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F. W. LIVERMONT

2,400,205

TORQUE WRENCH

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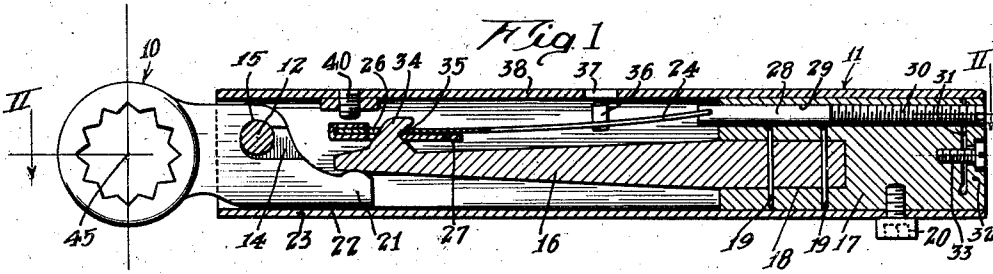


Fig. 2

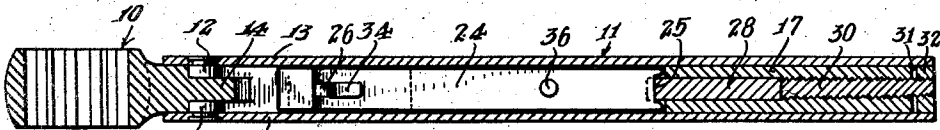


Fig. 3

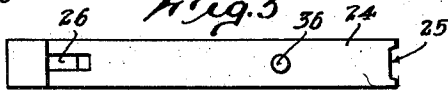


Fig. 4

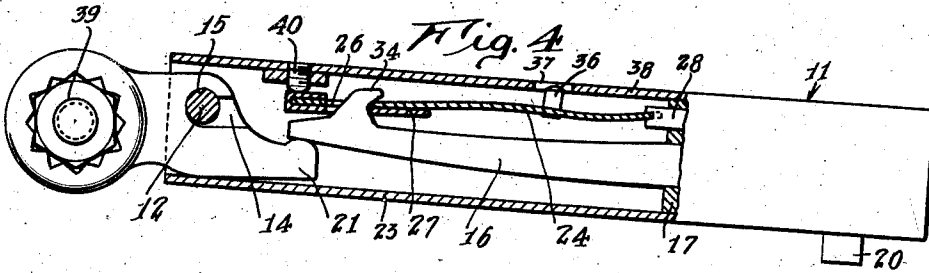


Fig. 5

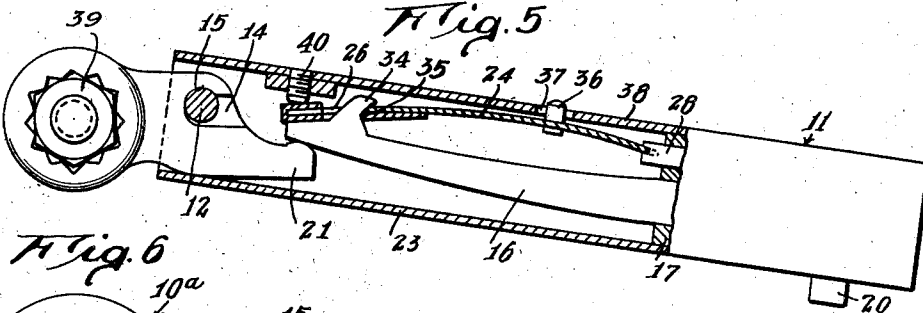
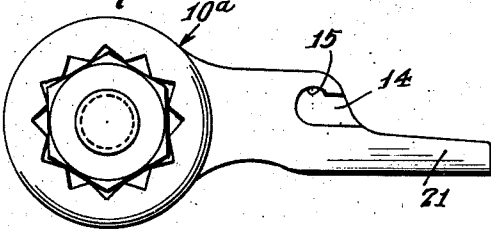


Fig. 6



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2,400,205

TORQUE WRENCH

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Application March 1, 1943, Serial No. 477,601

10 Claims. (Cl. 81—52.5)

This invention relates to wrenches for applying a predetermined measured torque to nuts and bolts and has as a broad object to simplify and increase the accuracy, reliability and service life of such wrenches.

The present wrench is a further development of the wrenches disclosed in my application Serial No. 468,793, filed December 12, 1942, issued March 20, 1945, Patent No. 2,371,901, which relate to torque wrenches of the snap-action type employing snap-action springs as distinct from the prior art devices employing cam mechanisms. The present wrench differs in detail from those disclosed in my prior application and has advantages in simplicity and reliability.

