Sept. 13, 1966 W. E. VAN HOOSE 3,272,036

TORQUE LIMITING WRENCH

Filed Oct. 30, 1964

FIG. 1.

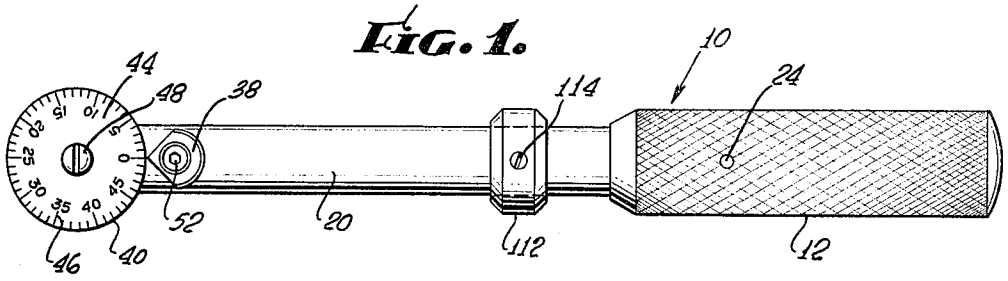


FIG. 2.

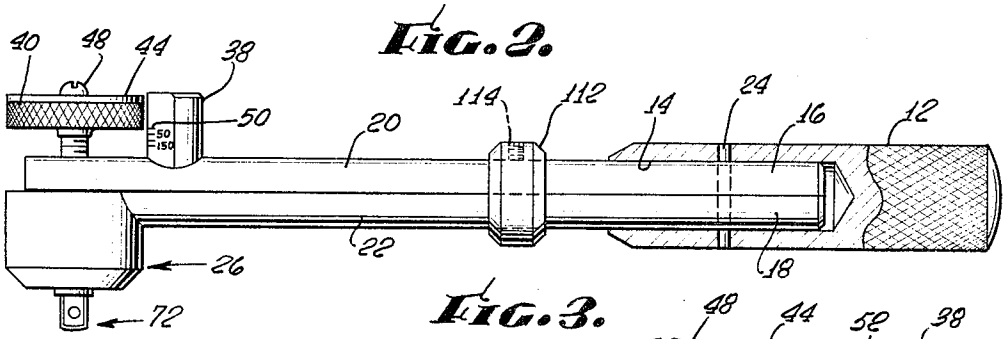


FIG. 3.

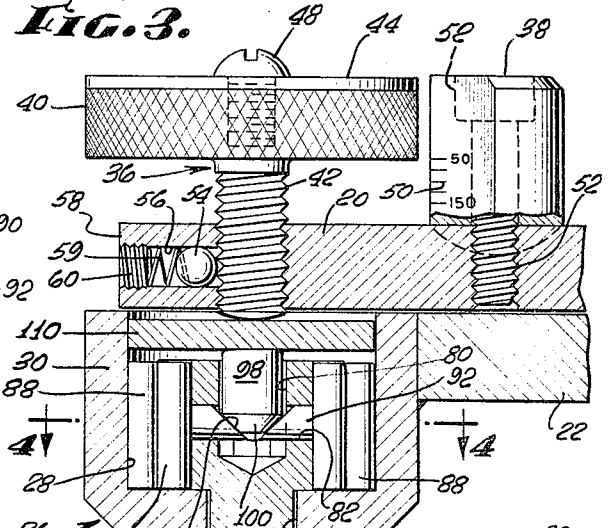


FIG. 4.

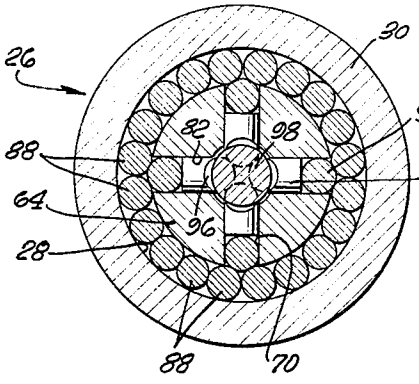


FIG. 5.

