April 14, 1942. K. R. LARSON 2,279,792

TORQUE WRENCH

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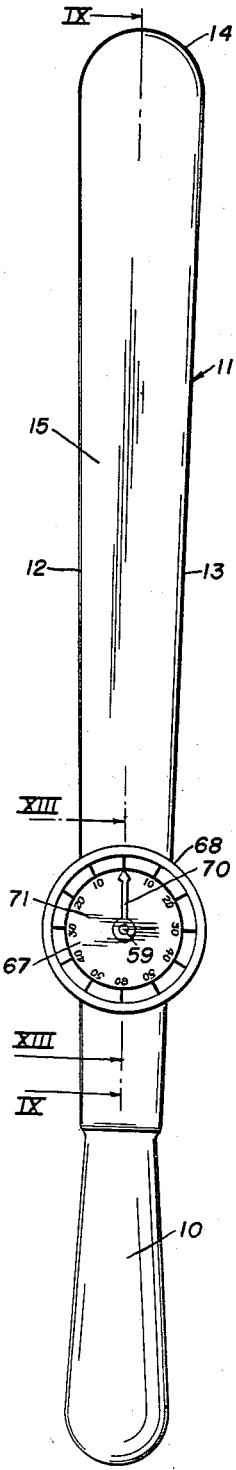

FIG. 1.

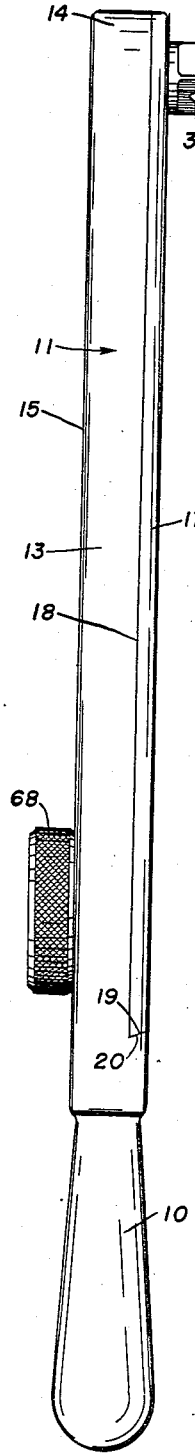

FIG. 2.

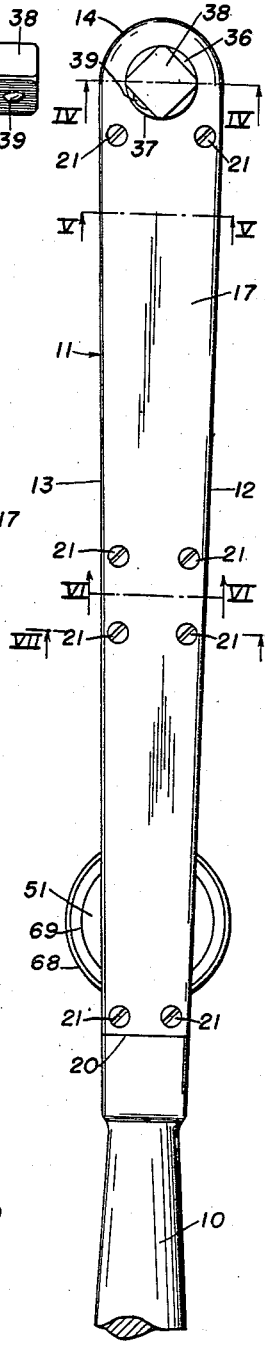

FIG. 3.

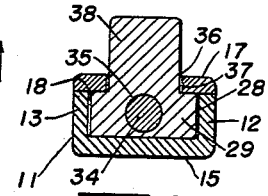

FIG. 4.

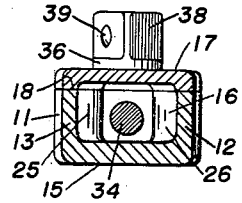

FIG. 5.

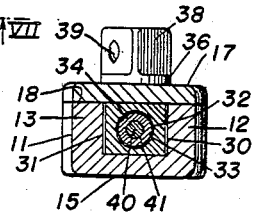

FIG. 6.

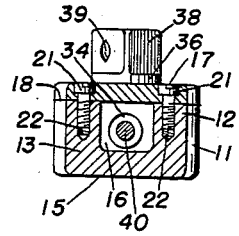

FIG. 7.

INVENTOR.
KENNETH R. LARSON.
BY Harry C. Lebuhn
ATTORNEY.

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TORQUE WRENCH

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FIG. 8.

