March 7, 1944. K. R. LARSON ET AL 2,343,380

TORQUE RATCHET WRENCH

Filed Oct. 30, 1941 2 Sheets-Sheet 1

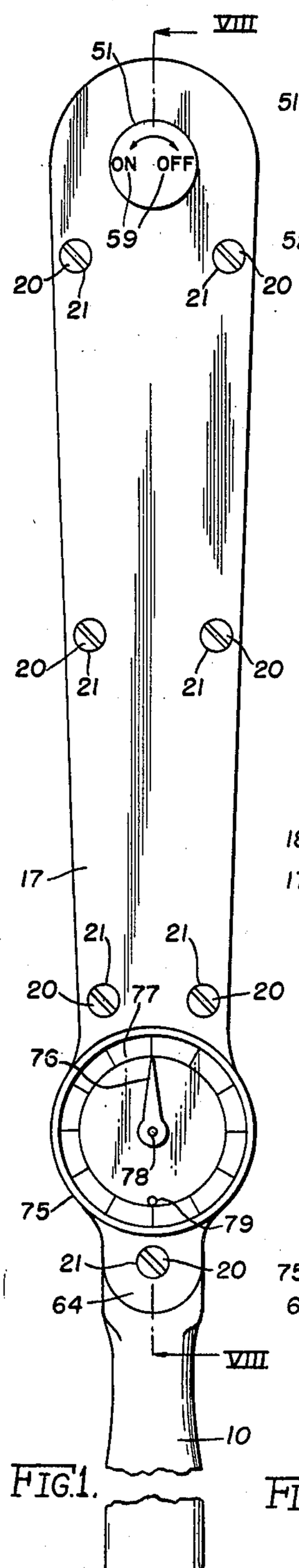

FIG. 1.

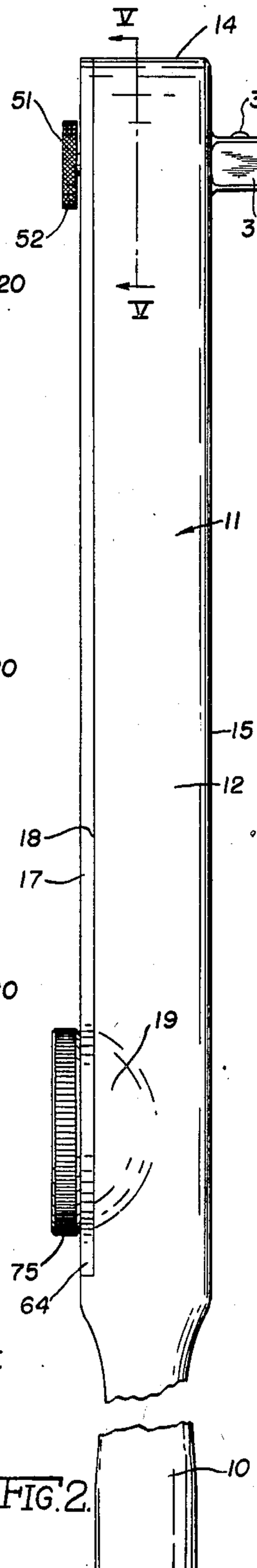

FIG. 2.

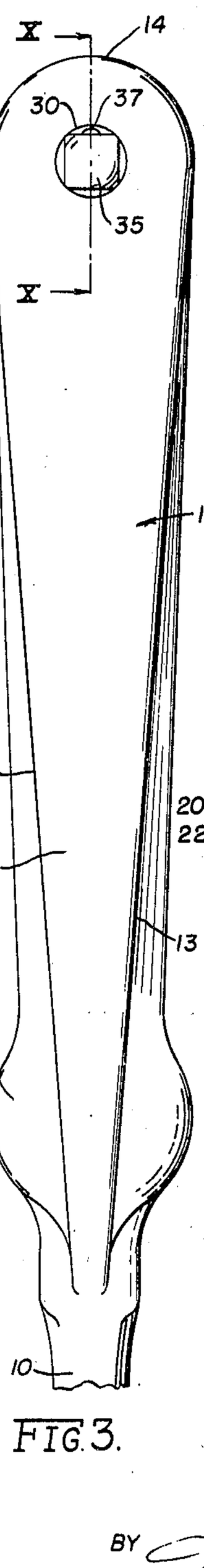

FIG. 3.

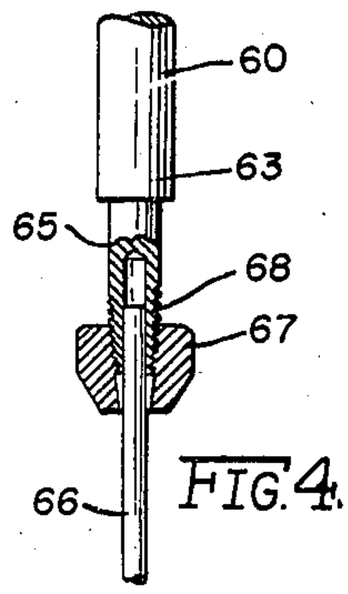

FIG. 4.

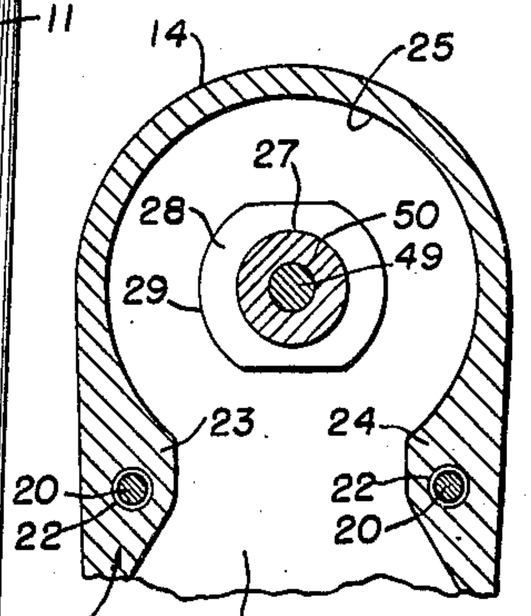

FIG. 5.