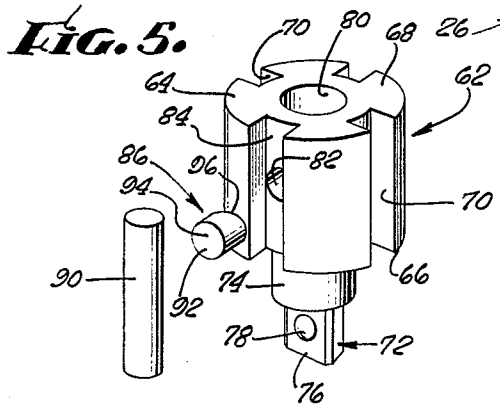
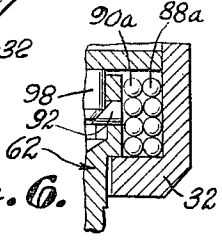


FIG. 6.



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TORQUE LIMITING WRENCH

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13 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 may include a wrench adapted to tighten a threaded fastener to a predetermined tightness.

In modern industry it has become the custom of the engineering profession to prescribe the torque limits to be applied to threaded fasteners used for joining parts together in a secured relationship. These torque limits are precisely defined in order that the elastic limits of the elements and the joined parts will not be exceeded and yet the parts will be secured as tightly together as required by specification.

To the end that specific torque limits may be met and not exceeded, it is an object of this invention to provide a torque limiting wrench which is precisely calibrated to measure accurately the amount of torque pressure required to set a fastener. Such calibrations may be measured in pound-feet, ounce-inches, in the metric scale, or the like.

Another object of this invention is to provide a torque limiting wrench which is adaptable for use in torquing a number of different types of fasteners dependent upon the wrench head which is associated with the wrench per se.

A further object of this invention is to provide a torque limiting wrench which may be used with equal precision in a clockwise or counterclockwise manner.

A further object of this invention is to provide a torque limiting wrench including a handle portion, upper and lower deflecting beams, a rotatable torque transmission means associated with said lower deflecting beam and adjustable calibration means.

A more specific object of this invention is to provide a torque limiting wrench having an adjustable compensating collar means associated with the upper and lower deflecting means which can be preset to a desired torque requirement which clamp will increase or decrease the effective length of the deflecting beams.

A further object of this invention is to provide a torque limiting means utilizing a friction principle for releasing the rotatable transmission means when the required torque has been achieved as a threaded fastener has been secured in place.

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 and calibration means of the torque limiting wrench;

FIGURE 4 is a cross sectional view of the ratchet head taken on line 4—4 of FIGURE 3;

FIGURE 5 is a detailed perspective view of the torque transferring means; and

FIGURE 6 is a fragmented sectional view similar to FIGURE 3 showing a modified embodiment of this invention.

This invention generally comprises two complementary coaxial rotatable members, one of which members includes a torque transfer means to receive a wrench adapted to grip a fastener; the other member includes a manually operable handle. There is also provided means for frictionally adjusting the member which includes the torque transferring means for simultaneous movement with said other rotatable member but yet being adjustable whereby said member may be disengageable from said other rotatable member through a slipping or camming action whereby the torque transferring means may remain stationary.

The torque limiting wrench generally designated **10**, includes a handle portion **12** which may be knurled for better gripping as illustrated in the drawings. The handle **12** is formed with a longitudinal bore **14** which receives the shank ends **16** and **18** of a pair of elongated upper and lower deflecting beams **20** and **22**, respectively. Each of the deflecting beams **20** and **22** are preferably half circles in cross section so that when the beams **20** and **22** are positioned within the bore **14** they form a complete circle. In order to secure the beams **20** and **22** within the handle **12** a set pin **24** may be employed.

The lower deflecting beam **22** remote from the shank **18** is secured to a ratchet head designated **26**. The ratchet head **26** is circular, as shown in FIGURE 4, and provided with a circular opening **28** including an annular upright wall **30** and a bottom wall **32**. Centrally located within the opening **28** and extending through the bottom wall **32** is a reduced opening **34** best seen in FIGURE 3. The ratchet head **26** will be generally referred to as the first rotating means or the roller housing.