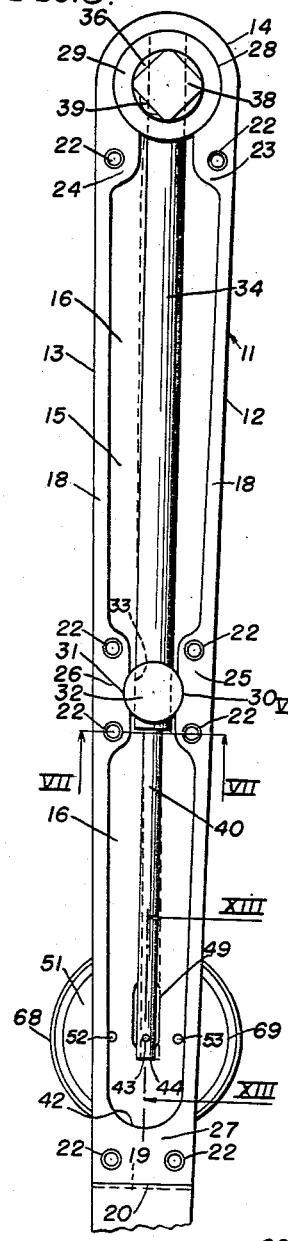


FIG. 9.

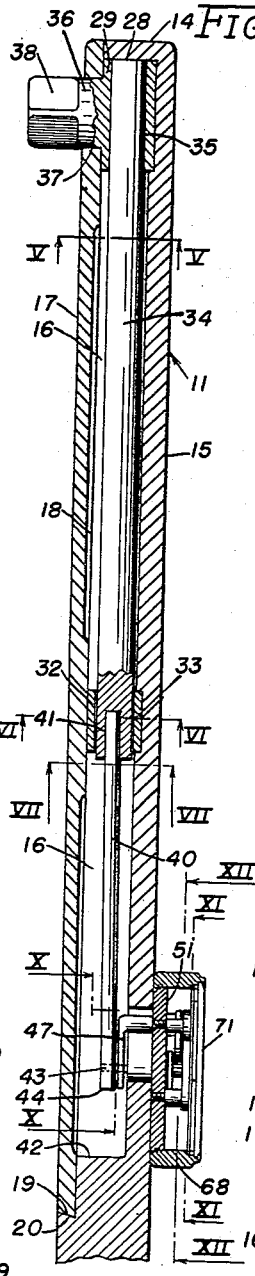


FIG. 11.

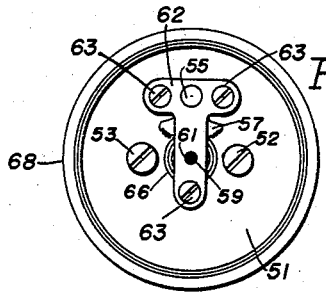
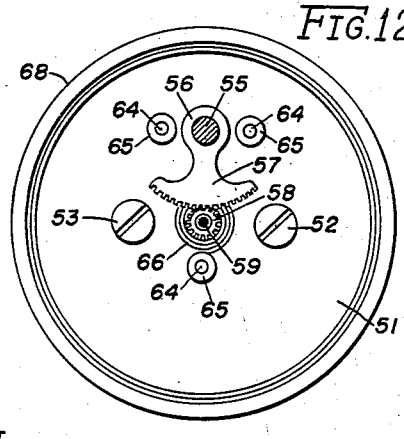


FIG. 12.



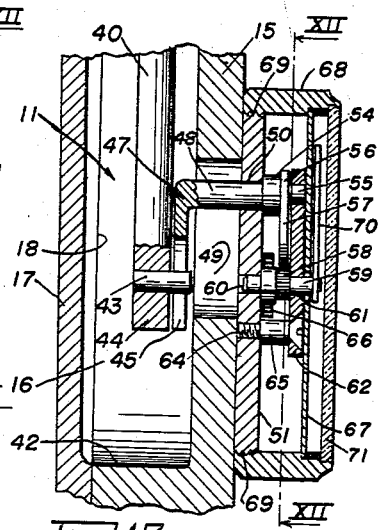


FIG. 13

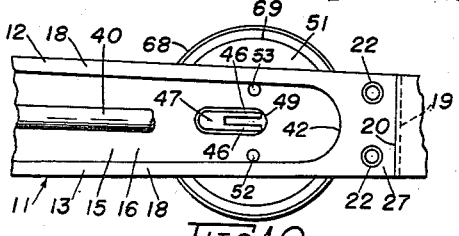


FIG. 10.

INVENTOR.
KENNETH R. LARSON.
BY Harry C. Lester
ATTORNEY.

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UNITED STATES PATENT OFFICE

2,279,792

TORQUE WRENCH

Kenneth R. Larson, Des Plaines, Ill., assignor, by direct and mesne assignments, to Automotive Maintenance Machinery Co., North Chicago, Ill., a corporation of Illinois

Application October 1, 1938, Serial No. 232,723

32 Claims. (Cl. 265—1)

This invention relates to turning devices and more particularly to nut turning wrenches, although certain features thereof may be employed with equal advantage for other purposes.

It contemplates more especially the provision of a simple, dependable, accurate and compact torque wrench that will instantly measure the force supplied in nut turning and similar movements.