A feature of the present invention is a torque wrench having a handle member and a head member which are readily separable to provide for the rapid interchange of different sized heads.

Essentially the present wrench comprises a handle to which there is pivotally connected a head member adapted to be attached to the nut to be tightened, with a pair of springs within the handle for yieldably resisting rocking movement of the handle with respect to the head. One of the springs is of the bar type, is relatively stiff, and provides most of the resistance to relative movement between the handle and the head. The other spring is of the thin strip type which is normally bowed in one direction but which is so stressed during rocking movement of the handle with respect to the head as to reverse its curvature with a sudden snap when the applied torque exceeds a predetermined value.

A full understanding of the construction may be had from the detailed description to follow, which refers to the drawing.

In the drawing:

Fig. 1 is a longitudinal sectional view through a wrench in accordance with the invention, the wrench being shown in its position of rest.

Fig. 2 is a longitudinal section taken at right angles to the section of Figure 1 and substantially along the line II—II of Figure 1.

Fig. 3 is a face view of the snap spring element of the wrench.

Fig. 4 is a view similar to Figure 1 but showing the wrench stressed just to the point where it applies the maximum torque for which it is adjusted.

Fig. 5 is a view similar to Figure 4 but showing the wrench just as the set torque has been exceeded and the snap spring has reversed its position; and

Fig. 6 is a side elevation of a wrench head of

different dimensions for use in the wrench of Figures 1 to 5.

Referring first to Fig. 1, the wrench therein disclosed comprises a head 10 adapted to engage the nut or other object to be turned, which head is removably associated with a handle 11. The handle 11 consists of a hollow shell of rectangular cross section, relatively thin as compared with its width, as is apparent from comparison of Figs. 1 and 2. The head 10 has an end portion insertable into one end of the handle 11 and pivotally engageable with a pair of stub shafts 12, which are secured to opposite side walls 13 of the handle and project inwardly toward each other. The juxtaposed faces of the stub shafts 12 are spaced apart a distance slightly greater than the thickness of a web portion 14 of the head 10, the sides of the inner portion of the head being recessed to define this web 14. The recesses are in the form of longitudinal grooves rounded at the inner end to define pivotal seats 15 which bear against the stub shafts 12 during rotation of the handle 11 with respect to the head 10. The seats 15 are slightly offset from the grooves so that while the head can be pressed into the handle or removed therefrom, the head is yieldably retained in position by cooperation between the offset seats 15 and a main spring 16 within the handle.

The main spring 16 is a bar spring rigidly supported at one end from the handle 11 by an anchor block 17, the latter having a longitudinal hole 18 into which the rear end of the spring 16 is pressed and locked in place by a pair of transverse pins 19 placed into holes provided therefor in the block 17 and the spring 16. The block 17 is slidable in the handle 11 for assembly but is locked in position with a screw 20. The head of the screw 20 is purposely permitted to project from the edge of the handle 11 to serve as an indication to the user of the direction in which the wrench is to be moved. Thus, the wrench as shown in Fig. 1 is to be used to apply clockwise torque to a nut by the application of force to the upper edge of the wrench handle.

It will be observed from Fig. 1 that the lower side of the left, free end of the bar spring 16 bears against an arm 21 on the inner end of the head 10, urging this arm downwardly so that a flat face 22 on the edge of the head bears against the edge wall 23 of the handle, in which position of the head the seats 15 therein rest against the pivoting stub shafts 12. The upper face of the arm 21 is preferably rounded to provide for line contact with the bar spring 16 at

a point displaced from the end of the arm. It will be apparent from the construction shown and described that the head 10 can be removed by forcing it up, thereby slightly deflecting the bar spring 16, and then pulling it straight out. The same or a similar head of another size can be reinserted by reversing the procedure.

The spring mechanism of the wrench includes in addition to the bar spring 16 a relatively thin strip spring 24 which extends approximately parallel to the spring 16 and is supported at one end from the handle 11 and at the other end from the bar spring 16. Referring to Fig. 3, the strip spring 24 has a notch 25 at its right end and a window 26 near its left end and it is reinforced adjacent the window by a short reinforcing strip 27 (Fig. 1) which extends along the under side of the spring 24 and is folded around the end of the spring. It may be spot welded to the strip spring 24 where it is folded around the end of it. The notch 25 at the right end of the spring is engaged by a notch in the end of a supporting pin 28 slidably mounted in a longitudinal hole 29 provided therefor in the block 17. The outer end of the hole 29 is threaded to receive an adjusting screw 30, the inner end of which bears against the pin 28. To lock the screw 30 in a position of adjustment, a transverse slot 31 is provided in the block 17 leaving a flexible segment 32 of the block which can be urged against the main portion of the block by a locking screw 33. The screw 33 can be adjusted to provide sufficient resistance to rotation of the screw 30 to hold the latter in a position of adjustment although permitting it to be intentionally turned with a screwdriver. The strip spring 24 is supported at its forward end by engagement of an integral hook 34 on the bar spring 16 with the rear edge 35 of the window 26, this window extending through the reinforcing strip 27 as well as through the strip spring 24.