The upper deflecting beam **20** remote from the shank **16** and positioned axially with the opening **34** in the housing **26** includes a torque calibrating screw means **36** and a calibrating pointer **38**. The calibrating screw means **36** is threadably secured in the upper deflecting beam **20** and includes a preferably knurled head **40** mounted upon the threaded shank **42**. In the preferred embodiment a calibration plate **44** including increments **46** which may be etched on the surface of the plate **44** is positioned on the top of the knurled head **40** and held in position by means of a screw **48**. The calibration plate may be adjusted by means of releasing the screw **48** so that the proper pounds-feet, ounces-inches, or the like of pressure may be properly achieved through the use of this torque limiting wrench. The pointer **38** may also include increments **50** for use with the torque calibration screw means **36** with the vertical adjustment of the screw means within the upper deflecting beam **20**. The pointer **38** is drilled so that a screw **52** may be inserted through the pointer to threadably secure the pointer onto the upper deflecting beam **20**.

In order to maintain the torque calibrating screw means **36** in proper alignment a friction ball **54** is placed within a bore **56** drilled in the end **58** of the upper deflecting beam **20**. The ball **54** is constantly urged against the screw **42** by means of a coil spring **59** which is seated against a set screw **60** threadably secured in the bore **56**. The set screw **60** may be turned creating greater pressure against the screw **42**, depending upon the wear placed on the threads of the screw **42**.

Mounted within the opening **28** in the ratchet head **26** is a drive plug means generally designated **62**. It includes a main circular body section **64** having generally flat parallel ends **66** and **68**. The height of the main body **64** is generally less than the height of the upright wall **30** of the ratchet **26**. The circular main body **64** is provided

with a plurality of longiutdinal slots 70 extending between the ends 66 and 68. These slots 70 are preferably arranged in the 90° increments around the body portion 64 as best seen in FIGURE 5.

The body portion 64 further includes a torque transferring element 72. The torque transferring element 72 includes a circular shank 74 extending downwardly from the surface 66 of the main body and having a common axis with the longitudinal axis of the body 64. The circular shank 74 further includes an adapter 76 which is adapted to receive a socket wrench or other type of wrench. It is a customary adapter including a spring loaded detent 78. The shank 74 is of a diameter slightly less than the diameter of the opening 34 in the ratchet head 26 so that it may extend through the opening 34 with the adapter protruding from the ratchet head as best seen in FIGURE 3.

The main body portion 64 is provided with a longitudinal axial bore 80 extending from the surface 68 to a point at least midway between the ends 66 and 68. The head 64 is further provided with openings 82 which extend from the axial bore 80 radially outward to a back wall 84 of the longitudinal grooves 70. Each of the slots 70 are provided with these openings 82 which communicate with the longitudinal axial bore 80.

Interposed between the wall 30 and the circular body portion 64 is a bearing cam lock means generally designated 86. Said means includes a plurality of elongated rollers 88 spaced in abutting relation around the wall 30 as best seen in FIGURE 4. The rollers 88 are generally of a length corresponding to the length of the main body 64. The bearing cam lock means 86 also includes cam means wherein each of the slots 70 is fitted with an elongated roller 90 corresponding in diameter and length to the rollers 88. The rollers 90 bear in aligned contact against the elongated rollers 88. Mounted within each of the openings 82 are bearing pins 92. These bearing pins are provided with a forward end 94 generally normal to the axis of the openings 82. The rear ends of the pins 92 are tapered at 96, best seen in FIGURE 3. Mounted within the elongated longitudinal bore 80 is an actuating pin or rod 98. The rod is provided with a generally flat top surface and the bottom end is beveled forming a cone 100. The taper of the cone 100 corresponds to the tapered ends 96 of the pins 92 and is in abuting relationship therewith.

Resting on the top surface of the actuating pin or rod 98 is a disc cover 110 having a diameter corresponding to the diameter of the circular opening 28 in the head 26.