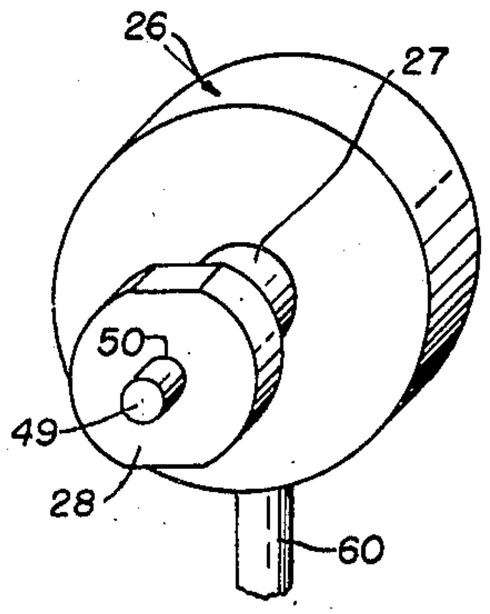

FIG. 6.

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TORQUE RATCHET WRENCH

Filed Oct. 30, 1941 2 Sheets-Sheet 2

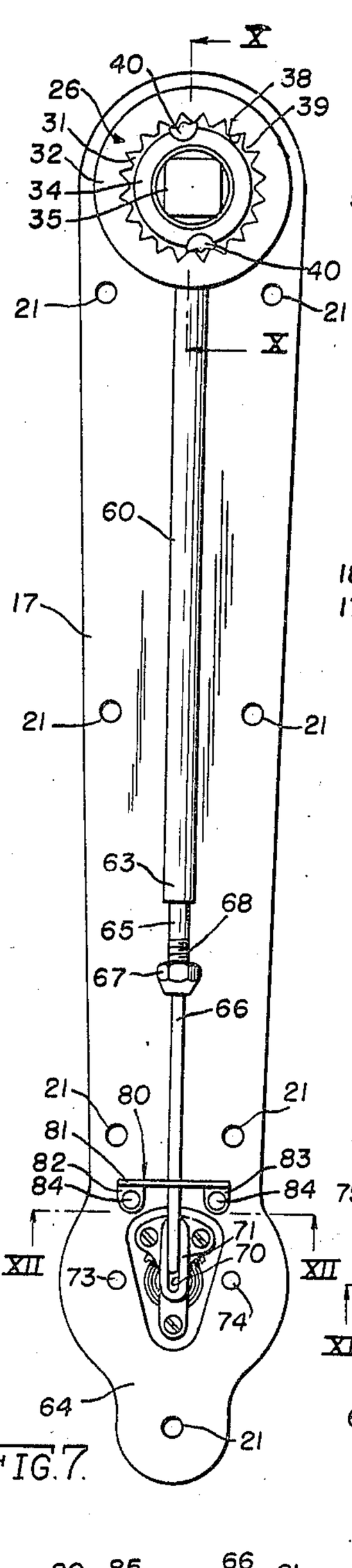

FIG. 7.

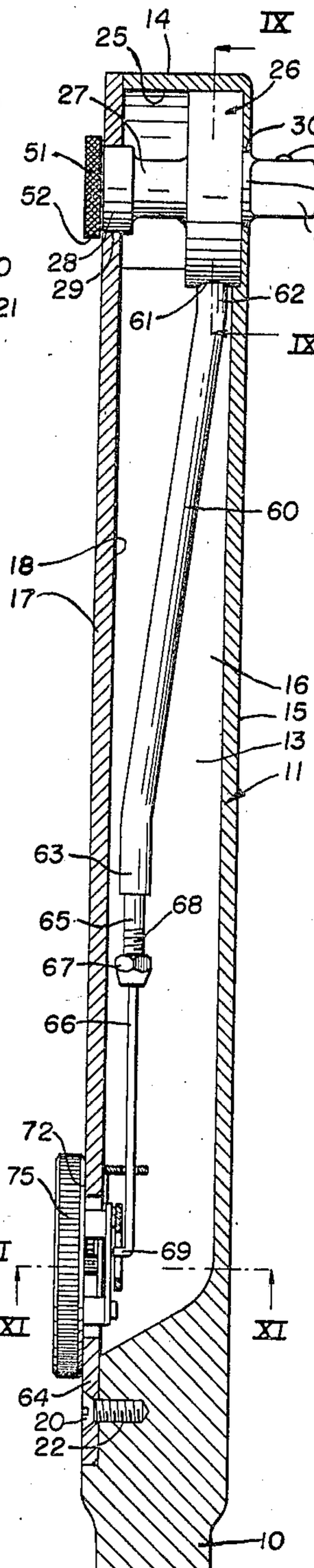

FIG. 8.