The strip spring 24 is normally slightly bowed, as shown in Fig. 1, so that it is concave on its upper side and an indicator pin 36 on the spring is positioned below a window 37 in the upper edge wall 38 of the handle 11. The pin 28 is so adjusted as to exert slight longitudinal force on the strip spring when the wrench is in the inactive position shown in Fig. 1. As torque is applied to the handle 11 to tighten a nut 39 (Fig. 4) to which the wrench head is affixed, the bar spring 16 yields to permit rocking movement of the handle with respect to the head. During the initial portion of this rocking movement the only resistance is that offered by the bar spring 16 but continued movement carries the left reinforced end of the strip spring 24 against an adjustable stop screw 40 mounted in the edge wall 38 so that further movement is in part resisted by the strip spring, which becomes distorted. Thus, referring to Fig. 4, the downward force exerted on the left end of the strip spring by the stop screw 40 tends to rock the left end portion of the strip spring counterclockwise about the hook 34 as a fulcrum, which places a reverse bend in the spring. As shown in Fig. 4, this movement has been carried to a point where the strip spring is about to snap over into a simple bow as shown in Fig. 5. In the latter position the indicating pin 36 is projected through the window 37 and would impinge against a finger of the operator using the wrench, thereby indicating to him that the torque for which the wrench was adjusted has been exceeded. The reverse movement of the spring from the posi-

tion shown in Fig. 4 to that shown in Fig. 5 occurs very suddenly and is accompanied by a clearly audible snapping sound which would indicate to the operator that the desired torque has been applied even though the operator's fingers should happen to be positioned clear of the window 37.

As the wrench moves from the position shown in Fig. 4 to that of Fig. 5, the torque applied from the handle to the wrench head is momentarily reduced by virtue of the fact that beyond the point of snap-over illustrated in Fig. 4 the strip spring 24 ceases to aid the bar spring 16 in resisting the rocking movement of the handle with respect to the head. It is desirable that the torque be reduced after the set value thereof is passed to prevent the accidental application of additional torque.

The wrench is adjustable to cover a relatively wide range of torques by adjustment of the stop screw 40 and by substituting heads of different dimensions. The torque can be adjusted within a range extending approximately fifty percent in either direction from a middle value by adjustment of the stop screw 40. If a larger variation is desired, it should be obtained by substituting a head 10 of different dimensions.

Variations in the torque setting may be obtained by changing the dimensions of the head 10 in either of two ways. One way is to lengthen the arm 21 so that it contacts the bar spring 16 nearer the base of the latter. Obviously in order to produce the same deflection of the bar spring 16, a force applied to the latter near the base must be much greater than force applied near the tip. Very large variations in the torque at which the wrench trips can be had by varying the length of the arm 21 on the head.

Obviously the torque applied to a nut engaged by the head 10 can be varied by varying the distance between the seat 15 and the center 45 of the nut engaging portion of the wrench, since this increases the length of the lever arm.

There is shown in Fig. 6 a wrench head 10a adapted for use on larger nuts than the head 10. Usually larger nuts require a larger torque to properly tighten them and in this instance the head 10a is adapted to apply a larger torque by making it longer on both sides of the seat 15 than is the case with the head 10 of Figs. 1 to 5.

It is easily possible by suitably choosing the length of the head to vary the torque at which the wrench trips from values as low as 10 inch-pounds to values as high as 800 inch-pounds.

The vigor of the snap of the strip spring 24 can be varied between rather wide limits by adjusting the longitudinal compression with the screw 30. This adjustment also determines the extent to which the applied torque is reduced at the instant of snap-over. It is found desirable to have a torque reduction of approximately twenty percent when snap-over occurs. The extent of this reduction can be varied between any limits desired by varying the relative stiffness of the strip spring 24 and the bar spring 16.

Ready adjustment of the vigor of the snap action of the strip spring is desirable because one operator, such as a husky man with calloused hands, might desire a relatively strong "kick" by the pin 36 whereas a relatively delicate woman worker would be afraid of the tool were it adjusted to give too violent a "kick."

Various changes can be made from the exact construction disclosed in the drawing without departing from the invention and the latter is,

therefore, to be limited only to the extent set forth in the appended claims.

