(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 788 862 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
13.08.1997 Bulletin 1997/33

(51) Int Cl.[6]: **B25B 23/142**

(21) Application number: **97300811.3**

(22) Date of filing: **07.02.1997**

(84) Designated Contracting States:
DE ES FR GB IE IT SE

(30) Priority: **08.02.1996 GB 9602565**

(71) Applicant: **BRITOOL LIMITED**
Cannock, Staffs. WS11 3JR (GB)

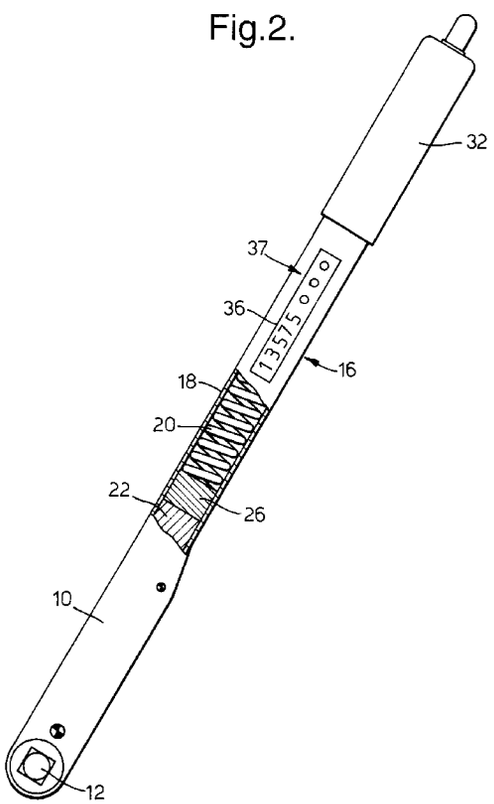
(72) Inventor: **Cooper, Ian Radford**
Cheslyn Hay, Nr. Walsall, WS6 7LB (GB)

(74) Representative: **Howden, Christopher Andrew**
FORRESTER & BOEHMERT
Franz-Joseph-Strasse 38
80801 München (DE)

(54) Torque wrench

(57) A torque wrench comprising a drive element 12 pivotally mounted at the end of a hollow lever 16 includes a load transference mechanism 22 prestressed by a spring 20 accommodated within the hollow lever. The compression of the spring 20, and hence the torque setting of the wrench, can be adjusted by means of a manually rotatable sleeve 32 at the free end of the lever 16. An electronic load cell 26 is disposed between the mechanism 22 and the spring 20 and provides an electrical signal, significant of the actual pre-stressing applied by the spring 18, to electronic circuitry which drives an electronic display 36 mounted on the lever 16. This arrangement allows the torque setting to be determined more accurately than in conventional torque wrenches and, in particular, renders the torque setting insensitive to changes in spring length or spring strength in use of due to manufacturing variations.

Fig.2.



EP 0 788 862 A1

Description

THIS INVENTION relates to torque wrenches, more particularly to torque wrenches of the pre-stressed spring type.

A torque wrench of this type generally comprises a lever carrying a member adapted for direct or indirect engagement with a screw fastener such as a nut or bolt to be turned, a load transference mechanism such as a slipping clutch, cam displacement mechanism or toggle lever mechanism including a pre-stressed spring exerting a force which determines the torque, applied *via* said member, at which said load transference mechanism will provide to the user an indication that the set torque has been reached and/or will slip to prevent a torque exceeding the set torque being applied to the fastener and further comprises an adjustable element acting on said spring for determining and adjusting the extent to which the spring is stressed and hence set the last-noted torque, which is herein, for convenience, referred as the "preset torque" of the torque wrench. Such a torque wrench is herein referred to as being "of the kind specified".

The term "load transference mechanism" as used herein is intended to refer to any mechanism which will transmit rotational drive up to a torque determined by the pre-stressing of an associated spring but which will slip, break, disengage or otherwise prevent transmission of torques above the predetermined torque, or at least indicate to the user that the predetermined torque has been reached. The term "load transference mechanism" is thus intended to include the spring loaded detent mechanisms used for this purpose in some torque wrenches.