In operation a slidable collar 112, which entends around a portion of the upper and lower deflecting beams 20 and 22, is positioned at a predetermined spot along the length of the beams and set in place by means of a set screw 114. This collar 112 will act as a fulcrum for the deflecting of the upper beam 20 away from the lower beam 22. When the proper amount of torque has been determined for the fastener which is to be secured by the torque limiting wrench, the torque calibrating screw means 36 is threadably drawn into and through the upper deflecting means 20 bearing against the disc cover 110 which in turn bears against the actuating pin or rod which is on a common axis with the shank portion 42 of the means 36 and is urged downwardly against the tapered ends 96 of the horizontally extending bearing pins 92 which in turn will urge the bearing pins outwardly against the single elongated roller 90 and will lock the rollers 90 between two of the elongated rollers 88, as best seen in FIGURE 4. The further down that the threaded shank 42 is turned the farther apart the upper deflecting means will be deflected and moved from the lower deflecting means and the greater the pressure in line contact will be exerted between the rollers 90 and adjacent rollers 88.

In this way when torque is applied through the handle 12 the head 26 and the assembly 62 will cooperatively rotate and torque will be transferred to the adapter 72 and a socket or other wrench, not shown, to a fastener, not shown. In this way a fastener may be secured to a predetermined inch-pounds or foot-pounds at which time the resistance is greater than the required torque and the line contact between the rollers 90 and 88 will be overcome and the head 64 will move independently of the ratchet head 26 and the rollers 90 will cam over the rollers 88 and thus the drive plug means 62 will be rendered inoperative and no further tightening of the fastener will be possible.

As long as the resistance is greater than the torque this camming or slipping of the bearing roller 90 will occur as the handle 12 is rotated.

While the applicant has illustrated and preferred the use of elongated rollers 88 and elongated bearing rollers 90 due to the complete line contact along the entire length of the respective rollers a plurality of ball bearings could be substituted for either or both the rollers 88 and 90. For instance, instead of rollers 88 and 90 stacked ball bearings 88*a* and 90*a*, respectively, could be used as shown in FIGURE 6.

With the calibrating plate 40 held in place to the knurled head 40 by means of a screw 48 it can be seen that recalibration is possible when constant use of the wrench has altered the accuracy required to achieve the exact inch-pounds or foot-pounds of pressure required for the specific torquing of fasteners. Additionally the sliding collar 112 provides an additional compensation means for recalibration which is achieved by moving the collar 112 toward the handle 12 or toward the pointer 38.

Although the invention has herein been 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 limiting wrench comprised of two complementary coaxial rotatable members mounted for rotation relative to one another about their common axis, the first said rotatable member including internal bearings and a handle, and the second said rotatable member mounted within the first rotatable member, said second rotatable member including a torque transfer member and radially mounted cam means, an actuating member resiliently mounted for axial movement within said second rotatable member which presses against and radially urges said cam means, means for adjustable frictional locking of said second rotatable member with said first rotatable member about their common axis through adjustable radial urging of the cam means outwardly against said internal bearings caused by axial pressure applied by said actuating member on said cam lock means and responsive radial locking between the first and second rotatable members up to a predetermined torque limit beyond which the first rotatable member will rotate independently of the second rotatable member, and means for adjusting the radial pressure of the first rotatable member relative to the second rotatable member so as to vary the amount of frictional engagement of the internal bearings of the first rotatable member with the cam means of the second rotatable member.

2. A torque limiting wrench as described in claim 1 wherein the cam means includes a plurality of pins which radiate from the common axis and are slidably adjustable so as to vary the amount of frictional engagement of the first rotatable member with the second rotatable member.

3. A torque limiting wrench as described in claim 2 wherein the pins of the cam means abut and press against rotatable bearings in the second rotatable member which in turn abut and press against the internal bearings of the first rotatable member.

