PREDETERMINED TORQUE RELEASE WRENCH WITH SIGNALLING MEANS

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.
PREDETERMINED TORQUE RELEASE WRENCH WITH SIGNALLING MEANS

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This invention relates to torque indicating wrenches and is particularly directed to improvements over the construction shown in my prior Patent No. 2,732,747 granted January 31, 1956.

Torque wrenches of this type are adjustable so that the required torque can be set in advance for any desired value within the range of operation. It is an important object of my invention to provide an improved torque indicating wrench which "signals" when the desired torque value is reached by abruptly decreasing the resistance of the handle to the force applied. A toggle mechanism contains parts which move "over-center" with a snap action. The abrupt release of resistance occurs in a relatively short time of travel of the handle.

Another object is to provide an improved torque indicating wrench having an improved mounting for the slide block which is actuated by the toggle mechanism and which moves against the force of a coil spring. Another object is to provide an improved load screw assembly for accurately adjusting the force of the spring. Another object is to provide an improved latch mechanism for securing the load screw in adjusted position.

In the drawings:

Figure 1 is a perspective view showing a preferred embodiment of my invention.

Figure 2 is a longitudinal sectional view thereof, partly broken away.

Figure 3 is a top plan view showing a portion of the case or housing.

Figure 4 is a detail partly broken away showing a portion of the housing and the load screw assembly.

Figures 5, 6, 7, 8, 9, and 10, are transverse sectional views taken on section lines as indicated on Figure 2.

Referring to the drawings, the torque wrench assembly generally designated 10 includes a case or housing 11, a work-engaging head 12 and a torque adjusting grip element 13. The head 12 is of conventional design and may include a ratchet device (not shown) for connecting the square driver 14 with the supporting lever arm 15.

The lever arm 15 is positioned within the forward end 16 of the housing 11. This portion of the housing is flattened to an oblong or oval shape in cross section. The lever arm 15 is pivotally mounted with respect to the housing 11 by means of the fulcrum pin 17. Ball elements 18 mounted on the lever arm 15 roll within the parallel inside surfaces 19 of the oval portion 16 of the housing.

A slide block 20 is mounted within the housing 11 and this block comprises a pair of parallel plates 21 having a space or gap 22 therebetween. The plates 21 are notched as shown at 23 to receive the oppositely extending trunnions 24 formed integrally with the roller 25. The roller 25 engages a flat axially extending surface 26 formed on the inside wall of the housing 11 near the transition zone between the flattened oval portion 16 and the cylindrical portion 27.

A toggle link 28 is mounted between the rearward end of the lever arm 15 and the forward end of the block 20. This toggle link 28 engages the pivot pin 29 mounted on the lever arm 15 and engages the pivot pin 30 mounted on the block 20. An adjusting screw 31 on the lever arm 15 engages a surface 32 provided on the inner surface of the housing 11 to limit swinging movement of the lever arm 15 about the fulcrum pin 17 in a clockwise direction as viewed in Figure 2. The setting of the screw 31 may be adjusted by means of a tool (not shown) inserted through the opening in the housing which is normally closed by a threaded plug 33.

The rearward end of the block 20 is centered on a projection 34 which is centrally mounted on the slide collar 35. The collar 35 slides freely within the cylindrical bore 36 in the housing part 27. The forward end of the load spring 37 engages the collar 35 and is held in central position by means of a lip 38 on the collar 35. The spring 37 normally maintains the toggle parts in the position shown in Figure 2. When torque is applied through the head 12 to the square driver 14, however, a force is applied to the toggle link 28 which tends to move the block 20 in a direction to compress the load spring 37. When the applied torque reaches a predetermined value, the lever arm 15 swings about the fulcrum pin 17 in a counterclockwise direction as viewed in Figure 2. The toggle link 28 moves toward center and the lever arm 15 comes to rest with the abutment 40 engaging the inner surface of the housing section 16. The side load on the forward end of the block 20 is taken by the roller 25 which rolls along the surface 26 with a minimum of fractional resistance. The toggle link 28 moves toward center with a snap action and this results in a sudden decrease in resistance exerted by the torque wrench assembly to the force exerted manually by the operator. This serves as a signal that torque of the proper magnitude has been applied. The mechanism automatically resets when the operator relaxes the force on the handle.

The rearward end of the load spring 37 engages a non-rotary dimple plate 42. A radial pin 42a on this dimple plate travels in an axial slot 64 provided in the cylindrical portion 27 of the housing 11. A second dimple plate 43 is mounted within the housing 11 and a circumferential series of balls 44 is mounted between the dimple plates 42 and 43. A retainer 45 may be provided to maintain the balls 44 in circumferentially spaced relationship. Each of the dimple plates 42 and 43 is provided with a series of shallow dimples or recesses 46 and 47.

