United States Patent

Mende

[15] **3,701,295**

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[54] **TORQUE WRENCH**

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June 3, 1970 Japan 45/47749

[52] **U.S. Cl.**.....**81/52.4**, 81/177 R, 16/150

[51] **Int. Cl.** **B25b 23/14**

[58] **Field of Search**.....81/177 R, 52.4, 52.5; 287/86; 306/20; 16/150, 180; 64/15 R, 15 B

[56] **References Cited**

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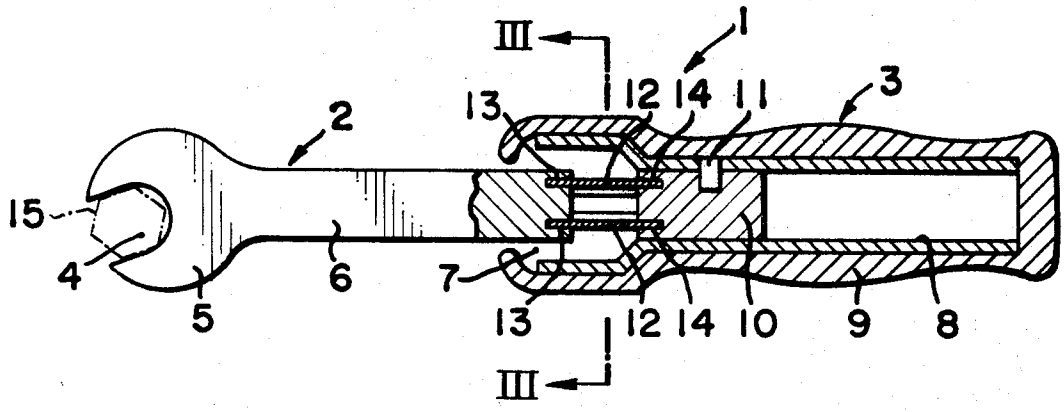
[57] **ABSTRACT**

A torque wrench comprises a tightening member and a handle member. The handle member includes a sleeve having an enlarged open end and an insert block is secured in the sleeve adjacent the enlarged open end. The tightening member and the insert block are connected with each other by means of a pair of spaced trough-shaped springs each having an arcuate transverse cross-section. A pair of the trough-shaped springs are arranged with the concaved surfaces thereof confronting each other.

4 Claims, 4 Drawing Figures



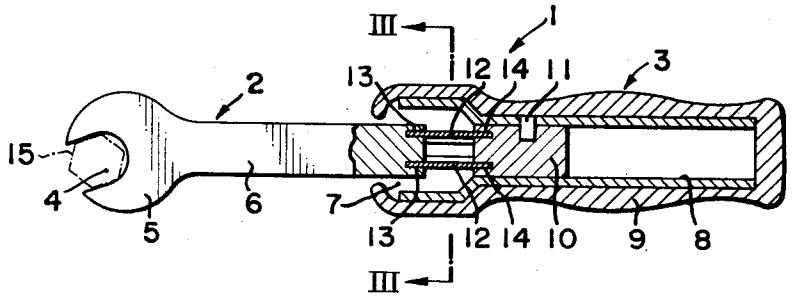


FIG. 1

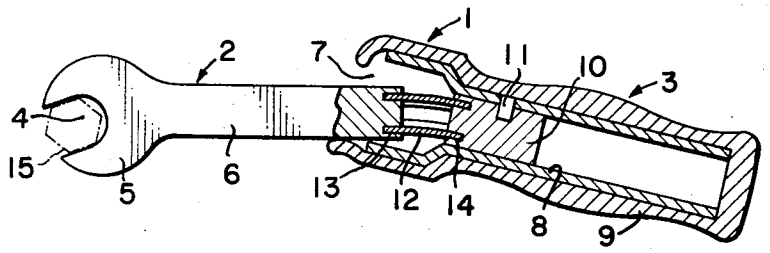


FIG. 2

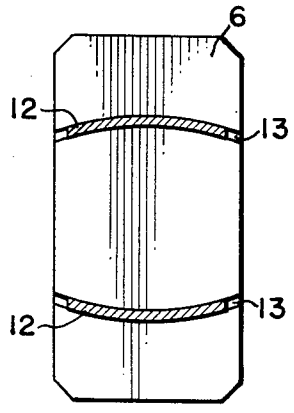


FIG. 3

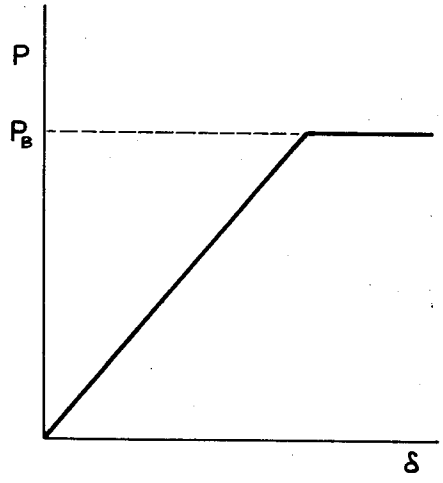


FIG. 4

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TORQUE WRENCH

This invention relates to a torque wrench for tightening a bolt, nut or the like with a predetermined torque, and has for its primary object the provision of a torque wrench which is very simple in construction and can be produced at a low cost.