A wrench of the kind specified is used by engaging the fastener engaging portion, (generally in the form of an interchangeable so-called socket fitted to a square-section head of a shaft rotatably mounted in the end of the wrench), over the nut or bolt to be turned and screwing up the nut or bolt using the wrench until the resistance to rotation of the nut or bolt reaches the preset torque, at which point the load transference mechanism will prevent further increase in torque applied to the nut or bolt or will indicate to the user that the required torque has been reached.

In known torque wrenches of the kind specified, the spring is stressed between two parts of the wrench, one of said parts being adjustable in position, relative to the other, for example by a screw adjusting mechanism, to adjust the pre-stressing of the spring and hence the preset torque of the wrench, and the relative position of said two parts is read by observing the position of a marker or indicator on one said part relative to a scale provided on the other, to determine the preset torque for which the wrench is set, the underlying assumption being that the characteristics of the spring are accurately known and that, therefore, the spring pre-stress, and hence the preset torque, can be determined from the position of the said first part relative to said second part. However, because this underlying assumption is not necessarily correct, calibration of such a torque wrench is complex.

By way of example, a typical known torque wrench of the kind specified comprises a lever, carrying at one end a head portion having a socket drive including a square-section drive member for engagement in a complementary square drive recess in interchangeable sockets for engagement with bolt heads or nuts to be screwed up using the wrench, the square-section drive member being connected to the load transference mechanism and the spring being accommodated in said lever and compressed between a said part at the head of the wrench and a said part incorporated in a spring pressure adjusting mechanism, the preset torque being indicated by fixed scale and cursor system. With such an arrangement, however, manufacturing variations in the spring length and spring rate, and long-term weakening of the spring with time and use can lead to torque setting errors, as can scale reading errors. Furthermore, marking of the scale system is critical to the accuracy of the wrench.

It is an object of the present invention to provide a torque wrench in which these difficulties are avoided.

According to the invention there is provided a torque wrench comprising a lever carrying a member adapted for direct or indirect engagement with a screw fastener to be turned, a load transference mechanism, as herein defined, acting between the lever and said member, said load transference mechanism including a pre-stressed spring exerting a force which determines the preset torque, applied *via* said member, at which said load transference mechanism will slip or break or disengage to prevent a torque greater than said preset torque from being applied to said member, or will operate to indicate to the user that the required torque has been reached, and an adjustable element acting on said spring for determining and adjusting the extent to which the spring is stressed and hence the preset torque of the torque wrench, characterised in that said adjustable element acts on said spring *via* a stress-measuring device arranged to display, or otherwise signal to a user, the preset torque.

An embodiment of the invention is described below by way of example with reference to the accompanying drawings in which:-

FIGURE 1 is an elevation view, partly in section, of a conventional torque wrench, and

FIGURE 2 is a corresponding view of a torque wrench embodying the invention.

Referring to Figure 1, the torque wrench shown comprises a lever 16 terminating in a head 10 at a free end of which is mounted a square-section drive element 12 projecting from the head 10, along an axis perpendicular to the axis of the lever, in manner known *per se*.

A load transfer mechanism (as herein defined) of a type known *per se* and shown only part, serves to transmit rotational torque applied through the lever 16, to the drive element 12. A tubular portion 18 of the lever accommodates a spring 20 which at one end bears against a displaceable component 22 of the load transference mechanism. The spring 20 is compressed between member 22 and a counter-element which is screw-threadedly engaged with the tubular portion 18 at the end of tubular portion 18 remote from head and is adjustable therealong to adjust the prestressing of the spring. The only portion of this counter element which is visible in Figure 1 is a tubular sleeve portion 32 which forms a handle of the wrench and which extends over the end of the tubular portion 18 remote from the head 10 and has a free edge 33 located intermediate the ends of tubular portion 18. This free edge 33 forms a cursor cooperating with a scale 35 marked on the exterior of the tubular portion 18. To adjust the set torque of the torque wrench, the counter element is screwed along the portion 18 to increase or decrease the compression of the spring 20, the screwing of the counter element at the same time moving the free edge 33 along the scale 35 from which the set torque can be read.

