

[54] **TORQUE APPLYING AND TORQUE LIMITING TOOL**

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[51] Int. Cl. **F16d 43/20**

[58] Field of Search 192/56 F, 59; 81/52.4 R, 81/52.4 A

[56] **References Cited**

UNITED STATES PATENTS

2,408,501	10/1946	Wright.....	192/56 F
3,608,334	9/1971	Zinner.....	192/56 F
3,664,474	5/1972	Blake et al.	192/56 F

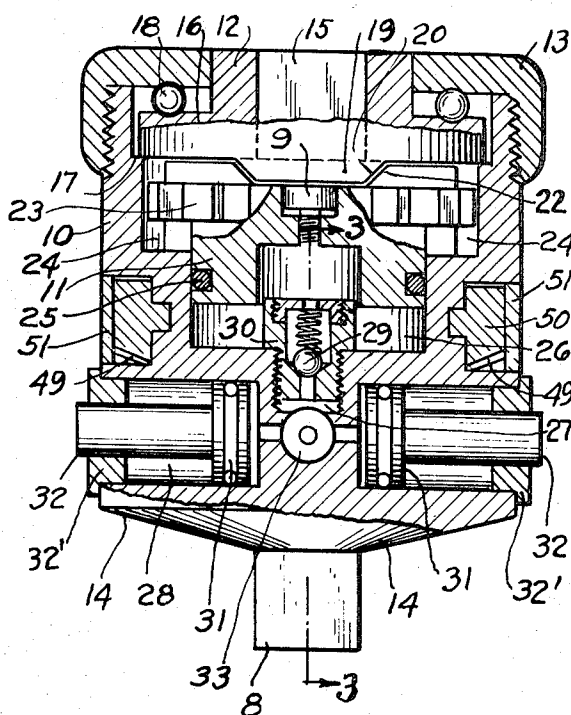
Primary Examiner—Allan D. Herrmann

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ABSTRACT

A compact torque limiting unit to be turned by an ordinary hand or slow speed power wrench. It releases and spins freely when the limit for which it is set is reached. This prevents over torqueing. It comprises a cup shaped housing containing two clutch members, one rotatable in and fluid supported for longitudinal movement in said housing and the other rotatable in the housing and having an outwardly opening socket to receive a driving part of a conventional wrench. The two clutch members are connected with each other by interengaging means which transmits torque and releases for free running when a maximum torque for which the tool is set is reached. The housing has an external shank to receive a wrench socket by which a threaded part can be turned. The housing has in it a self contained, adjustable, valve controlled fluid circulation system which includes fluid storage cavities and controls release of the two clutch members for free running.