A load screw member 50 is provided with external threads 51 which engage the internal threads 52 provided in the rearward end of the housing section 27. A dished washer-like spring 53 of the Belleville type is positioned between the forward end of the load screw 50 and the dimple plate 43. Spline elements are provided to cause the dimple plate 43 to turn as a unit with the load screw 50. From this description it will be understood that turning movement of the load screw 50 with respect to the housing 11 serves to adjust the compression of the load spring 37.

The load screw 50 is provided with axially extending slots 56 and a portion of the slotted section is provided...
with external threads 57 which engage within the internal threads 58 on the grip element 13. The bore 59 of the grip element 13 has a free running fit with the outer surface of the cylindrical portion 27 of the housing 11. The load screw 50 is fixed for operation as an integral unit with the grip element 13 by means of an expanding threaded ring 66. The tapered threads on this ring serve to expand the slotted portion of the load screw 50 to prevent any relative motion between the threads 57 and 58 during normal operation of the tool. Suitable indicia such as a scale 61 calibrated in inch pounds or foot pounds may be provided on the housing portion 27, with means being provided for the grip element 13 serving as the indicator. The threads 57 and 58 provide a means of initially adjusting the position of the grip element 13 with respect to the load screw 50 so that the scale 61 produces a correct reading with respect to the indicator 62.

It is desirable that the cooperating threads on the load screw 50 and housing 11 have a Class 3 or Class 4 fit, in order to prevent any looseness or backlash. I have found that a very effective way of providing desired fit between the threads 51 and 52 is to form the axially extending slots 64 in the housing portion 27, which slots terminate short of the extreme rearward end of the housing. The slots extend through the threads 52. Narrow slits 65 are then formed in the housing wall between the slots 64 and the extreme rearward end of the housing 11. Metal wire (not shown) is wrapped around the outside of the housing portion 27 in the region of the slits 65 drawing down the diameter of the internal threads 52. The housing 11 is then heat treated with the wire in place. After heat treatment the wire is removed and discarded, and thereafter the threads 52 within the housing grip the external thread 51 on the load screw 50 to eliminate looseness and backlash.

Means are provided for latching the load screw 50 in the adjusted position and as shown in the drawings, this means includes the bolt 67 having a hollow head 68 provided with internal wrenching surfaces. The bolt extends axially through a portion of the load screw 50, dimple plates 43 and 42 and is engaged by a nut which serves as a pilot for the load spring 37. After assembly the nut is crimped or otherwise distorted or welded to prevent any motion with respect to the bolt 67. The nut engages the nonrotary dimple plate 42. The bolt 67 is loosely received within cylindrical openings provided in the parts 43, 45 and 46 and is threaded into the load screw 50. A hexagonal shank 71 is caged or held into the wrenching surfaces in the hollow head 68 of the bolt 67 by the screw 77. This hexagonal shank 71 is slidably received within the hexagonal bore 72 of the lock sleeve 73. This sleeve 73 has a flange 74 which engages the back side of a split retainer ring 75 mounted at the rearward end of the grip element 13. The manually operable knob 76 projects rearwardly of the grip element 13 and is formed integrally with the sleeve 73. Turning of the knob 76 in a left hand direction serves to turn the clamping bolt 67 and thereby prevents relative axial movement of the dimple plates 42 and 43. Turning of the knob 76 in a right hand direction serves to lock the adjusting screw 50 in a selected position.

In operation, the manual knob 76 is turned in a right hand direction to release the load screw 50, and the grip element 13 is turned manually to the desired torque setting as indicated by the parts 61 and 62. The load screw 50 of the grip element 13 carries turning movement of the load screw 50 since these parts operate as a single integral unit. The dimple plate 43 turns with the load screw 50 while the dimple plate 42 does not turn. The balls 44 accordingly climb into and out of successive dimples 46 and 47 thereby causing axial movement of the dimple plate 43. This, in turn, causes the pin 42a to move axially in the slot 64 and causes the main load spring 37 alternately to expand or contract as the dimple plate 42 moves back and forth.

The screw 77 is threaded into the sleeve 73 until the end portion thereof abuts the end of the hexagonal shank 71 in an unlocked position. The sealing plug 78 is then installed to prevent access to the screw 77. A slight amount of looseness is present when the adjustment is in the unlocked position but not enough to permit removal of the snap ring 79.

The Belleville spring 53 maintains resilient pressure contact between the dimple plates 42 and 43 and thereby prevents the balls 44 from moving out of the dimples in one of the plates when no pressure is being exerted by the spring 37. The knob 76 is then turned in the left hand direction to lock the load screw 50 at the selected torque setting. The square driver 14 is engaged with the work (not shown) and the lever 80 on the ratchet head 12 is moved to the desired position to transmit right hand torque or left hand torque. The operator then applies a force manually to the grip element 13 in a direction approximately at right angles to the axis thereof.

When the torque load on the square driver 14 reaches the value as shown by the scale parts 61 and 62, the toggle link 28 moves toward center and the abutment surface 40 on the lever arm 15 strikes the interior of the housing portion 16. The sudden release of resistance to the outward end of the housing 11 then causes the dimple plate 42 to move rearwardly back into the housing and the main load spring 37 alternately to expand or contract as the dimple plate 42 moves back and forth.