A further object of the invention is to provide a torque wrench which enables a predetermined tightening torque to be maintained constant at all times, irrespectively of a positional change of the force applied to a handle member of the torque wrench.

According to the invention, there is provided a torque wrench in which a tightening member and a handle member are connected with each other by means of a pair of spaced trough-shaped springs arranged with the concaved surfaces thereof confronting each other.

An embodiment of the present invention will be described hereunder with reference to the accompanying drawings.

In the drawings:

FIG. 1 is a front elevation, partially shown in section, of an embodiment of the torque wrench according to the present invention;

FIG. 2 is a front elevation showing the manner of using the torque wrench of FIG. 1;

FIG. 3 is a cross section taken along the line III—III of FIG. 1; and

FIG. 4 is a graph showing the relationship between the load P and the deflection δ of the spring when a pair of the opposed trough-shaped springs are fixed at one end and the load P is applied to the other end.

Referring to the drawings and particularly to FIG. 1, the torque wrench of the invention comprises a tightening member 2 and a handle member 3, and the tightening member 2 has a spanner head 5 formed with an opening 4 engageable with a bolt head or a nut to be tightened, and a spanner shank 6. The handle member 3 includes an inner sleeve 8 having an enlarged open end 7, and a grip 9 covering said inner sleeve 8. An insert block 10 is slide-fitted in the sleeve 8 and secured therein by means of a fixing pin 11 at a portion adjacent the enlarged open end 7. A pair of spaced trough-shaped springs 12, 12, each having an arcuate transverse cross section, are arranged in opposed parallel relation with their concaved surfaces confronting each other. The spanner shank 6 and the insert block 10 have formed in the confronting end faces thereof arcuate slots 13, 13 and 14, 14 respectively, which are complementary to the arcuate cross-sectional shapes of the trough-shaped springs 12, 12. The trough-shaped springs 12, 12 have one of their ends inserted into the arcuate slots 13, 13 of the spanner shank 6 and at the other end inserted into the arcuate slots 14, 14 of the insert block 10, and secured therein as by screws or welding, thereby to connect the tightening member 2 and the handle member 3 with each other. It will be obviously understood that the securement of the trough-shaped springs 12, 12 to the spanner shank 6 and the insert block 10 may be achieved by directly securing the ends of the former to the latter as by welding or screws.

Now, the operation of the torque wrench according to the invention will be described. In using the torque wrench, the opening 4 of the spanner head 5 is engaged with the bolt head or nut 15 and the handle member 3 is turned in a clockwise direction, as shown in FIG. 2, to tighten said bolt head or nut 15. While the tightening torque is small, the trough-shaped springs 12, 12 are not deflected and the tightening force applied to the handle member 3 is transmitted to the tightening member 2 through said trough-shaped springs 12, 12. As the tightening torque progressively increases, the trough-shaped springs 12, 12 are deflected and the handle member 3 is angularly displaced relative to the axis of the tightening member 2. When the force applied to the handle member or the load exerted on the ends of the trough-shaped springs connected to the insert block increases in proportion to the deflection of said springs and reaches a critical value, the spring 12 undergoing compressive force on the convex surface thereof is subjected to buckling, with the result that the angular displacement of the handle member 3 relative to the tightening member 2 suddenly increases and the tightening torque applied to the bolt head or nut disappears. FIG. 4 shows the relationship between the bending load P and the deflection δ of a pair of the trough-shaped springs connecting the tightening member and the handle member with each other. It will be understood from the graph that the trough-shaped springs have such a characteristic that they deflect increasingly in proportion to the increasing bending load exerted thereon and are subjected to buckling at the maximum load P_B.

According to the invention, as described above, when the buckling of the trough-shaped spring occurs, the angular displacement of the handle member to the tightening member suddenly increases namely the handle member pivots relative to the tightening member to release the tightening torque. Therefore, it is possible to positively tighten a bolt, a nut or the like with a predetermined torque. Furthermore, according to the invention, since the tightening member and the handle member are connected by way of the trough-shaped springs, the predetermined tightening torque will not change, no matter to what position the acting point of the force applied to the handle member may be shifted on said handle member.

I claim:

1. A torque wrench comprising, in combination, a tightening member, a handle member and a spring mechanism, said spring mechanism consisting of a pair of spaced trough-shaped springs arranged with their concave surfaces facing each other, each of said springs being affixed at one of its ends to the tightening member and at the other of its ends to the handle member, said trough-shaped springs having the characteristic of deflecting increasingly in proportion to an increasing bending load and buckling at a load corresponding to a predetermined maximum torque of the wrench, said spring mechanism retaining said tightening member and said handle member in an operative position relative to each other only as long as the load acting on the trough-shaped springs does not exceed the buckling load, said handle member pivoting relative to said tightening member to release the tightening torque when said buckling load is exceeded.

2. The torque wrench of claim 1 in which the handle member includes a sleeve having an enlarged open end and in which an insert block is fixedly disposed in said sleeve adjacent said enlarged open end.

3. The torque wrench of claim 2 in which the insert block has arcuate slots of a shape complementary to the transverse cross-sectional shape of said trough-shaped springs and in which one of the ends of said trough-shaped springs is inserted into said arcuate slots and secured therein.

4. The torque wrench of claim 3 in which the tightening member has arcuate slots of a shape complementary to the transverse cross-sectional shape of said trough-shaped springs and in which the other of the ends of said trough-shaped springs is inserted into said arcuate slots and secured therein.

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