7 Claims, 6 Drawing Figures



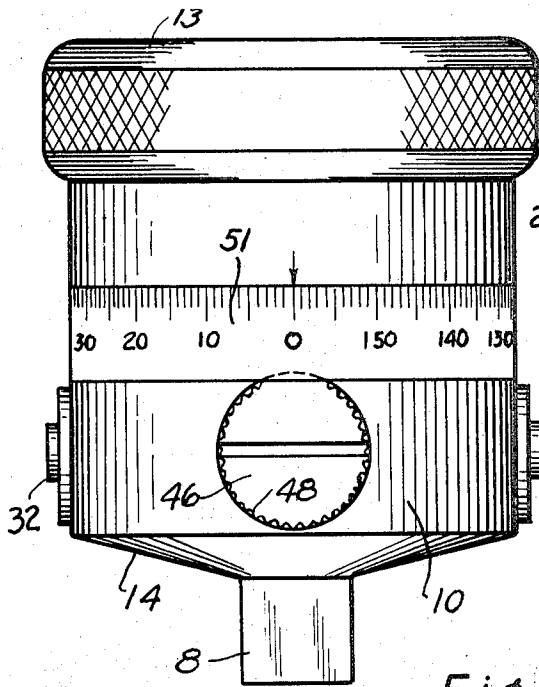


Fig. 1

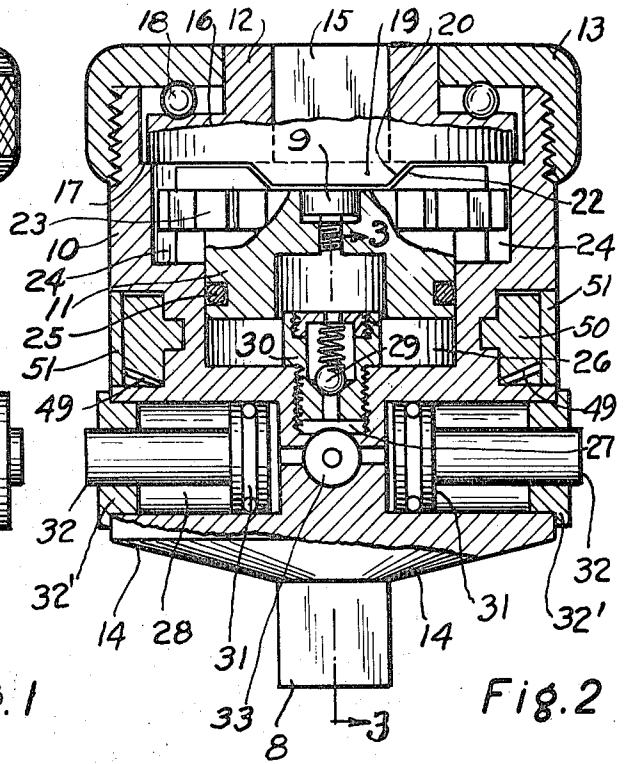


Fig. 2

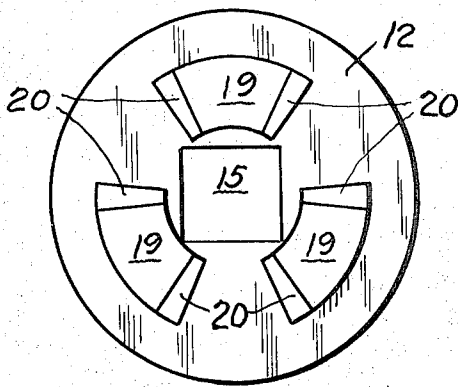


Fig. 4

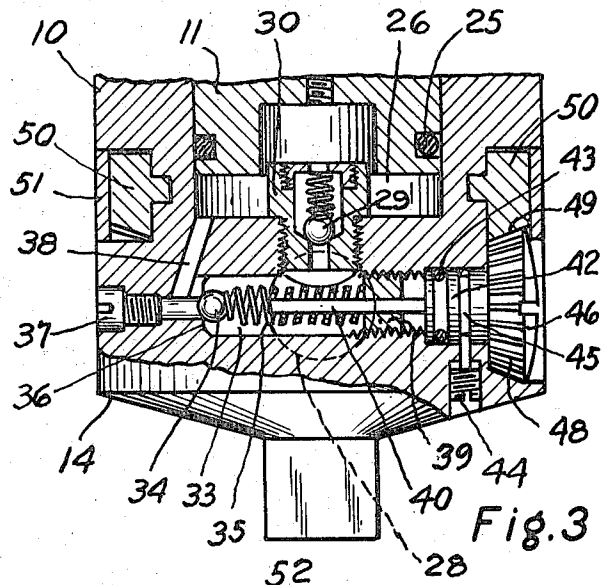


Fig. 3

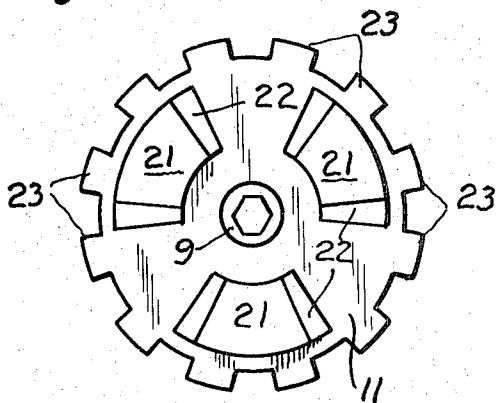


Fig. 5

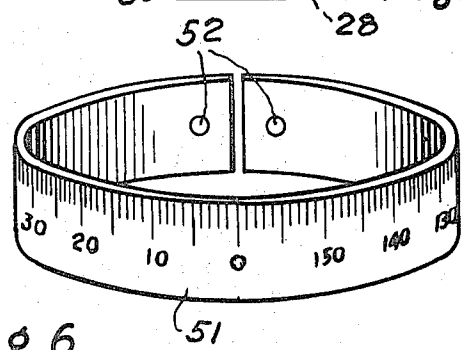


Fig. 6

TORQUE APPLYING AND TORQUE LIMITING TOOL

SUMMARY OF THE INVENTION

Conventional torque wrenches are usually large cumbersome devices complete with handles or other driving means and they usually have means to sound or display a signal when the torque for which they are set is reached. This does not prevent the user from applying more torque after the signal is given.