Numerous types of torque turning wrenches have heretofore been proposed, but these have not proven entirely satisfactory owing to their substantially increased bulk over ordinary nut turning tools and their failure to render a dependable and uniform service in gauging the torque applied in any nut or other fastening expedient such as a screw. There has been a long felt want for a torque turning tool that is simple, compact, dependable, accurate, and instantly indicates the desired tension or torque applied to a nut or other fastening expedient.

One object of the present invention is to simplify the construction and improve the operation of devices of the character mentioned.

Another object is to provide a simple and compact torque indicating wrench that is dependable in operation.

Still another object is to provide an improved turning tool having dependable torque indicating means associated therewith for measuring the torque applied in the turning operation.

A further object is to provide a turning tool with a single beam for flexing responsive to the application of force in turning fastening expedients such as nuts, screws, and the like to measure the torque with which such is being applied.

A still further object is to provide an improved nut turning wrench having a single beam in the form of a uniform rod that is operatively connected to a torque indicator at its point of greatest flexing displacement.

Still a further object is to provide a wrench having a single elongated rod disposed longitudinally therein for flexing responsive to the application of force in nut turning to indicate the torque of applied force commensurate with the instant of flexing at one extremity thereof.

Other objects and advantages will appear from the following description of an illustrative embodiment of the present invention.

In the drawings:

Figure 1 is a plan view of a wrench embodying features of the present invention.

Figure 2 is a side view in elevation of the wrench shown in Figure 1.

Figure 3 is a bottom plan view of the wrench shown in Figure 1, part of the handle being broken away for convenience.

Figure 4 is a sectional view taken substantially along line IV—IV of Figure 3.

Figure 5 is a sectional view taken substantially along line V—V of Figure 3, and Figure 9.

Figure 6 is a sectional view taken substantially along line VI—VI of Figures 3 and 9.

Figure 7 is a sectional view taken substantially along line VII—VII of Figure 8.

Figure 8 is a bottom view of the wrench shown in Figure 3 with the bottom plate removed to illustrate the inner construction, the handle being broken away for convenience.

Figure 9 is a sectional view taken substantially along line IX—IX of Figure 1.

Figure 10 is a fragmentary broken view taken substantially along line X—X of Figure 9.

Figure 11 is a plan view of an indicator mechanism viewed substantially from line XI—XI of Figure 9 with the dial removed therefrom.

Figure 12 is a sectional view of the indicator mechanism taken substantially along line XII—XII of Figures 9 and 13.

Figure 13 is an enlarged sectional view of the indicator mechanism taken substantially along line XIII—XIII of Figures 1 and 8.

The structure selected for illustration comprises a solid handle member 10 of standard construction having an elongated chambered wrench shank or body 11 cast or otherwise shaped to present inclined side walls 12 and 13 to terminate in a semi-circular extremity or head 14. The handle 10 with its chambered body 11 is preferably though not essentially cast from an aluminum alloy so as to possess the desired strength and lightness for convenience and manipulation in nut turning as will appear more fully hereinafter. It will be observed that the handle shank or body 11 consists of the inclined side-walls 12—13 which converge in the direction of the handle 10 with an intermediate body wall 15 formed integral therewith to define an elongated chambered interior 16.

The shank 11 is normally covered by a solid plate 17 that is shaped to conform with the configuration of the body wall 15 to confront therewith and serve as a complement of an open edge 18 that extends around the side walls 12—13 of the semi-circular extremity 14, the face plate 17 being shaped to correspond therewith and its lower inclined edge 19 cooperates with a correspondingly inclined recess 20 (Figures 2 and 9) formed in the shank 11 proximate to the solid

handle 10. A plurality of threaded screw fasteners 21 project through apertures in the plate 17 to engage correspondingly threaded bores 22 in the edge 18 that extends along the side walls 12—13 of the handle shank or body 11 and end 14, thereby enclosing the chamber 16 and confining the torque resisting instrumentalities and measuring instrumentalities to be described hereinafter.

It will be noted that the handle shank or body 15 and especially the inclined side walls 12—13 are reinforced in the region of the threaded bores 22 by increasing the thickness of the cast metal as at 23—24, 25—26 and 27 which is a solid portion of the handle shank 11 proximate to the lower extremity of the chamber 16 provided therein. The semi-circular head 14 of the body 11 is provided with a circular recess 28 corresponding in curvature therewith and measured to receive an accurately fitting revoluble or turning head member 29 of corresponding shape and size for rotary association therein. It is to be noted that the circular recess 28 communicates with the chamber 16 in the handle shank 11, and the entire head portion is reinforced by the enlarged thicknesses 23—24 of the side walls 12—13 in the region of the recess 28.