4. A torque limiting wrench comprising a handle portion, a pair of elongated first and second deflecting beams

one overlying the other having one end of each pair mounted in said handle for simultaneous rotation, said first beam at the opposite end including a first member rotatable with said handle, a second member coaxially mounted in said first member including a torque transferring element and capable of simultaneous rotation with said first member about a common axis, said second beam including a portion overlying said first and second members and capable of being resiliently deflected axially away from said first and second members, radiating bearing cam means projecting from said common axis and interposed between said first and second members whereby said members may be locked for simultaneous rotative movement and cammingly disengaged when a predetermined resistance on said torque transferring element is encountered, an actuating member mounted for axial movement within said second member which presses against and radially urges said bearing cam means, and said second beam exerting downward pressure along said common axis against said actuating member which, in turn, causes said radiating bearing cam means to vary the camming resistance whereby said first member is capable of independent movement from said second member.

5. A torque limiting wrench as described in claim 4 wherein a collar means encircles the first and second deflecting beams and can be slidably adjusted to increase or decrease the effective deflectable length of the beams.

6. A torque limiting wrench as described in claim 4 wherein the first member is a ratchet head.

7. A torque limiting wrench comprising a handle portion, a pair of elongated first and second deflecting beams, one overlying the other, having one end of each beam mounted in said handle for simultaneous roation, a slidable collar encircling both of said deflecting beams which is adjustable so as to vary the effective deflectable length of the beams, said first beam at the opposite end including a ratchet head rotatable with said handle, a drive plug including a torque transfer element coaxially mounted in said ratchet head which is capable of simultaneous rotation with said ratchet head, said drive plug being provided with an axial bore and radially extending openings communicating with said axial bore, pins slidably mounted within said radially extending openings which are of sufficient length to engage objects at both ends of said radially extending openings, an adjustable actuating member slidably mounted within said axial bore having a cone-shaped end which abuts the ends of the pins in the axial bore so as to move said pins within the radially extending openings as different diameter horizontal sections of the cone are abutted by the pins, and calibrated means on said first deflecting beam exerting adjustable axially directed pressure on said actuating member so as to vary the radial movement of said pins, rotatable bearings peripherally mounted on the drive plug and abutting the end of said pins which is remote from the ends abutting said actuating member, and internal bearings axially mounted in said ratchet which may be frictionally locked to said rotatable bearings in the drive plug by radially directed pressure of said pins upon the rotatable bearings and cammingly disengaged when a predetermined resistance on the torque transferring element is encountered.

8. A torque limiting wrench as defined in claim 7 wherein the rotatable bearings are roller bearings.

9. A torque limiting wrench as defined in claim 7 wherein the rotatable bearings are ball bearings.

10. A torque limiting wrench as described in claim 7 wherein the pins mounted within the radially extending opening of the drive plug slope at an angle substantially complementary to the slope of the cone-shaped end of the actuating pin where said pins abut the actuating member.

11. A torque limiting wrench as described in claim 7 wherein the rotatable bearings are each mounted in peripheral recesses in the drive plug which communicate through the radially extending openings with the axial bore of the drive plug so as to allow engagement of the ends of the pins in said axial radially extending openings with rotatable bearings mounted in the peripheral recesses and the actuating member within the axial bore of the drive plug at the same time.

12. A torque limiting wrench comprising a handle portion, a pair of elongated first and second deflecting beams, one overlying the other, having one end of each mounted in said handle for simultaneous rotation, said first beam at the opposite end including a first member rotatable with said handle, a second member coaxially mounted in said first member including a torque transferring element and capable of simultaneous rotation with said first member about a common axis, said second beam including a portion overlying said first and second members and capable of being deflected away from said first and second members, radiating bearing cam means projecting from said common axis and interposed between said first and second members whereby said members may be locked for simultaneous rotative movement and cammingly disengaged when a predetermined resistance on said torque transferring element is encountered, wherein said bearing cam means includes a plurality of pins which radiate from said common axis and are slidably adjustable so as to vary the pressure against the internal surface of said first member, and an adjustable means associated with said second beam exerting downward pressure along said common axis against said radiating bearing cam means to vary the camming resistance whereby said first member is capable of independent movement from said second member.

13. A torque limiting wrench as defined in claim 12 wherein the pins of the bearing cam means abut and press against rotatable bearings in the second member which in turn abut and press against internal bearings in the first member.

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