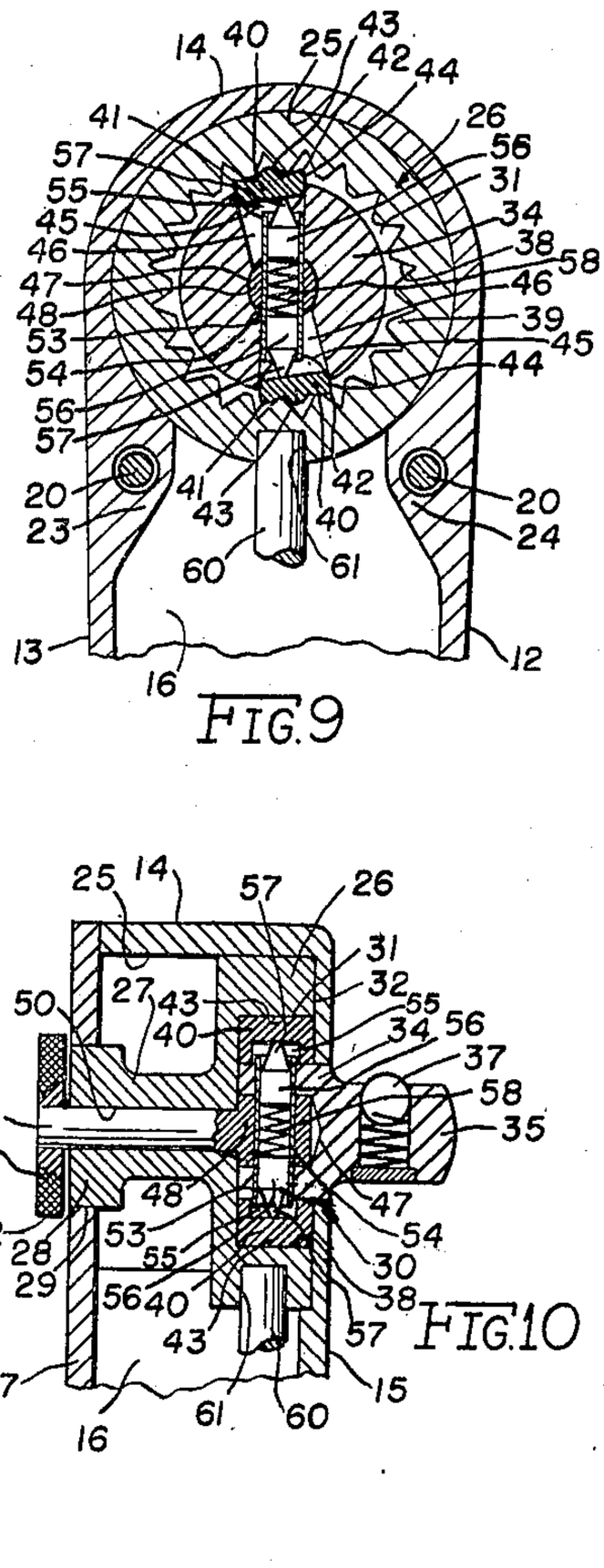

FIG. 9

FIG. 10

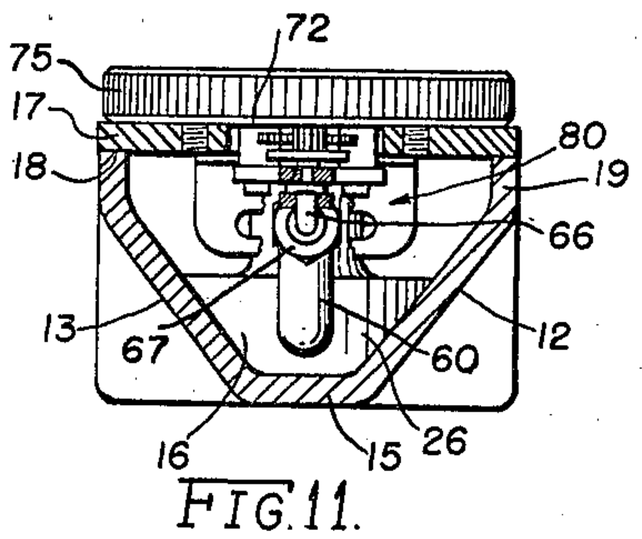

FIG. 11.

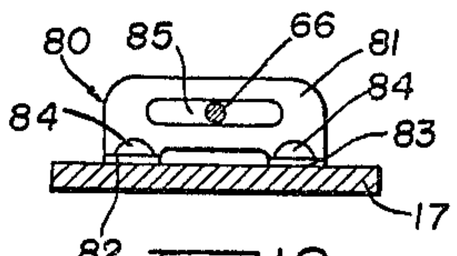

FIG. 12.

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UNITED STATES PATENT OFFICE

2,343,380

TORQUE RATCHET WRENCH

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Application October 30, 1941, Serial No. 417,126

6 Claims. (Cl. 265—1)

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

It contemplates more especially the adaptation of a self-contained ratchet mechanism to a simple, dependable, accurate and compact torque wrench of the type described in copending patent application of Kenneth R. Larson, Serial Number 374,361, and filed January 14, 1941, which eventuated into Letters Patent 2,312,104, dated February 23, 1943.

Numerous types of torque turning wrenches have been in widespread use, but these are of the flexible torque resisting beam type wherein ratchet mechanisms can more easily be supplied than in torsion type load measuring devices such as illustrated in the aforesaid copending application for Letters Patent. There has been a long felt want for ratchet torque turning tools, and these should be compact, dependable, and accurate as well as light in weight and effective in operation. This coupled with the fact that the turning head constitutes the torsion resisting element which should be as long and unaffected as possible by any other influences, complicates the adaptation of ratchet mechanisms thereto.

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 incorporate a compact ratchet mechanism into a nut turning or other type of a torque wrench head member presenting limited space and special operating instrumentalities.

Still another object is to provide an improved ratchet member embodying a plurality of pawls that are circumferentially spaced to provide registry with an annular ratchet member comprising part of a sectional turning head.

A further object is to provide a plurality of circumferentially spaced pawls that are operatively connected to an annular actuator to place certain pawls in and out of registry therewith for operative head turning engagement in selected directions of rotation.