Now, then, the enlarged thicknesses 25—26 of the side walls 12—13 are approximately along a transverse median line of the handle 16 and its contiguous shank or body 11, and these are circularly recessed to provide interrupted arcuate portions 30 and 31 which receive a cylindrical bearing or bushing 32 of pressed or other suitable material. The bushing 32 is provided with a diametrically disposed bore 33 which freely receives a closely fitting cylindrical rod 34 that extends therethrough from the revoluble member 29 to serve as a torque resisting beam.

To this end, the cylindrical elongated rod 34 is, in this instance, of uniform diameter and projects diametrically through the revoluble member 29 as at 35 for fixed engagement therewith to constitute a single acting unit or member. As shown, the revoluble member 29 has a transversely disposed cylindrical extension 36 which is journalled in a correspondingly shaped aperture 37 provided in the cover plate 17. The cylindrical extension 36 is, in this instance, formed integral with the revoluble member 29 and terminates beyond the cover plate 17 in a polygonal shank 38 for registry with a correspondingly shaped and sized recess formed in the wrench socket or other turning implement as commercial practice may dictate for use therewith.

It will be observed, therefore, that any wrench socket of standard construction may be detachably associated with the journalled shank 38 that is preferably though not essentially provided with a spring impelled ball detent 39 to preclude accidental separation therewith. While the elongated beam 34 terminates just beyond the bearing or bushing 32, in this instance, which serves as a floating mount therefor, it should be appreciated that such may extend appreciably therebeyond depending upon the dictates of commercial practice. It has been found more proficient, however, from a manufacturing standpoint to terminate the elongated cylindrical beam 34 just beyond the floating mount 32 thereof and join therewith a smaller elongated rod 40 of comparatively smaller diameter for pressed fitting axial engagement in an end bore 41 provided in the free extremity of the elongated beam 34. This effects the equivalent of an integral joinder between the beam 34 and its reduced extension 40 that terminates proximately to the lower end 42 of the chamber 16 in the body 11.

It should be noted that the beam 34 together with its reduced extension 40 would function exactly the same even though these were turned or otherwise shaped from a single unit; however, such construction would be somewhat more expensive from a production standpoint than the pressed co-axial fitting relationship between the rods 34 and 40 serving as a floating beam on the mount 32. The reduced rod 40 has a pin 43 which projects transversely therethrough proximate to the lower extremity 44 thereof for registry between two furcations 45—46 in a lever 47 that is disposed in the chamber 16 and has an offset arm 48 extending through an opening 49 (Figure 13) in the wall 15 of the body 11.

The offset arm 48 is journalled in a correspondingly sized bore 50 provided in the bottom plate 51 constituting a part of the indicator mechanism as will appear more fully hereinafter. The bottom plate 51 constitutes a part of the indicator casing and is fixed to the wall 15 of the wrench body 11 by means of threaded studs 52—53. The lever arm 48 has an enlarged peripheral shoulder 54 terminating in a reduced stud 55 over which is pressed an apertured arm 56 of a gear segment 57. The gear segment 57 meshes with a pinion 58 mounted on a stub shaft 59 which is journalled in axial aligned bores 60 and 61 provided in the casing plate 51 and a bracket plate 62 in parallel spaced relation therewith.

The bracket plate 62 is, in this instance, substantially T-shaped and is held or mounted in spaced parallel relation to the indicator casing bottom 51 by means of threaded studs 63, in this instance three, projecting through the extremities thereof for engagement with correspondingly threaded bores 64 (Figure 12) formed in the bottom indicator casing plate 51. It should be observed that the fastening studs 63 are provided with an enlarged shank 65 serving as a spacer collar beyond the reduced threaded extremity thereof that engages the correspondingly threaded bores 64 (Figure 13), thereby maintaining the T-shaped bracket 62 in spaced relation with the indicator casing bottom plate 51. The bracket 62 also serves as a bearing for the reduced extremity 55 of the lever arm 48 to insure the proper mounting of the gear segment 57 and maintaining the meshing engagement thereof with the pinion 58.

A spiral spring 66 envelops the stub shaft 59 on which the pinion 58 is mounted or integrally formed, to normally urge or return the indicator instrumentalities to an initial position. A calibrated dial 67 is mounted in a cylindrical collar 68 that threadedly engages the bottom plate 51 as at 69 to constitute a casing for the indicator instrumentalities. A pointer 70 is fixed to the reduced extremity of the pinion shaft 59 which projects beyond the indicator dial 67 to designate in foot pounds the torque exerted in turning a nut or other fastening expedients by proper engaging attachment with the polygonal shank 38 while the turning force is applied to the handle 10. A glass or other transparent crystal 71 is fitted to the indicator casing 68 to preclude obstruction to the pointer 70 and avoid the entrance of foreign substances therein which would

impair the accuracy and operation of the indicating instrumentalities.