An object of this invention is to provide a simple, reliable, compact and efficient torque tool which can be set for any desired torque within chosen limits and will release and spin freely when the limit for which it is set is reached thus making it impossible for the user to apply torque in excess of the chosen limit.

Another object is to provide a torque wrench head or cell or unit which is externally smooth and is light in weight, making it convenient to carry in an ordinary tool kit and one which does not have any handle but can be turned or driven by the handle or driving part of any hand operated socket wrench or the driving part of any slow speed power wrench of proper size.

Another object is to provide a releasable torque wrench head or cell in which release or free spinning of the wrench is responsive to variations in fluid pressure but which is self contained and free from external connections with fluid conduits and other fluid pressurizing and controlling devices.

Another object is to provide a torque wrench head or cell comprising a cup shaped housing having, in its bottom end, fluid storage cavities and having in it a ram clutch member which is rotatable with it and longitudinally movable in it and forms one wall of a fluid pressure chamber, and also having in it rotatively supported driving clutch member adapted to receive the driving part of an ordinary square-drive wrench, said two clutch members having between their two opposed sides, interengaging means, which can be cams, and which will transmit torque and will be automatically disengaged by the escape of fluid from said fluid pressure chamber into said fluid storage cavities when torque generated pressure of the fluid in said chamber reaches a predetermined amount for which the wrench head or cell is set and said wrench head further having means for returning fluid from the cavities to the pressure chamber when the wrench is free from torque.

Other objects of the invention will be apparent from the following description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in elevation of a torque wrench head or cell embodying my invention.

FIG. 2 is an axial sectional view, with parts in elevation, of the same.

FIG. 3 is a fragmentary axial sectional view of said wrench head, with parts in elevation, taken on a plane substantially at right angles to the plane of cross section of FIG. 2. FIG. 4 is a detached plan view showing the torque transmitting side of a driving clutch member embodied in my invention.

FIG. 5 is a detached plan view showing the torque transmitting side of a ram clutch member embodied in the invention.

FIG. 6 is a detached perspective view of a rotatively adjustable torque indicator ring used on the housing of my wrench head or cell.

Like reference numerals refer to like parts throughout the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

This torque wrench head or cell comprises four main parts, namely, a cup shaped housing 10, a ram clutch member 11 and a driving clutch member 12, both disposed within the housing 10, and a cap 13 adapted to be removably threaded onto the upper end of the housing 10 and cooperating therewith in containing and supporting clutch members 11 and 12. Ram clutch member 11 has in it an axial bleeder opening which is normally closed by a screw plug 9. The inside wall of the housing 10 is cylindrical and dimensioned to provide chambers of different diameters with shoulders between them, as shown in FIG. 2. The bottom wall 14 of housing 10 is relatively thick and is provided with an external axial shank 8, preferably of square cross section to adapt it to fit within the socket of a conventional square drive socket wrench. This device thus functions as a torque head or cell by which an ordinary socket wrench can be converted into a torque limiting wrench.

The upper end portion of the driving clutch member 12 is cylindrical and rotatively supported in a suitable bearing in the cap 13 and it has an upwardly opening socket 15 of square cross sectional shape to receive the driving part of a hand operated or a slow speed power operated socket wrench. An external annular flange 16 is provided on the lower end of the driving clutch 12 and a narrow internal shoulder 17 in the wall of housing member 10 limits downward movement of said driving clutch 12. Ball type thrust bearings 18 are provided between flange 16 and an overhanging part of the cap 13. A plurality of downwardly extending members 19, herein termed cams, are integral with the lower face of the driving clutch 12. These cams 19 are of generally triangular shape and have inclined or beveled side walls 20. The cams 19 on driving clutch member 12 are adapted to fit between and react against similar cams 21 on the upper face of the ram clutch member 11. Cams 21 have inclined side walls 22 which contact and react against inclined side walls 20 of cams 19.

