaged when a predetermined resistance on said torque transfer adapter means is encountered, a resilient torque bar means overlying a portion of said handle portion and said members and secured at a point to said handle portion remote from said members, said torque bar means bearing on said first member urging said members together, an adjustable clamp means mounted on said torque bar means adapted to vary the shiftable resistance of said first member away from said second member whereby said second member may be singularly cammingly rotated.

8. A torque limiting wrench as defined in claim 7 wherein said second member is formed with a recess and said first member includes a thrust plate seated within said recess.

9. A torque limiting wrench as defined in claim 7 wherein said bearing cam lock means includes complementary opposed axial projections extending from said first and second members, and said projections of each member extending into the plane of the other.

10. A torque limiting wrench as defined in claim 9 wherein said projections are ball bearings.

11. A torque limiting wrench as defined in claim 7 wherein said handle may be rotated in a clockwise or counterclockwise direction.

12. A torque wrench comprising a torque transferring adaptor, a handle extending from said torque transferring adaptor, a resilient torsion bar affixed to said handle at a point remote from said torque transferring adaptor, said torsion bar overlying at least a portion of said handle and adapted for partial resilient separation therefrom, means clamping said handle and torsion bar together and said clamp means being shiftable toward and away from said point of fixed connection to increase or decrease the effective length of the torsion bar, a first thrust plate associated with said torsion member coaxially aligned with said torque transferring adaptor, a second thrust plate

mounted on said handle and formed with an annular recess, said first thrust plate mounted within said recess, said plates having mutually facing surfaces and formed with a plurality of equally spaced apart recesses arranged in complementary relationship on each of said mutually facing surfaces, each of said recesses fitted with a ball bearing having a portion projecting into the plane of a complementary ball bearing and adapted to interlock for imparting rotative movement of the handle to the torque transferring means, said ball bearings being interlocked for torque transmitting purposes and being adapted

to slide over each other by a relative camming action dependent upon the effective length and consequent flexibility of the torsion bar.

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