This flexes the beam 34—40 in one direction or the other depending upon the direction of the applied force to the handle 10, and this flexing will vary proportionately to the force applied to flex the beams 34—40 as indicated by the dotted outline thereof in Figure 8. The beam 34 together with its reduced extension 40 is preferably turned or otherwise shaped from a high quality steel alloy that has limited flexibility and a comparatively high elastic limit so that it will uniformly flex and return to its initial position to provide accurate readings within the range and elastic limit thereof without variation within ordinary requirements. Any number of high quality steel alloys may be used for this purpose, and by way of example the beam 34—40 can be advantageously constructed from an oil hardened tool steel.

It will be observed from the foregoing description of an illustrative embodiment constituting the subject matter hereof, that clockwise rotation imparted to the handle 10 (viewed from Figure 1) during the engagement of the polygonal shank 38 with a nut or other fastening implement, will cause flexing of the beam ends 34—40 as shown in the dotted outline in Figure 8. This action will cause slight longitudinal displacement of the beam 34—40 relative to its mount 32 and the latter will simultaneously rotate for a fractional extent to facilitate the displacement of the beam 34—40 in opposite directions responsive to the flexing thereof. The flexing of the beam 34—40 will correspondingly displace the pointer 70 which is connected to indicator instrumentalities calibrated to the selected size or capacity of the beam 34—40.

Then, too, it should be appreciated that the attachment of the indicator casing 68 with its bottom plate 51 on the body wall 15 aways maintains the indicator instrumentalities in operative connection with the beams 34—40, thereby rendering the cover plate 17 removable for inspection, replacement, and cleansing purposes without interfering with the setting and operative connection between the beam extensions 40 and the indicator lever 47. The operative connection of the indicator lever 47 to the terminal free end of the beams 34—40 also provides for the measurement of the torque at the point of maximum deflection of the torque resisting beam 34—40, thereby affording more accurate measurements than would otherwise be possible.

With the arrangement of parts above described, a very simple, dependable and accurate torque resisting and measuring beam 34—40 has been incorporated into a wrench or other turning devices without sacrificing compactness or encumbering the turning tool with any objectionable added weight. Various changes may be made in the embodiment of the invention herein specifically described without departing from or sacrificing any of the advantages of the invention or any features thereof, and nothing herein shall be construed as limitations upon the invention, its concept or structural embodiment as to the whole or any part thereof except as defined in the appended claims.

I claim:

1. In a torque wrench, the combination with a handle member, of a turning head member journalled in one extremity of said handle member, a yieldable torque resisting beam anchored in said turning head member, a supporting bearing carried by said handle member and engaging said beam intermediate the extremities thereof, and torque indicating means operatively connected to the free extremity of said yieldable beam.

2. In a torque wrench, the combination with a handle member, of a turning head member journalled in one end of said handle member, a yieldable torque resisting beam anchored in said turning head member, a bearing slidably engaging said beam intermediate the extremities thereof and journalled in said handle member, and calibrated indicating means operatively connected to the free extremity of said yieldable beam.

3. In a torque wrench, the combination with a handle member, of a turning head member journalled in said handle member, an elongated yieldable torque resisting rod anchored at one extremity thereof to said head member, a bushing journalled in said handle member and slidably engaging said yieldable rod intermediate the extremities thereof, said elongated yieldable rod terminating in a free extremity beyond said bushing, and torque indicating means operatively connected to the free extremity of said yieldable rod which is displaced responsive to applying force to said handle means.

4. In a torque wrench, the combination with a handle member, of a turning head member journalled in said handle member, an elongated cylindrical and yieldable torque resisting rod anchored at one extremity thereof to said head member, a bushing journalled in said handle member and engaging said yieldable rod intermediate the extremities thereof, said elongated yieldable rod terminating in a free extremity beyond said bushing, a smaller rod projecting from the free extremity of said elongated yieldable rod, and torque indicating means operatively connected to the free extremity of said last named rod which is displaced responsive to applying force to said handle means.

5. In a torque wrench, the combination with a handle member, of a turning head member journalled in said handle member, an elongated cylindrical and yieldable torque resisting rod of substantially uniform diameter anchored at one extremity thereof to said head member, a bushing journalled in said handle member and slidably engaging said yieldable rod intermediate the extremities thereof, said elongated yieldable rod terminating in a free extremity beyond said bushing and extending along a longitudinal median line of said handle member, and torque indicating means operatively connected to the free extremity of said rod which is displaced responsive to applying force to said handle means.

6. In a torque wrench, the combination with a chambered handle member, of a turning head member journalled in said handle member, an elongated cylindrical and yieldable torque resisting rod of substantially uniform diameter anchored at one extremity thereof to said head member, a bushing journalled in said handle member and slidably engaging said yieldable rod intermediate the extremities thereof, said elongated rod terminating in a free extremity beyond said bushing and extending along a longitudinal median line of said handle member, torque indicating means operatively connected to the free extremity of said rod and which extremity is displaced in response to the application of force to said handle means, and a cover plate attached to said chambered handle member to cooperate therewith in confining said torque resisting rod.