Referring to Figure 2, in which parts corresponding to parts in Figure 1 have corresponding references, the torque wrench embodying the invention shown in this figure differs from that described with reference to Figure 1 in that the scale 35 fixedly marked on tubular portion 18 is dispensed with and the free edge 33 of sleeve portion 32 consequently no longer functions as a cursor, and in that an electronic load cell 26, incorporating a strain gauge, is accommodated within the tube 18 in the spring/load train. In the arrangement illustrated, the load cell 26 is disposed between component 22 and the spring 20 but in variants it may be located between the end of spring 20 remote from member 22 and the counter-element carrying the sleeve portion 32. Furthermore, in the torque wrench of Figure 2, electronic circuitry, (not shown) drives an electronic digital display 36 such as an LCD or an LED display, utilising sufficient digits to suit the accuracy requirements of the wrench, the display 36 being mounted on the lever 16. The arrangement is such that the compressive load on the load cell 26 and which corresponds to the force applied *via* spring 20 to member 22 and thus to the torque setting, is measured by the load cell and is displayed digitally, as the corresponding preset torque, on display 36. Figure 2 also shows a control panel 37 disposed adjacent the display 36 and incorporating push buttons controlling operation of the electronic circuitry, for example a button operating an on/off switch, a button operating a switch to change the circuitry and display between a condition in which the torque setting will be displayed in metric units and a condition in which the torque setting will be displayed in imperial units and so on.

It will be understood that the load cell 26 is displaced longitudinally within the tubular portion 18 of the lever 16. The load cell may be connected by flexible leads or sliding contacts (not shown) with the remainder of the electrical circuitry which may be mounted in fixed position on lever 16. Alternatively, the electronic circuitry and possibly even the display, may be incorporated in a housing displaceable, with the load cell, along the lever 16 or even in a compartment in the load cell itself, the display being visible through a window (not shown) in the lever 16.

It will be appreciated that the preferred embodiment of the invention described with reference to the drawings eliminates the indirect element in determining the spring compression. The strain gauge pressure monitoring device 26 situated next to the spring will measure the actual pressure exerted on the mechanism. The readings gained from the device 26 can then be displayed on display 36, as a torque measurement. This means that fluctuations in the spring rate and spring length, during its life, will be compensated by the measuring device. Calibration of such a wrench can be made simple by electronic adjustment of the scale. The wrench is wholly dependant on the pressure exerted by the spring and hence the scale can be directly related to spring pressure instead of the indirect linear scale of conventional torque wrenches.

The invention affords advantages in terms of the speed and accuracy of calibration during manufacture. Long term accuracy is not, as in conventional torque wrenches, affected by variations in spring rate. This is made possible by electronic compensation for the spring variations. Marking of scales on torque wrench tubes is no longer necessary, eliminating that operation.

Users of a torque wrench in accordance with the invention will be more confident of the torque setting when adjustment merely involves adjusting to a value displayed on display 36. The current scale arrangement of conventional torque wrenches needs some judgment from the calibrator and the user as to where the cursor should be for a particular setting. The digital display in the torque wrench of the preferred embodiment requires no such judgment.

The features disclosed in the foregoing description, in the following claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. A torque wrench comprising a lever carrying a member adapted for direct or indirect engagement with a screw fastener to be turned, a load transference mechanism, as herein defined, acting between the lever and said member, said load transference mechanism including a pre-stressed spring exerting a force which determines the preset torque, applied *via* said member, at which said load transfer-

ence mechanism will slip or break or disengage to prevent a torque greater than said preset torque from being applied to said member, or will operate to indicate to the user that the required torque has been reached, and an adjustable element acting on said spring for determining and adjusting the extent to which the spring is stressed and hence the preset torque of the torque wrench, characterised in that said adjustable element acts on said spring *via* a stress-measuring device arranged to display, or otherwise signal to a user, the preset torque.

2. A torque wrench according to claim 1 wherein said stress-measuring device includes an electronic transducer, electronic circuitry arranged to receive signals from said transducer representing the stress applied to the spring *via* said stress-measuring device, and arranged to drive display means or signalling means to indicate the preset torque.

3. A torque wrench according to claim 2 wherein said transducer comprises a load cell incorporating a strain gauge.

4. A torque wrench according to claim 2 or claim 3 wherein said electronic circuitry is arranged to drive a digital electronic display.