A still further object is to provide a plurality of pawls in an annular head member concentric to the axis of rotation of a torsion resisting shank to comprise a sectional ratchet head comprising part of a turning member.

Still a further object is to provide a plurality of pawls operatively connected with an axially positioned actuator for controlled directional engagement with an annular ratchet head comprising part of a torsion resisting turning member.

An additional object is to provide a plurality of pawls in a head member for selected registry with circumferentially spaced pawl engaging members on a revoluble turning member for engagement by one or the other of the opposite pawls to constitute a torque indicator actuator element.

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 top plan view of a wrench and dial embodying features of the present invention.

Figure 2 is a side view of a wrench and dial embodying features of the present invention.

Figure 3 is a bottom plan view of a wrench embodying features of the present invention.

Figure 4 is a fragmentary view of the indicator actuator rod and tail piece connected therewith.

Figure 5 is a sectional view taken substantially along line V—V of Figure 2.

Figure 6 is a fragmentary perspective view of a ratchet mechanism utilized in connection with a torsion head member of a torque wrench.

Figure 7 is a bottom view of the top cover plate assembly of the wrench shown in Figure 1 with the casing and handle removed to illustrate the inner construction.

Figure 8 is a sectional view taken substantially along line VIII—VIII of Figure 1, the handle being broken away for convenience.

Figure 9 is a fragmentary sectional view taken substantially along line IX—IX of Figure 8.

Figure 10 is a fragmentary sectional view taken substantially along line X—X of Figure 3.

Figure 11 is a sectional view taken substantially along line XI—XI of Figure 8 showing the dial mechanism and actuator rod tail piece connected thereto, parts thereof being broken away to clarify the showing.

Figure 12 is a sectional view taken substantially along line XII—XII of Figure 7.

The structure selected for illustration comprises a solid handle 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 terminating in a semi-circular top or head extremity 14. The handle 10 with its chambered body 11 is preferably though not essentially cast from an alumi-

num 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 and also toward the bottom wall 15 formed integral therewith to define an elongated chambered interior 16. It should be noted that, in this instance, the side walls 12—13 not only converge toward the handle 10 (Figures 3 and 11) but also toward the bottom 15 (Figure 11) to define a compact and well balanced casing or body 11.

The body or casing shank 11 is, in this instance, covered by a rigid steel plate 17 that is shaped to conform with the configuration of the peripherally flanged open side 18 opposite the bottom wall 15 to confront therewith and serve as a complement thereof. The handle 10, body 11, and cover plate 17 comprise a handle member to impart turning movement to a nut or other fastener as will appear more fully hereinafter. The lower or handle extremity 19 of the chamber 16 is of the same general size and semi-circular configuration as the head extremity 14. The peripherally flanged open edge 18 of the casing 11 extends around the side walls 12—13 and their semi-circular head and handle extremities 14 and 19.

The rigid face or cover plate 17 is shaped to correspond with the flanged open edge 18 including its upper and lower semi-circular head and handle extremities 14 and 19 to serve as an enclosure therefor and also as a rigid turning arm to which the measuring instrumentalities are attached as will appear more fully hereinafter. A plurality of threaded screw fasteners 20 project through apertures 21 in the rigid cover plate 17 to engage correspondingly threaded bores 22 in the peripheral casing edge 18 that extends along the side walls 12—13 of the handle shank or casing body 11 and semi-circular ends 14—19, thereby enclosing the chamber 16 and confining the torsion displacing, indicating, and measuring instrumentalities to be described hereinafter.

It will be noted that the handle shank or casing body 11 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 peripheral flange 18 as at 23—24 so that the comparatively rigid and load carrying cover plate 17 can be effectively attached to the casing body 11 which is greatly strengthened and reinforced therewith. In fact, the casing 11 does not sustain any appreciable turning load and primarily serves to confine the measuring instrumentalities as a protection against foreign substances and impacts. The cover plate 17 is sufficiently rigid to avoid a flex, distortion or consequential variation under turning load.

The semi-circular head 14 of the body 11 is provided with a circular recess 25 corresponding substantially in curvature therewith and sized to receive a revoluble turning member 26 of substantially corresponding size for free rotation therein. The revoluble turning member 26 is formed, in this instance, integral with a substantially smaller cylindrical shank 27 that terminates in a somewhat enlarged polygonal shoulder 28 (Figure 6). The polygonal shoulder 28 is formed integral with the shank 27 in axial relation to the revoluble turning member 26.

The polygonal shoulder 28 registers with a correspondingly sized and shaped opening 29 provided in the cover plate 17 coaxially with a circular aperture 30 (Figure 8) provided in the confronting bottom wall 15 of the casing 11. As shown, the revoluble turning member 26 is confined within the head 14 of the casing 11 and is disposed adjacent the bottom 15 for free rotation therein except for the fixed association between the polygonal shoulder 28 and the cover plate 17. To this end, the polygonal shoulder 28 of the shank 27, is flush with the cover plate 17 and is preferably though not essentially welded thereto for fixed connection therewith. For that matter, the somewhat enlarged shoulder 28 of the turning shank 27 and the revoluble turning member 26, may contact the inner surface of the cover plate 17 and be welded thereto around the peripheral edge thereof either from the exterior or interior or both surfaces of the cover plate 17 depending upon the dictates of commercial practice.

The revoluble turning member 26 has, in this instance, a circular recess 31 provided axially therein through the bottom end surface 32 thereof. The revoluble turning member 26 cooperates with an axially disposed work engaging member 34 telescoped in the axial recess 31 thereof for radial confronting relation therewith for connection through a ratcheting mechanism to be hereinafter described. A polygonal wrench socket receiving shank 35 is, in this instance, formed integral with the work engaging member 34 which is journalled in a circular bearing aperture 30 provided in the bottom wall of the head 14. The work engaging wrench socket receiving shank 35 projects beyond the bottom 15 of the casing shank 11 to provide accessibility to fasteners such as nuts for turning to a predetermined degree.

