

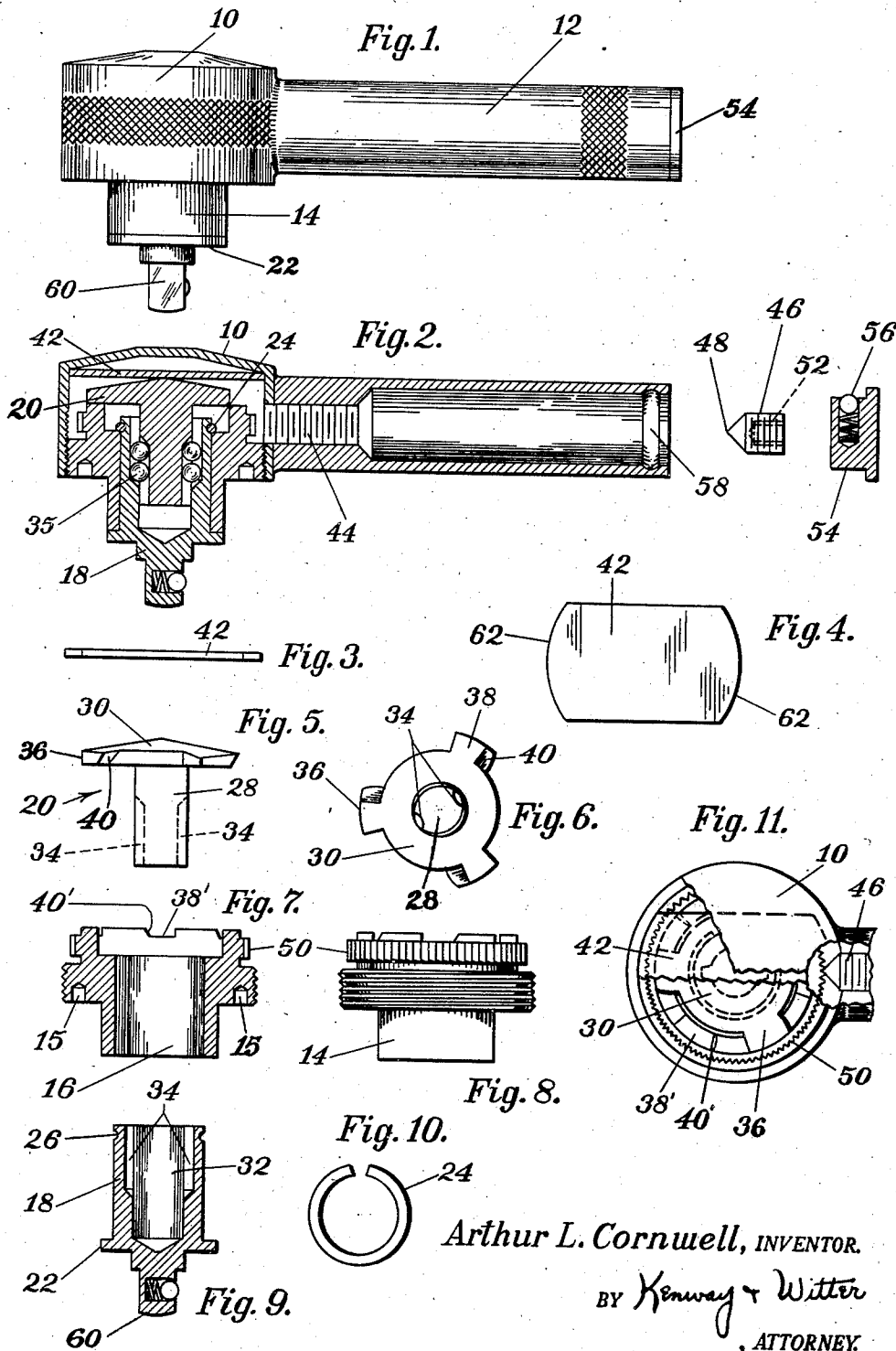
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TORQUE WRENCH