The upper peripheral end portion of ram clutch member 11 is provided with outwardly protruding, spaced apart tooth like members 23 which mate and interfit with spaced apart longitudinally extending ribs or splines 24 on the inner wall of housing 10. The meshing teeth 23 and splines 24 compel the ram clutch member 11 to rotate with housing 10 while allowing it to move longitudinally in said housing. The lower end part of ram clutch member 11 is cylindrical and fits snugly within a cylindrical part of the housing 10 and an O-ring 25 is provided in a suitable groove near the lower end of said cylindrical part of member 11 to serve as a fluid seal. This forms a fluid pressure chamber 26 between the housing bottom 14 and the ram clutch member 11.

The bottom wall 14 has in it two transverse, intersecting bores or passageways 28, FIG. 2 and 33, FIG. 3, which serve as fluid storage cavities and said bottom wall 14 further has in it an axial bore 27 which connects the pressure chamber 26 with the fluid storage cavities

28 and 33. A spring pressed valve 29 is disposed in a suitable housing 41 which is threaded into the upper end of bore 27. The check valve 29 is adapted to permit fluid to flow from cavities 28 and 33 into chamber 26 but to prevent a reverse flow of such fluid. Two pistons 31 of duplicate construction are provided in the bore or passageway 28 at opposite sides of the axial position where bore 28 intersects bore 27. A push rod 32 is rigid with each piston 31 and extends outwardly through a fitting 32' to the exterior of housing 10. Rods 32 are used to manually move the pistons 31 inwardly.

An adjustable, pressure responsive valve 34 in the cavity 33 is urged by a spring 35 against a valve seat 36 in said cavity. A screw plug 37, spaced outwardly from valve seat 36, closes the end of the cavity 33 shown at the left in FIG. 3. A fluid pressure relief passageway 38 extends between fluid pressure chamber 26 and a part of the cavity 33 adjacent plug 37 and at the side of the valve seat 36 opposite the valve 34.

When ram clutch 11 is moved so as to reduce the volume of chamber 26 fluid will be caused to flow through passageway 36 into a part of cavity 33 between valve 34 and plug 37, thence past valve 34 into a part of cavity 33 which communicates with a part of the cavity 28 between pistons 31. This will move said pistons apart and cause said rods 32 to protrude outwardly from opposite sides of the housing 10. When the clutch members 11 and 12 are free from torque and the pistons 31 are thus spread apart ram clutch 11 can be moved toward and into meshing relation with driving clutch 12 by exerting a squeezing pressure on said rods 32.

The end of spring 35 remote from valve 34 rests against a nut 39 which is threaded within passageway 33 and can be turned by an adjusting spindle 40 to vary the pressure of said spring 35 against valve 34. Both the spindle 40 and the hole in the nut 39 through which said spindle 40 passes are preferably square so the nut is rotatable with and movable lengthwise of the spindle. Spindle 40 has on its outer end a rigidly attached coaxial hub 42 which fits snugly and rotatively within the bore 33 and is grooved to receive an O-ring 43 for fluid sealing purposes. The hub 42 is secured against longitudinal movement in bore 33 by a screw 44, the inner end of which extends into an annular groove 45 in said hub. A head 46 rigid with the outer end of hub 42 is adapted to receive a screw driver or like tool by which the spindle 40 can be turned to move the unit 39 lengthwise in the bore 33 and adjust the pressure of the spring 35 against the valve 34. The periphery of the head 45 is provided with gear teeth 48 which mesh with other gear teeth 49 on the edge of a two piece mounting ring which is composed of two similar semi-circular parts 50 and is adapted to fit rotatively within an annular groove on the exterior of the housing 10. A circular split ring 51 of thin resilient material is adapted to be snapped over the two piece mounting ring 50. The split ring 51 fits snugly around the two piece mounting ring 50 and is secured thereto by screws or other devices applied through perforations 52, FIG. 6, in the split ring. This provides a ring assembly which can be readily applied to housing 10. The split ring 51 and housing 10 are provided with graduations, preferably expressed in foot pounds, which can be set relative to each other by the turning of spindle 40 which simultaneously adjusts the pressure of spring 35 against valve 34.