A spring impelled detent 37 of standard construction is provided in a face of the polygonal shank 35 for cooperation with a correspondingly sized and shaped recess provided in a wrench socket or other turning implement that is telescoped thereon for retention thereon against accidental detachment. Wrench sockets or other turning implements (not shown) would normally be provided with a recessed shank shaped and sized to conform with the polygonal shank 35 of the revoluble work engaging member 34 so that the friction exerted by the spring impelled detent 37 would be effective in retaining the turning implement thereon against accidental removal.

It should be noted that the revoluble turning member 26 is rigidly attached to the cover plate 17 that is preferably of rigid and non-yielding material such as steel while the body or casing shank 11 may be cast or otherwise shaped from aluminum in that the revoluble turning member 26 is mounted for movement relative thereto in sustaining the turning load. The casing 11 does not directly carry any appreciable load. Turning movement is imparted to a fastener such as a threaded nut through a wrench socket attached to the polygonal shank 35 of the revoluble work engaging member 34, responsive to manually applying force or effort to the handle 10 in one direction or another.

To enable ratcheting of the handle 10 with the revoluble member 26 in opposed directions by selective adjustment relative to the work engaging member 34, the interior periphery 38 of the circular recess 31 is provided with a series of radially extending ratchet teeth 39 cut or other-

wise formed for extension therefrom to present engagement with diametrically opposed pawls **40**, in this instance two, operatively confronting the axial work engaging member **34**. As shown, each of the pawls **40** has oppositely directed or diverging teeth **41** and **42** with an intermediate projection **43** of curved contour to confront the ratchet teeth extremities **39** and to contact therewith to serve as a fulcrum for pivoting the pawls **40**. The pawl teeth **41** or **42** engage between adjacent ratchet teeth **39** depending upon the desired directional ratcheting for nut turning by resort to a socket (not shown) carried by the work engaging member **34**.

The remaining edge surfaces **44** extending from the pawl teeth **41—42** are circular or arcuate within a common circumference to serve as a complement of the semi-circular grooves or recesses **45** provided opposite each other in the cylindrical wall of the confronting cylindrical work engaging member **34**. The circular grooves or recesses **45** communicate, in this instance, with aligned slots **46** which extend radially from opposite points on the periphery of the work engaging member **34** to the axis thereof.

The slots **46** are preferably of variable cross-section with the interior walls thereof tapering inwardly toward the center or axis of the work engaging member **34** so as to communicate with an axial bore **47** provided therein. The axial bore **47** in the work engaging member **34**, is closed on all sides except the inward end thereof to receive a pawl actuator member **48** which merges with a coaxial rod **49**. The coaxial pawl actuator extension rod projects, in this instance, through a bore **50** provided axially in the cylindrical torque resisting shank **27** constituting a part of the revoluble member **26**.

The pawl actuator rod **49** extends beyond the cover plate **17** to receive a finger manipulating knob **51** thereon. The finger manipulating knob **51** is in pressed fitting engagement with the pawl actuator rod **49** and has a knurled periphery **52** to afford the convenient rotary displacement thereof to control the directional rotation of the work engaging member **34** that carries a nut or other fastening engaging socket on its polygonal shank **35**.

The pawl teeth **41** and **42** are sufficiently spaced to enable the desired rotary throw of the work engaging member **34** for ratcheting purposes so that one pawl tooth **41** or **42** will engage a ratchet tooth **39** without interference with the other inactive pawl tooth **42** or **41**, thereby partially rotating the pawls **40** about their curved confronting edge surfaces **44** in the recesses **45** responsive thereto until the next successive ratchet tooth **39** is engaged. To maintain the pawls **40** stationary and in adjusted positions for the desired directional ratcheting, a tubular sleeve **53** projects through a transverse aperture **54** provided in the pawl adjusting member **48** so as to be lodged in the aligned tapered slot **S46**. The sleeve **53** is of sufficient length to extend within the range of and register with slots **55** disposed transversely through the center of the pawls **40** intermediate the ends thereof.

Opposed pins **56** are reciprocally mounted within the sleeve **53** so that the pointed extremities **57** thereof will contact with the bottom of the pawl slots **55**. The pin extremities **57** contact or engage the pawls **40** on either side of their center line which is in confronting relation with the tooth fulcrum ridge **43** thereon, thereby holding or tending to hold the pawls **40** in an inclined position so that one of its teeth **41** or **42** is in engagement with a ratchet tooth **39**. To this end, the opposed pins **56** are urged radially outwardly by means of a coiled spring **58** which is confined therebetween within the sleeve **53** to normally urge the pin extremities **57** outwardly in the direction of the pawls **40** to maintain engagement with their transverse slots **55**.

With the ratchet arrangement above described, any suitable device for turning may be detachably or otherwise associated with the work engaging member **34**. The rotation of the adjusting knob 51 in one direction or the other as indicated by indexing indicia **59** preferably inscribed on the surface thereof, determines the angular position of the pawls **40** so that one or the other of their teeth **41—42** are in engagement with or between the ratchet teeth **39**. Thereupon, the handle **10** may be manually oscillated to either turn a nut or other fastener device in a clockwise or counter-clockwise direction.

In order to guide the adjustment of the pawls **40**, the indexing indicia **59** in this instance directional "on" and "off" indicators are impressed in the knob surface **51**. Movement of the knob **51** in a clockwise direction indicated by directional indicator "off" (viewed from Figure 1) will cause the pawl tooth **41** to engage the ratchet teeth **39** for rotating the revoluble member **26** with the work engaging member **34** in an opposite or counter-clockwise direction. Opposite pawl adjustment indicated by the directional indicator "on" places the pawl tooth **42** in engagement with the ratchet teeth **39** for rotating the revoluble member **26** and the work engaging member **34** in a clockwise direction (viewed from Figure 1) to tighten or turn a nut on a right-handed threaded member.