7. In a torque wrench, the combination with a handle member, of a turning head member journalled in said handle member, an elongated cylindrical and yieldable torque resisting rod of substantially uniform diameter anchored at one extremity thereof to said head member, a bushing journalled in said handle member and slidably engaging said yieldable rod intermediate the extremities thereof, said elongated rod terminating in a free extremity beyond said bushing, a smaller rod projecting from the free extremity of said elongated rod and extending along a longitudinal median line of said handle member, and torque indicating means operatively connected to the free extremity of said last named rod and which extremity is displaced in response to the application of force to said handle means.

8. In a torque wrench, the combination with a chambered handle member, of a turning head member journalled in said handle member, an elongated cylindrical and yieldable torque resisting rod of substantially uniform diameter anchored at one extremity thereof to said head member, a bushing journalled in said handle member and slidably engaging said yieldable rod intermediate the extremities thereof, said elongated rod terminating in a free extremity beyond said bushing, a smaller rod projecting from the free extremity of said elongated rod and extending along a longitudinal median line of said handle member, torque indicating means operatively connected to the free extremity of said last named rod and which extremity is displaced in response to the application of force to said handle means, and a cover plate attached to said chambered handle member to cooperate therewith in confining said torque resisting rod.

9. In a torque wrench, the combination with a handle member, of a turning head member journalled in said handle member, an elongated cylindrical and yieldable torque resisting rod anchored at one extremity thereof to said head member, a bushing journalled in said handle member and slidably engaging said yieldable rod intermediate the extremities thereof, said elongated rod terminating in a free extremity beyond said bushing, a smaller rod projecting from the free extremity of said elongated rod, a pin projecting transversely from said smaller rod extremity, torque indicating means operatively mounted on said handle member, a furcated lever extending from said indicating means and cooperating with said pin connected to the free extremity of said last named rod and which extremity is displaced in response to the application of force to said handle means.

10. In a torque wrench, the combination with a handle member, of a turning head member journalled in said handle member, an elongated yieldable torque resisting rod of substantially uniform cross-section anchored at one extremity thereof to said head member, a guide in said handle member for reciprocally receiving said yieldable rod intermediate the extremities thereof, said elongated rod terminating in a free extremity beyond said guide, a smaller rod projecting from the free extremity of said elongated rod and extending along a longitudinal median line of said handle member, a pin projecting transversely from said smaller rod extremity, torque indicating means operatively mounted on said handle member, a furcated lever extending from said indicating means and freely cooperating with said pin connected to the free extremity of said last named rod and which extremity is displaced in response to the application of force to said handle means with said turning head member in registry with a part to be turned.

11. In a torque wrench, the combination with a chambered handle member, of a turning head member journalled in said handle member, an elongated cylindrical and yieldable torque resisting rod of substantially uniform diameter anchored at one extremity thereof to said head member, a bushing in said chambered handle member to reciprocally receive said yieldable rod intermediate the extremities thereof, said bushing being journalled in said handle member, said elongated rod terminating in a free extremity beyond said bushing, a smaller rod projecting from the free extremity of said elongated rod and extending along a longitudinal median line of said handle member, a pin projecting transversely from said smaller rod extremity, torque indicating means operatively mounted on said handle member, a furcated lever extending from said indicating means and cooperating with said pin connected to the free extremity of said last named rod and which extremity is displaced in response to the application of force to said handle means.

12. In a torque wrench, the combination with a chambered handle member, of a turning head member journalled in said handle member, an elongated cylindrical and yieldable torque resisting rod of substantially uniform diameter anchored at one extremity thereof to said head member, a bushing journalled in said handle member and slidably engaging said yieldable rod intermediate the extremities thereof, said elongated rod terminating in a free extremity beyond said bushing, a smaller rod of substantially uniform diameter projecting from the free extremity of said elongated rod and extending along a longitudinal median line of said handle member, a pin projecting transversely from said smaller rod extremity, torque indicating means operatively mounted on said handle member, a furcated lever extending from said indicating means into said chambered handle member and cooperating with said pin connected to the free extremity of said last named rod and which extremity is displaced in response to the application of force to said handle means.

13. A torque wrench comprising, an elongated body member having a grip portion at one end thereof, a head member rotatably carried by the other end of said body member, an elongated torque resisting beam disposed substantially parallel with respect to said body and yieldably opposing relative rotation of said members, indicating means, said head member, beam, indicating means, and grip portion being arranged in longitudinally disposed relation in the order named, and means projecting from the end of said beam nearest said grip portion and connecting said end of said beam with said indicating means.

14. A torque wrench comprising, an elongated body member having a grip portion at one end thereof, a head member rotatably carried by the other end of said body member, a yieldable torque resisting beam having one end thereof connected to said head member and its opposite end flexibly connected with said body member, indicating means, said head member, beam, indicating means, and grip portion being arranged in longitudinally disposed relation in the order named, and means connecting said opposite end of said beam with said indicating means.