To fill or charge the tool with hydraulic fluid, which can be SAE 20 oil, the tool is preferably held upright by securing the shank 8 in a vise, the filler plug 37 is removed and an ordinary oil pump is applied to the filler plug opening and the oil forced into the tool. The oil will fill passageway 38 and chamber 26 and will move the ram clutch member 11 upwardly as far as possible into fully meshed relation with the driving clutch member 12. At this time the oil pressure will not usually be high enough to cause the oil to open and flow past valve 34. After chamber 26 has been filled the driving clutch is turned until it runs free to force ram clutch 12 down and force the oil past valve 34 into cavities 28 and 33, the oil pump being constructed so the oil can not be forced back into it. This procedure is repeated, if necessary, until the two pistons 31 stand at about the limit of their outward movement or until there is enough oil in the cavities 28 and 33 so that when the pistons 31 are moved from their outermost to their innermost positions they will always displace enough oil to move the ram clutch member 11 into fully meshed relation with driving clutch member 12. When oil is introduced into the tool, as just hereinbefore described most of the trapped air will be in the upper part of chamber 26 and this air can be evacuated by removing the bleeder plug 9 from the ram clutch member 11 and manipulating the piston rod 32 so as to bubble it out through the bleeder plug opening.

This tool can be used to apply either right or left torque to various different threaded fastening devices to which shank 8 can be connected by an ordinary wrench socket. Before applying the tool to a part on which a predetermined torque is to be exerted a squeezing pressure is applied to the piston rods 32 and the pistons 31 are caused to displace enough oil from the oil storage cavities past check valve 29 into chamber 26 to move the ram clutch member 11 upwardly until the cams 21 are in fully meshed engagement with the cams 19 on driving clutch 12. The cams 19 and 21 serve as interengaging means which will transmit torque between clutch members 11 and 12 and at the same time will exert end thrust which bears a constant relation to the torque and which tends to move the two clutch members apart and will disengage them at the limit for which the indicator ring 51 is set.

I claim:

1. Torque wrench means comprising a cup shaped housing having a closed end provided with fluid storage cavities and an external shank; a driven ram clutch member fitting snugly within said housing, said ram clutch member being longitudinally movable within said housing and rotatable with said housing and cooperating with the housing in forming a fluid pressure chamber between it and the bottom of said housing; a driving clutch member rotatively supported in the upper end portion of said housing and having in it a socket shaped and dimensioned for non-rotatable connection with a driven part; interengageable devices provided between adjacent sides of said two clutch members operable in transmitting torque between said clutch members and responsive to torque in moving said clutch members apart and disengaging them from each other; fluid passageways in said housing extending between said fluid pressure chamber and said fluid storage cavities; an adjustable spring pressed check valve in said passageways providing for a flow of fluid under torque generated pressure from said chamber to said

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fluid storage cavities; another check valve in said passageways providing for a flow of fluid from said cavities to said chamber; and fluid displacement means connected with said cavities between said two valves and operable from the exterior of said housing for displacing fluid from said cavities past said other check valve into said chamber in the absence of torque generated pressure in the fluid therein.

2. The torque wrench means as claimed in claim 1 in which the fluid displacement means includes two opposed pistons reciprocable in the fluid storage cavities in the housing and provided respectively with two piston rods which extend in opposite directions from the pistons and protrude from the housing.

3. The torque wrench means as claimed in claim 1 in which the interengageable devices between the two clutch members are cams rigid with the clutch members and shaped and dimensioned to mesh with each other and having contacting side surfaces which are convergently inclined from the clutch members outwardly.

4. The torque wrench as claimed in claim 1 in which adjusting devices readily accesable from the exterior of the housing are operatively connected with said adjust-

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able spring pressed check valve.

5. The torque wrench as claimed in claim 1 in which adjusting devices readily accesable from the exterior of the housing are operatively connected with said adjustable spring pressed check valve and in which pressure indicating means is movably supported on the exterior of said housing and operatively connected with said adjusting devices.

6. The torque wrench as claimed in claim 1 in which the bottom of the housing is of substantial thickness and in which a major portion of the fluid cavity spaces therein are formed by two transverse intersecting bores positioned at a substantial angle relative to each other.

7. The torque wrench as claimed in claim 1 in which the bottom of the housing is of substantial thickness and in which a major portion of the fluid cavity space therein is formed by two transverse intersecting bores positioned at a substantial angle relative to each other and in which the fluid displacement means is disposed in one of said bores and the adjustable spring pressed valve and adjusting means for said valve are disposed in the other bore.

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