I claim:

1. In a torque wrench, a work engaging head member, a handle member, means rockably inter-coupling said members, and spring means interposed between said members for yieldably resisting rocking movement therebetween, said spring means comprising: a spring strip having a transverse shoulder adjacent to but spaced from one end thereof, first and second strip-supporting elements adapted to bear against said shoulder and against the other end of said strip respectively and compress said strip longitudinally therebetween, said strip being normally curved longitudinally so that it is concave on one side, means for laterally moving said one supporting element in the direction of the concave side of said strip in response to rocking movement between said handle and head members, and a stop member for contacting said one end of said strip and limiting lateral movement thereof whereby continued movement of said one supporting element reverses the longitudinal curvature of said strip with a snap action.

2. A wrench as described in claim 1, in which said one end portion of said strip is reinforced to reduce flexing of said spring adjacent said shoulder.

3. A wrench as described in claim 1, in which said first strip-supporting element comprises a spring bar anchored at one end to said handle member and in which said second supporting member is anchored to said handle member adjacent the point of anchorage of said spring bar.

4. In a torque wrench, a work engaging head member, a handle member, means rockably inter-coupling said members, and spring means interposed between said members for yieldably resisting rocking movement therebetween, said spring means comprising a spring strip having a transverse shoulder adjacent to but spaced from one end thereof, first and second strip supporting elements adapted to bear against said shoulder and against the other end of said strip respectively and compress said strip longitudinally therebetween to bow it longitudinally so that it is concave on one side, and means for laterally moving said one supporting element in the direction of the concave side of said strip in response to rocking movement between said handle and head members, a stop member for contacting said one end of said strip and limiting lateral movement thereof, whereby continued movement of said one supporting element reverses the longitudinal curvature of said stripping spring with a snap action, and means for varying the longitudinal compression of said strip to vary the vigor of said snap action.

5. In a torque wrench, a work-engaging member, a handle member, means for rockably connecting the work-engaging member with the handle member at one end thereof, a spring beam, means for anchoring the spring beam within the handle member at a point spaced from the said rockable connecting means, the spring beam member extending toward the work-engaging member, the work-engaging member having a pressure arm adapted to engage the free end of the spring beam, a snap member mounted within the handle member and operatively connected with the free end of the spring beam so as to be reversely actuated when the force exerted through the handle member to the work-engaging member causes said spring beam to be

deflected beyond a predetermined amount and when said force is released.

6. A torque wrench, comprising: a handle member; a work-engaging member including a pressure arm and a work-engaging head; a spring beam anchored in said handle and having a free end engageable with said pressure arm; separable journal means for said work-engaging member located between said head and said pressure arm, said journal means including a pivot shaft in said handle member and pivot seat means in the form of longitudinally extending laterally recessed guide surfaces on the sides of the work-engaging portions adapted to receive said pivot shaft means, said spring beam adapted to bear on said pressure arm to seat said pivot shaft means in the laterally recessed portions of said pivot seat means.

7. A torque wrench, comprising: a handle member having a recess in one end; a tool element including a work-engaging head and an arm extending therefrom, the length of the arm being proportioned to the size of the work-engaging head; separable journal means for full-cruming said tool element in said handle with its head protruding therefrom; and a cantilever spring beam anchored in said handle and extending into engagement with the arm of the tool element inserted in said head, the length of the arm of said tool element between said journal means and its engagement with said spring beam being determinative of the pressure required to deflect said spring beam.

8. A construction as set forth in claim 7, wherein: said journal means includes a pair of coaxial stub pivots projecting into said handle from the sides thereof, coaxing journal seats depressed in the sides of said tool element, and axially accessible communicating with said seats and adapted to receive said pivots as said tool element is inserted into said handle; said spring beam adapted to bear on the arm of said tool element to yieldably hold said pivots in said seats.

9. A torque wrench, comprising: a handle member having a recess in one end; a tool element including a work-engaging head in an arm extending therefrom, the length of the arm being proportioned to the size of the work-engaging head; separable journal means for full-cruming said tool element in said handle with its head protruding therefrom; a cantilever spring beam anchored in said handle and extending into engagement with the arm of the tool element inserted in said head, the length of the arm of said tool element between said journal means and its engagement with said spring beam being determinative of the pressure required to deflect said spring beam; and an over-center snap spring in said handle positioned to be deflected past its center when said spring beam is deflected beyond a predetermined point; and a tell tale element actuated by said snap spring.

10. A construction as set forth in claim 9, wherein: said journal means includes a pair of coaxial stub pivots projecting into said handle from the sides thereof, coaxing journal seats depressed in the sides of said tool element, and axially accessible communicating with said seats and adapted to receive said pivots as said tool element is inserted into said handle; said spring beam adapted to bear on the arm of said tool element to yieldably hold said pivots in said seats.

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