Fig.1.

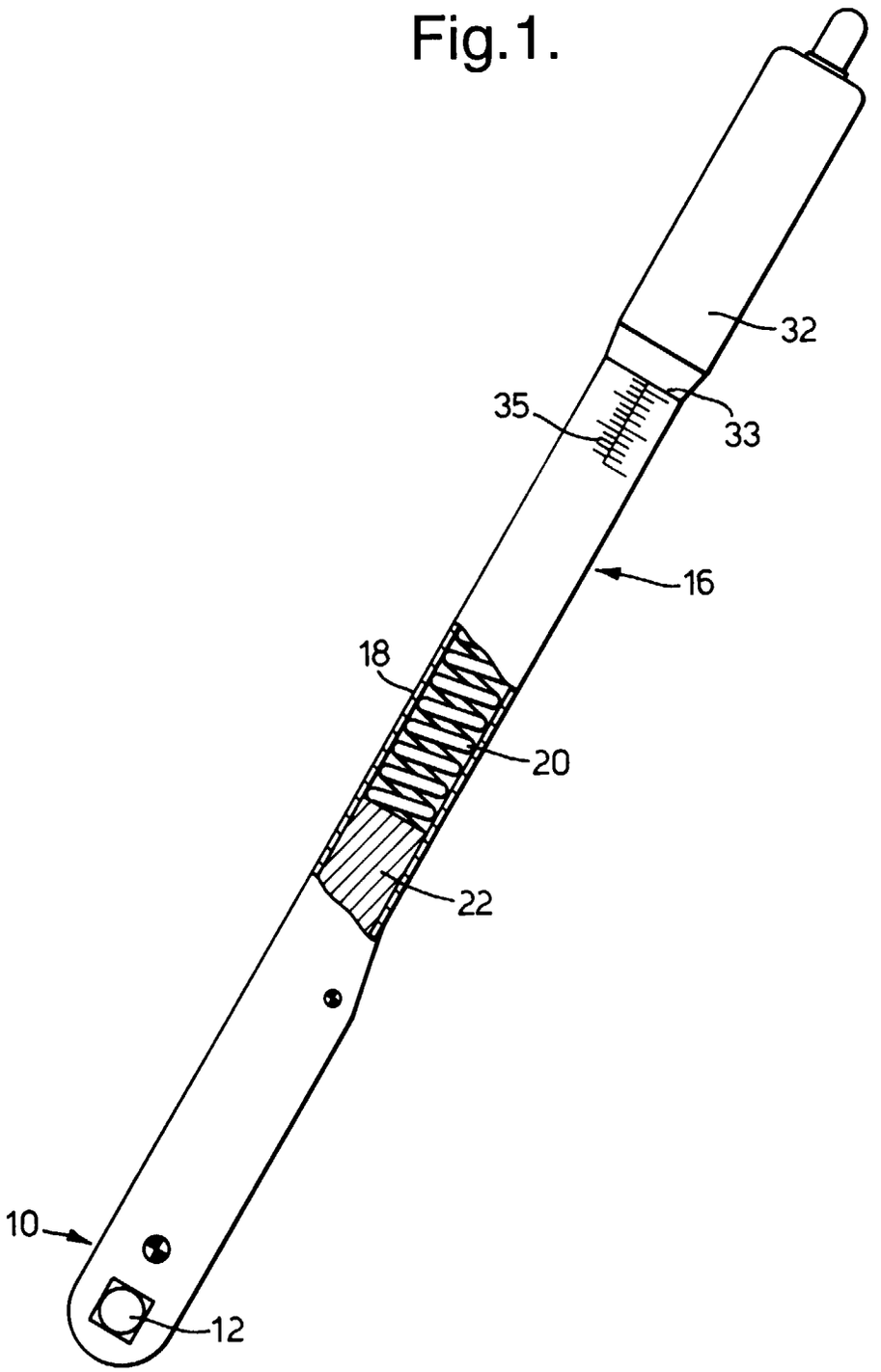
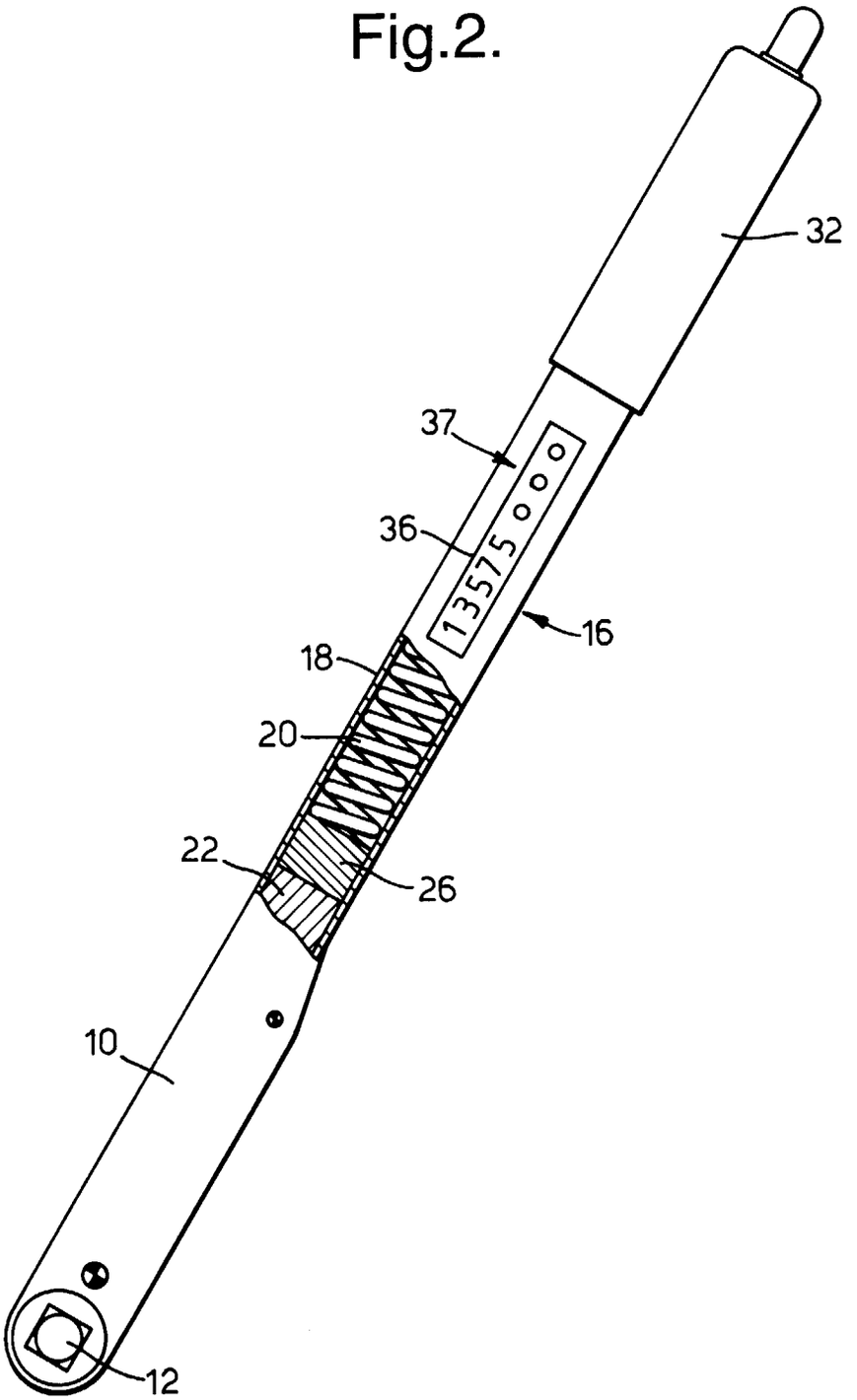


Fig.2.



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 30 0811

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	EP 0 360 894 A (JOMI TRUST REG.) * the whole document * ---	1-3 4	B25B23/142
Y	DE 295 15 519 U (F.HSU) * page 9, line 32 - line 39; figures 2,3 * ---	4	
A	DE 295 01 355 U (HAZET-WERK HERMANN ZEVER GMBH &CO KG) * claims; figures * -----	1-4	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 April 1997	Majerus, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)