It is apparent that the knob adjusting member **51** enables the ratchet to function in opposed directions with the dual pawls **40** easily adjusted for the purpose set forth and without possible accidental displacement owing to the fact that the pin extremities **57** are resiliently urged to assume a displaced position in the direction of pawl tooth engagement. Consequently, when the wrench handle **10** with its casing **11** and cover plate **17** are turned to carry the nut turning load, the revoluble member **26—27—28** and the work engaging member **34** are operatively connected together to rotate as a unit through the pawls **40**. However, when the handle **10**, casing **11**, and cover plate **17** are momentarily moved back to effect another bite or engagement between the ratchet teeth **39** and the pawls **40**, the revoluble member **26—27—28** rotates relative to the then stationary work engaging member **34** to accomplish ratcheting action.

In order to measure the extent to which any fastener such as a threaded nut is applied through the manipulation of the handle **10**, the extent of twist sustained by the cylindrical extension **27** of the revoluble turning member **26** is determined in that this will be uniform for any predetermined applied force and will vary proportionately to the turning load imparted through the handle **10** that is primarily sustained by the rigid cover plate **17**. It will be observed that owing to the polygonal shoulder **28** on the revoluble member extension **27** and the attachment thereof to the cover plate **17** in any suitable manner such as welding, any load turning movement applied to the handle **10** will be

transferred to the cover plate 17 which, in turn, will rotarily displace the revoluble turning member 26 with its pawl connected work engaging member 34 which carries a nut or other turning implement, to the end that proportional twist is imparted to the cylindrical extension 27 anchored to the cover plate 17 at one extremity 28 and free to twist at the other extremity 26 responsive to carrying the turning load. It is to be noted that the revoluble member 26 is much larger in diameter than its extension 27 and, therefore, it is subjected to a proportionately less torque so that the torsional stress will mostly be effective in the solid member 27 and to a slight degree in the work engaging member 34.

In order to measure the degree of twist or torsion imparted to the revoluble member 26—27 and work engaging member 34 responsive to any turning operation, an elongated cylindrical indicator displacing rod 60, is in this instance of uniform diameter, and projects radially in the annular shoulder of the revoluble member 26 as at 61 for fixed engagement to constitute a single acting unit or member therewith. The elongated rod 60 projects longitudinally of the body or casing shank 11 for confinement therein. So that the casing shank 11 together with its associated instrumentalities may be as compact as possible, the cylindrical indicator displacing rod 60 is preferably disposed at a slight angle between the extremities 62 and 63 thereof (Figure 8) to avoid contact with either the bottom plate 15 or cover plate 17 and free to circumferentially move or oscillate for a limited extent depending upon the degree of twist imparted to the revoluble member extension 27 or the torsion effect therein responsive to carrying the turning load relative to its polygonal extermity 28 fixed to the cover plate 17.

The elongated indicator displacing rod 60 need only be heavy enough to overcome the friction in the measuring instrumentalities and the load occasioned by their operation without causing any flex in the rod 60. Its diametrical size, however, may be determined by other factors such as the elimination of back-lash and conditions of abuse in actual nut turning operations. For that reason, the elongated rod 60 in actual practice may be somewhat heavier than otherwise required merely to carry a comparatively negligible load of operating the measuring instrumentalities without any flex in the rod 60.

It may be more desirable from a manufacturing standpoint to terminate the elongated cylindrical rod 60 just short of the lower circular handle extremity 64 of the cover plate 17 with a reduced portion 65, and join therewith a rod extension 66 of comparatively smaller diameter. To this end, the rod extension 66 has its upper extremity projecting within an axial bore provided in the lower extremity of the reduced rod portion 65. The upper extremity of the rod extension 66 is frictionally engaged in the axial bore by means of a tapered tightening nut 67 that threadedly engages a correspondingly tapered and lower extremity 68 of the reduced rod portion 65 to effect rigid connection of the rod extension 66 with the elongated cylindrical actuating rod 60 for the measuring instrumentalities to be hereinafter described.

With this arrangement, the rod extension 66 may be extended or retracted within the axial bore of the reduced rod portion 65 to enable longitudinal adjustment of the rod extension 66 relative to the indicator mechanism to be hereinafter described. The longitudinal adjustment of the rod extension 66 will vary the extent to which the dial mechanism is actuated or displaced responsive to a predetermined torsional stress imparted to the shank 27 of the interconnected revoluble and work engaging members 26—34. This enables also the replacement of the rod extension 66 should occasion demand or should such become impaired in any nut turning operation.

It should be noted that the rod 60 together with its reduced portion 65 and extension 66 function exactly the same even though these were turned or otherwise shaped to constitute an integral unit; however, such construction would be somewhat more expensive from a production standpoint than the co-axial connected rods 60—65—66 serving as an actuator for measuring instrumentalities when displaced by the twist imparted to the turning member shank 27. The reduced rod extension 66 has a right angularly offset extremity 69 which projects transversely within the casing body chamber 16 near the bottom end thereof for registry in a longitudinally elongated slot 70 provided in a lever 71 that comprises a part of measuring and indicating instrumentalities fully described in copending application Serial Number 374,361, filed January 14, 1941.