15. A torque wrench comprising, an elongated body member having a grip portion at one end thereof, a head member rotatably carried by the other end of said body member, a yieldable torque resisting beam carried by said head member and flexibly connected to said body member, indicating means, said head member, beam, indicating means, and grip portion being arranged in longitudinally disposed relation in the order named with said indicating means disposed in close proximity to said grip portion where it may readily be observed by the wrench operator, and means including an extension on the end of the beam adjacent to said grip portion adapted to engage said indicating means and operate the latter as said beam is flexed.

16. A torque wrench comprising, a body member having a grip portion at one end thereof, a head member rotatably carried by the other end of said body member, an elongated torque resisting beam between said body and head members and having one end rigidly connected to one of said members and its other end flexibly connected to the other of said members so as to yieldingly resist relative rotation of said members, an indicator carried by one of said members in close proximity to said grip portion and having an operating-part, and means for operating said indicator as said beam is flexed which includes an extension on said other end of said beam operably engaged with said operating part.

17. A torque wrench comprising a body member having a grip portion at one end thereof, a head member rotatably carried by the other end of said body member, a yieldable torque resisting beam between said body and head members and extending longitudinally of said body member, an indicator carried by said body member in close proximity to said grip portion and having an operating-part, and means for operating said indicator as said beam is flexed which includes a longitudinally projecting extension on the end of said beam nearest said grip portion operably engaged with said operating-part.

18. A torque wrench comprising, a body member, a head member rotatably carried by said body member, a torque resisting beam carried at one end by one of said members, means providing a pivotal connection between the other end of said beam and the other of said members, indicating means, and means for directly connecting the end portion of said beam remote from said head member to said indicating means.

19. A torque wrench comprising, a body member, a head member rotatably carried by said body member and having provision for engagement with the work, a yieldable torque resisting beam having one end portion connected to said head member and extending away therefrom longitudinally of said body member, means providing a pivotal connection between the opposite end portion of said beam and said body member, indicating means, and means directly connecting the pivotally-connected end portion of said beam to said indicating means.

20. A torque wrench for use with an indicator for measuring the force applied to the work comprising, a body member, a head member rotatably carried by said body member and having provision for engagement with the work, an elongated torque resisting beam carried by one of said members, a flexible connection between said beam and the other of said members, whereby said beam yieldingly resists relative rotation of said members, and indicator-operating means directly connected to the end portion of said beam remote from said head member to actuate said indicator to measure the flex of said beam.

21. A torque wrench comprising, a pair of rockably connected members, one of which is adapted to be operably engaged with the work and the other is adapted to receive the pressure to be applied to the work, a torque resisting beam having one end thereof carried by one of said members and having its opposite end connected to the other of said members for yieldably resisting relative rock movement of said members, said connection being such as to provide for free flexing movement of said opposite end of said beam, indicating means, and means for directly connecting said indicating means to said beam at its end having free flexing movement.

22. A torque wrench comprising, an elongated body member, a head member rotatably connected to said body member, a substantially cylindrical torque resisting beam between said body and head members and connected thereto at its opposite end portions for yieldably resisting relative rotation of said members, indicating means, and an axial extension projecting from one end portion of said cylindrical beam and having operative engagement with said indicating means, whereby to measure the flex of said cylindrical beam responsive to the application of force to said body member.

23. A torque wrench comprising, a body member, a head member rotatably carried by said body member and having provision for engagement with the work, a yieldable torque resisting beam carried by said head member and extending away therefrom longitudinally of said body member, means connecting the end portion of said beam opposite said head member to said body member, said means permitting pivotal movement as well as longitudinal slide movement of the end portion of the beam relative to said body member, indicating means, and an extension on the body-connected end portion of said beam operably connected to said indicating means for measuring the flex of said beam as said head and body members are relatively rotated.

24. A torque wrench comprising, a body member, a head member rotatably carried by said body member and having provision for engagement with the work, a yieldable torque resisting beam connected at one end portion to said head member and extending away therefrom longitudinally of said body member, means providing a pivotal connection between the opposite end portion of said beam and said body member, indicating means, and an extension on the pivotally-connected end portion of said beam operably connected to said indicating means for indicating the flex of said beam.

25. A torque wrench comprising, a chambered casing, a detachable cover plate for said casing, a head member rotatably supported in said casing adjacent one end thereof, a torque resisting beam housed in said casing and having one end connected to said head member and its other end flexibly connected to said casing at a point longitudinally removed from said head member, an indicator carried by said casing, and means supported by the casing-connected end portion of said beam and operatively connected with said indicator for operating the latter, said head member, beam, indicator, and means being so supported independently of said cover that said cover may be removed without disturbing said in-

dicator and the operative relationship of the wrench parts.