Holding firmly describe my invention, it is to be understood that I do not wish to be limited to the details herein set forth, but my invention is of the full scope of the appended claims.

1. In a torque wrench, the combination of: a work- engaging member having a laterally projecting part, a tubular housing extending longitudinally over the laterally projecting part of said work-engaging member, fulcrum means pivotally connecting the member to the housing, a block mounted for axial movement within the housing, a collar supporting one end of the block and slidably guided by the tubular housing, a spring acting on the collar to move the block axially, the collar having a lip engaging the spring to prevent contact of the spring and housing, a toggle link operatively interposed between the laterally projecting part of said work-engaging member and the end of said block removed from said collar, and a roller on the block near the toggle link and extending laterally thereof for engaging an inner surface on the tubular housing.

2. In a torque wrench, the combination of: a work- engaging member having a laterally projecting part, a tubular housing extending longitudinally over the laterally projecting part of said work-engaging member, fulcrum means pivotally connecting the member to the housing, a block mounted for axial movement within the housing, a collar supporting one end of the block and slidably guided by the tubular housing, a spring acting on the collar to move the block axially, the collar having a lip engaging the spring to prevent contact of the spring and housing, a toggle link operatively interposed between the laterally projecting part of said work-engaging member and the end of said block removed from said collar, and a roller on the block near the toggle link and extending laterally thereof for engaging an inner surface on the tubular housing.

3. In a torque wrench, the combination of: a work- engaging member having a laterally projecting part, a tubular housing extending longitudinally over the laterally projecting part of said work-engaging member, having an oval portion and a cylindrical portion, fulcrum means pivotally connecting the member to the oval portion of the housing, a block mounted for axial movement within the cylindrical portion of the housing, a collar supporting one end of the block and slidably guided by the tubular housing, a spring acting on the collar to move the block axially, the collar having a lip engaging the spring to prevent contact of the spring and housing, a toggle link operatively interposed between the laterally projecting part of said work-engaging member and the end of said block removed from said collar, and a roller on the block near the toggle link and extending laterally thereof for engaging an inner surface on the tubular housing.
between the oval and cylindrical portions, and a roller on the block near the toggle link engaging said flat surface.

4. In a torque wrench, the combination of: a work-engaging member, a tubular housing having internal threads at one end interrupted by an axial slot, a block axially movable within the housing, toggle means interposed between said member and the block, a non-rotary dimple plate having a pin adapted to travel in the housing slot, a compression spring within the housing interposed between the dimple plate and the block, a load screw having external threads engaging the internal threads of the housing, a second dimple plate connected to turn with the load screw, a plurality of balls interposed between said dimple plates, and a spring washer interposed between the load screw and the second dimple plate.

5. A torque wrench comprising: a work engaging member; a tubular housing having means at one end to fulcrum said work engaging member and internal screw threads at its opposite end; a force-transmitting block axially slideable in said housing; a toggle means interposed between said block and work engaging member; a compression spring engageable with said block; a load screw engaging the internal screw threads of said housing; a dimple plate assembly interposed between said load screw and spring, said assembly including a non-rotatable dimple plate, a rotatable dimple plate, balls interposed between said plates and a spring interposed between the rotatable dimple plate and load screw; a clamp screw rotatably mounted in said load screw and extending into said non-rotatable dimple plate to draw said dimple plates together; a sleeve axially adjustable on said load screw; and a telescopic drive means for said clamp screw extending to an axial end of said sleeve.

6. In a torque wrench, the combination of: a work-engaging member having a laterally projecting lever arm, a tubular housing extending axially over said lever arm and having an internal roller-engaging surface and fulcrum means pivotally connecting the member to the housing, a block mounted for axial movement within the housing and having an end confronting said lever arms, resilient means acting to move the block axially toward said lever arm, a toggle link operatively interposed between the lever arm and the confronting end of said block, a roller on the block near the toggle link and extending laterally thereof for engagement with said internal surface within the tubular housing, and a guide member at the end of said block remote from said lever arm cooperating with the walls of said housing and said roller to limit said block to axial movement.

7. In a torque wrench, the combination of: a work-engaging member having a laterally projecting lever arm, a tubular housing extending axially over said lever arm and having an internal roller-engaging surface and an internal guide member-engaging surface, fulcrum means near one end of the housing pivotally connecting the work-engaging member to the housing, a block mounted for axial movement within the housing and having an end confronting said lever arm, a spring acting to move the block axially, a toggle link operatively interposed between the lever arm and the confronting end of said block, a roller on the block near the toggle link and extending laterally thereof for engagement with the internal roller-engaging surface within said housing, a guide member at the end of said block remote from said lever arm engaging said internal guide member-engaging surface and cooperating with said roller to limit said block to axial movement, and means near the other end of the housing for adjusting the force of the spring.

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