The measuring instrumentalities which are assembled as a unit to the dial casing plate 72 are attached to the exterior surface of the lower circular extremity 64 of the cover plate 17 which is provided, in this instance, with a pair of apertures 73—74 for receiving threaded studs therethrough to engage correspondingly spaced and threaded apertures (not shown) provided in the casing plate 72. Consequently, the measuring and indicator mechanism can be attached to the cover plate 17 together with the revoluble member 26 and its torsion displacing rod 60—65—66. The cover plate 17, together with these instrumentalities, are, in turn, attached for confinement in the chamber 16 of the body or casing shank 11 by means of fasteners such as the threaded studs 20.

It should be observed that the lower end of the chamber 16 of the body casing 11 is outwardly flared to define a circularly flared configuration 19 to conform with the size and shape of the lower extremity 64 of the cover plate 17 together with the dial casing plate 72 and its confronting ring 75. It will be apparent from the foregoing arrangement of parts that a manual turning force applied to the handle 10 will impart a corresponding turning effect to the revoluble turning member 26. This creates a slight twist in the turning member extension or shank 27 which can be measured with the advantage procured through the moment arm dial indicator displacing member 60 therebetween.

This turning operation is transmitted to a suitable tool or implement or fastener such as a threaded nut which requires a predetermined turning load in securing it to the desired degree of tightness for the suitable performance of its intended function. This turning movement and sustained turning load will create a fractional twist in the revoluble member shank or extension 27 primarily between its enlarged annular shoulder 26 and the polygonal stationary shoulder 28. This fractional twist created by the torsional effect on the cylindrical extension 27, will be translated to the measuring instrumentalities culminating in the rotary displacement of the pointer 76 relative to its calibrated dial 77 through

the medium of the elongated rod 60—65—66. The degree of twist or torsional strain within the turning member shank 27 is measured at the extreme end of the elongated rod 60—65—66 which is the point of its greatest displacement.

As a result, the rod 60—65—66 will accentuate the twist created in the revoluble head extension 27 to effectively turn the indicator pointer 76 to an extent proportional to the length of the elongated rod 60—65—66. The measurement of the twist imparted to the revoluble head extension 27 at a point of maximum displacement of the comparatively long twist-translating rod 60—65—66 is an important factor in producing accurate readings. Then, too, the rod 60—65—66 need only be heavy enough to overcome the comparatively negligible force required to actuate the measuring instrumentalities so that comparatively little friction is encountered between the revoluble turning member 26 and the measuring instrumentalities. This is conducive to accuracy accomplished with utmost simplicity in construction and operation.

With the arrangement of parts above described, the rod 60—65—66 comprising a single or sectional member is of such flexibility as to preclude injury to the dial mechanism in the event the handle 10 is abruptly released or the turning load should fall by virtue of a rupture in the nut or bolt or other instrumentality that is being tightened. The rather flexible rod 60—65—66 would absorb a substantial part of the shock without permitting such to damage the dial mechanism or any part thereof under abnormal conditions of abrupt release. Then, too, the pointer 76 is frictionally mounted on the stud shaft 78 for rotation relative thereto or therewith.

This enables resetting of the dial indicator pointer 76 relative to a pin 79 anchored in the dial 77 prior to applying a wrench to an instrumentality that is to be turned therewith. However, when the turning force is intended to be applied in the other direction corresponding to the back lash movement described supra, the dial ring 75 with its dial 77 is rotated in the reverse direction so that the pointer 76 will initially be set to occupy a position on the opposite side of the pin 79 to avoid engagement therewith. Any abrupt release of the nut turning load even though the comparatively flexible rod 60—65—66 would be unable to absorb the entire shock owing to backlash, would result in the pointer 76 striking the pin 79 (Figure 1) and allowing the pinion stud shaft 78 to be rotatively displaced relative to the pointer 76 without injury thereto through the elongated dial actuator rod 60—65—66. Any back-lash occasioned by the abrupt accidental release of the turning load would otherwise jar, impair and render permanently defective the measuring instrumentalities.

This can be largely overcome by the actuator rod extension 66 which is highly flexible, resilient and possessed of only sufficient rigidity to overcome the measuring instrumentalities connected thereto. Consequently, the severe stress and strains resulting from any back-lash action, will be absorbed for the most part by the flexing of the actuator rod extension 66 and thus protect the measuring instrumentalities in any type of beam device under such abnormal conditions of abusive operation. The steel spring wire 66 is sufficiently rigid to carry the comparatively small load involved in actuating the indicator instrumentalities without any flex therein and yet sufficiently resilient to absorb any shock created in the abnormal operation of the turning head or revoluble member 26.

Then, too, the torsional displacement in a torsion-type wrench embodying a comparatively short load turning shank 27, is comparatively small in that the degree of twist therein would be a minute amount approximating five thousandths of an inch under normal loads. Because the elongated rod 60—65—66 actuates the dial mechanism at its extremity which is the point of maximum displacement, this minute torsional displacement of the load carrying shank 27 is appreciably translated and accentuated at the dial end of the actuator rod 66. Even though there was an abrupt release of load, therefore, the backlash in the aforesaid structure would be negligible and the actuator rod 60—65—66 would not be called upon to withstand any appreciable back-lash shock which could, however, be absorbed by the resilient actuator extension 66 which is preferably constructed from small diameter spring steel wire.

In order to maintain the flexible extension 66 of the measuring actuator 60 in proper assembled relation with the lever 71 of the measuring instrumentalities, a bracket 80 is provided for attachment to the cover plate 17. The bracket 80 comprises a substantially rectangular upstanding plate 81 having offset ears 82—83 proximate to the extremities thereof for receiving suitable fasteners such as rivets 84 therethrough, thereby attaching the bracket plate 81 to the underside of the cover plate 17 near the measuring instrumentalities including the displacing lever 71 thereof.