26. A torque wrench comprising an elongated chambered body member having a grip portion at one end thereof, a head member rotatably carried in the chamber of said body member, said head member having an extension adapted to receive a work-engaging member, a yieldable torque resisting beam in said chamber opposing relative rotation of said members, indicating means carried by the top wall of said chamber and operable upon relative rotation of said rotatable members, said head member, beam, indicating means, and grip portion being arranged in longitudinally disposed relation in the order named, and a detachable cover plate for said chambered body member arranged so that it may be removed without disturbing the operative relationship of the wrench parts, said cover plate having an opening through which said extension projects and being arranged so as to confine said head member against substantial axial movement between said top wall and the inner surface of said cover plate.

27. A torque measuring wrench comprising, a handle member, a work-engaging member pivotally supported adjacent one end of said handle member, said work-engaging member having a bore formed therein and extending across the axis of rotation of said work-engaging member, a normally straight spring bar yieldably opposing relative rock movement of said work-engaging member and said handle member, said spring bar having one end thereof fixedly mounted in said bore and having its opposite end arranged to have a force applied thereto through said handle member, indicator means responsive to flexing of said spring bar and consequent relative rock movement of said work engaging and handle members for indicating the force applied to the work, and means operatively connecting said opposite end of said spring bar with said indicator means.

28. A torque measuring wrench comprising, a handle member, a work-engaging member pivotally supported adjacent one end of said handle member, said work-engaging member having a bore formed therein and extending across the axis of rotation of said work-engaging member, a normally straight spring bar yieldably opposing relative rock movement of said work-engaging member and said handle member, said spring bar having one end thereof fixedly mounted in said bore, means pivotally connecting the opposite end of said spring bar to said handle member, indicator means responsive to flexing of said spring bar and consequent relative rock movement of said work-engaging and handle members for indicating the force applied to the work, and means including an element connecting said pivotally-connected end of said spring bar with said indicator means.

29. In a torque wrench, the combination with an elongated wrench body member, of a handle member extending from one end of said body member and of substantially lesser length than said body member, a turning head member operatively connected to said body member proximate to the other end thereof, a yieldable elongated torque resisting beam extending between said handle member and said turning head member and connected to said turning head member, and calibrated indicating means operatively connected to the free extremity of said torque resisting beam to measure the flex of said yieldable torque resisting beam responsive to applying force to said handle member.

30. In a torque wrench, the combination with a handle member, of a turning head member journaled in said handle member, an elongated and yieldable torque resisting rod interposed between said handle member and said turning head member and connected to said turning head member, a rod bearing journaled in said handle member to freely receive said rod therethrough, and calibrated indicating means operatively connected to the free extremity of said yieldable rod.

31. A torque wrench comprising: a handle member including an elongated body member having a chamber extending throughout substantially the full length thereof, said body having a longitudinally extending grip portion at one end thereof; an indicator carried by said handle member, said indicator being located at the end of said chamber nearest to said grip portion; a head member having an enlarged portion in said chamber and a relatively smaller portion extending exteriorly of said chamber and adapted to be operatively connected with the work; elongated substantially cylindrical rod means in said chamber, one end of said elongated rod means being fixedly secured to the enlarged portion of said head member and extending radially from said enlarged portion and lengthwise of said chamber toward said grip portion, said enlarged portion of said head member being so arranged and operatively connected with said handle member that it can turn relative to said handle member in proportion to the force applied to the work, the opposite end of said elongated rod means being free and unrestrained against movement in opposite directions in said chamber, said free end being moved upon turning of said enlarged portion of said head member relative to said handle member; and means between said indicator and the free end of said elongated rod means and extending angularly of the free end of said elongated rod means operatively connecting the free end of said elongated rod means to said indicator to actuate said indicator upon movement of the free end of said elongated rod means.

32. A torque wrench comprising: a handle member including a body having a chamber extending throughout substantially the full length thereof, and a grip portion extending longitudinally from said body; indicator means carried by said handle member adjacent one end of said chamber; a preassembled unit including a head member and an elongated substantially cylindrical rod means, said preassembled unit being adapted to be inserted bodily into said chamber, said head member having an enlarged portion received in said chamber and a relatively smaller portion extending exteriorly of said handle adjacent the opposite end of said chamber and adapted to be operatively connected with the work, said elongated rod means having one end thereof fixedly secured to the enlarged portion of said head member and extending lengthwise of said chamber toward said grip portion, said enlarged portion of said head member being so arranged and operatively connected with said handle member that it can turn relative to said handle member in proportion to the force applied to the work, the opposite end of said elongated rod means terminating at a point beneath said indicator means and being free and unrestrained against movement in op-

posite directions in said chamber with respect to said handle member upon turning movement of said enlarged portion of said head member relative to said handle member; and means operatively connecting the free end of said elongated rod means with said indicator means to actuate said indicator means in response to the application of force to said handle member, said means including an operating part on said indicator means and a coupling part on the free end of said elongated rod means.

KENNETH R. LARSON.