The bracket plate 81 is provided with an elongated slot 85 (Figure 12) that is substantially of the same width as the diameter of the flexible rod extension 66 which projects therethrough for free movement within the limits thereof. The flexible actuator rod extension 66 is movable laterally within a slot 85 without any possible movement normal to the cover plate 17. This bracket plate 81 maintains the flexible rod extension 66 in the proper assembled relation with the measuring actuator lever 71 so that the offset extremity 69 of the flexible rod extension 66 will always be lodged within the lever slot 70 without movement normal to the cover plate 17. This prevents the extremity of the rod extension offset 69 from offering any obstruction to the measuring instrumentalities without any possible accidental removal from the lever slot 70.

With the arrangement of parts above described, it will be apparent that a very simple, inexpensive and highly accurate ratchet torque measuring wrench has been provided wherein there are few moving parts and the friction thereof has been reduced to a minimum to preclude variable and inaccurate readings. These features coupled with the fact that the torsional stress created by the turning load is measured at the point of maximum displacement of the elongated dial mechanism actuator rod, eliminates or reduces to a negligible minimum any inaccuracies even at small loads.

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.

We claim:

1. In a torque wrench, the combination with a handle member, of a torque resisting work engaging head member comprising complemental elements, one of said elements comprising a shank anchored to said handle member, the other of said members having work engaging means axially aligned with said anchored shank for rotation relative thereto, ratchet means interposed between said complemental elements, an elongated rod anchored at one extremity to one of said complemental elements of said head member, said rod extending along said handle member, and calibrated indicating means operatively connected to the other extremity of said elongated rod to measure the twist of said head member responsive to displacing said handle member with a turning force applied to the load.

2. In a torque wrench, the combination with an elongated rigid handle member, of a work engaging head member comprising complemental relatively rotatable axially aligned elements, one of said elements being anchored to said handle member proximate to one extremity thereof, ratchet means on said complemental elements to effect their operative ratcheting connection, an elongated rod anchored to one of said complemental elements of said work engaging head member at a point spaced from the latter's anchorage to said handle member through the other of said elements, and torque indicating means on said handle member operatively connected to the free extremity of said elongated rod to measure the twist of said work engaging head member between its anchorage points to said elongated handle and said rod responsive to sustaining a turning load with a turning force applied to said handle member.

3. In a torque wrench, the combination with an elongated rigid handle member, of a casing open along one side for fitted engagement with said handle member, a work engaging turning head member anchored in one end of said rigid handle member, said work engaging turning head member comprising a torque resisting shank anchored to said handle member and an axially aligned work turning element journalled for movement relative to said casing, an enlarged peripheral shoulder on said torque resisting shank, said peripheral shoulder being spaced from said handle member, ratchet means in said enlarged peripheral shoulder between radially confronting portions of said torque resisting shank and said work turning element, an elongated rod anchored to said torque resisting shank at a point spaced from its anchorage to said rigid handle member, and calibrated indicating means on said handle member and operatively connected to the free extremity of said elongated rod to measure the degree of twist occasioned in sustaining turning loads imparted by turning a load with said work engaging member.

4. In a torque wrench, the combination with a rigid handle member, of a work engaging turning head member anchored in one end of said rigid handle member, a casing complemental to said rigid handle member, a torque resisting shank on said work engaging turning head member comprising a cylindrical torsion shank anchored in said handle member and having a substantially enlarged peripheral shoulder spaced therefrom for confinement in said casing, said turning head member including a work engaging shank extension journalled in said casing and extending axially in said enlarged peripheral shoulder, ratchet means in said enlarged peripheral shoulder and interposed between said torsion and work engaging shanks therein, an elongated rod anchored to the enlarged peripheral shoulder of said torsion shank to project radially therefrom at a point spaced from its anchorage to said rigid handle member, a flexible extension on said rod, and calibrated indicating means on said handle member and operatively connected to the free extremity of said flexible rod extension to measure the degree of twist occasioned in sustaining turning loads imparted by said work engaging shank to said torsion shank relative to said handle member.

5. In a torque wrench, the combination with a handle member including a casing, of a rigid cover plate attached to said handle member casing, a work engaging turning head member comprising a cylindrical torsion shank anchored in said rigid cover plate and having a substantially enlarged peripheral shoulder spaced therefrom for confinement in said casing, said turning head member including a work engaging shank extension journalled for movement relative to said casing, said work engaging shank extension being axially aligned for projection in the said enlarged peripheral shoulder to present radially confronting spaced surfaces, complemental ratchet means interposed between the radially confronting spaced surfaces of said torsion and work engaging shanks, an elongated rod anchored at one extremity thereof to the enlarged peripheral shoulder of said work engaging head member at a point spaced from its anchorage to said rigid cover plate, said elongated rod extending along said rigid cover plate for confinement by said casing, and torque indicating means operatively connected to the free extremity of said elongated rod which is displaced responsive to applying force to said rigid cover plate through said handle member.

6. In a torque wrench, the combination with an elongated rigid handle member, of a turning head member anchored proximate to one extremity of said rigid handle member, said turning head member including coaxial shank elements, an enlarged peripheral shoulder on one of said shank elements, a complemental portion on the other of said shank elements to extend within said enlarged peripheral shoulder in radial spaced relation therewith, ratchet means interposed between said coaxial radially spaced confronting shoulder and complemental portion of said shank elements, said ratchet means serving to resist rotation in one direction relative to said handle member to effect a torsional stress therein responsive to sustaining a turning load, means for changing the position of said ratchet means to resist rotation in the other direction relative to said handle member to effect an opposite torsional stress therein responsive to changing the turning direction of the sustaining load, an elongated rod extending from said enlarged shoulder along said handle member, and torque indicating means attached to said handle member and operatively connected to the free extremity of said elongated rod for measuring the torsional stress in said turning head member.

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