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TORQUE WRENCH

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This invention relates to devices, commonly known as torque wrenches, for uniformly tightening nuts, screws, bolts, etc., with a predetermined load. These wrenches are of various types and operate on various principles, one type employing co-engaging driving and driven members of a frictional or non-positive nature normally held in driving engagement by a spring or other resilient means by which the driving member rotates the driven member until the torque load thereon overcomes the co-engaging driving connection and permits the driving member to rotate independently of the driven member. I am aware that such devices are not broadly new and that numerous devices for performing this function have heretofore been constructed and used with varying degrees of success. The primary object of my invention resides in the production of an improved and superior wrench of this nature.

It will be readily apparent that a satisfactory torque wrench for close tolerance work must not only serve accurately to perform its intended function at the outset but must continue to perform that function uniformly over a considerable period of use. Such wrenches heretofore known have been somewhat complicated and so constructed that this uniformity of action has not been satisfactorily maintained, due to excessive wear of cooperating parts, some permanent setting taking place in the resilient elements employed and failure in other features of construction. A further object of my invention resides in the production of an improved wrench of this nature having few and relatively simple and accurate working parts adapted to be economically constructed and easily assembled and to function uniformly, continuously and accurately over considerable periods of time.

A further and more specific feature of the invention resides in the production of a new and improved torque wrench embodying a cup-like housing having one open face adapted to be closed by a bushing threaded into the housing and enclosing therein driving and driven members provided with co-engaging ratchet-like inclined faces normally held in resilient driving contact by a substantially flat spring seated in the bottom of the cup-like chamber of the housing, rotation of the bushing being adapted adjustably to vary the contact pressure of the members and the torque setting of the wrench. The wrench also embodies a handle carried by and disposed laterally outward of the handle and enclosing releasable and normally inaccessible

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means for securing the bushing against rotation when the wrench has been set to operate at the predetermined torque required.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof selected for purposes of illustration and shown in the accompanying drawing in which,

Fig. 1 is a side elevation of a preferred embodiment of my invention,

Fig. 2 is a longitudinal sectional view thereof, certain elements being illustrated in detached position,

Fig. 3 is a side elevation of a leaf or plate spring employed,

Fig. 4 is a plan view of the spring,

Fig. 5 is a side elevation of one portion of a driven member,

Fig. 6 is an end elevation thereof,

Fig. 7 is a longitudinal sectional view through a bushing constituting a driving member,

Fig. 8 is a side elevation thereof,

Fig. 9 is a longitudinal sectional view through another portion of the driven member,

Fig. 10 is a plan view of a locking ring, and

Fig. 11 is a fragmentary plan view of the wrench, illustrated as partially broken away.

A preferred embodiment of torque wrench comprising my invention includes a body in the form of a cup-like housing 10 open at one face, and a handle 12 preferably integral with the housing and extending laterally outward. Threaded into the housing at said face and forming a portion of the body is a bushing 14 provided with wrench-receiving sockets 15. The bushing constitutes a driving member and carries within its centrally disposed bore 16 a driven member illustrated as comprising two parts 18 and 20. The part 18 fits within the bore 16 and is provided with an annular shoulder 22 adapted to seat against the outer end of the bushing, a resilient split ring 24 seated within an annular groove 26 being adapted to hold the two parts assembled as shown in Fig. 2. The part 20 of the driven member has a stem portion 28 with a flange-like portion 30 at one end. The stem seats within the bore 32 in the part 18 and cooperating longitudinal grooves 34 are provided in the adjacent faces to receive ball bearings 35 providing a ball bearing splined connection between the elements 18 and 20.

The flange-like portion 30 of the driven member includes three lugs 36 extending radially outward and each is provided with a flat face 38 and an inclined face 40 for respectively cooperating with like faces 38' and 40' formed in

the inner end of the bushing, these elements constituting co-engaging ratchet-like inclined faces at their engaging contact. A substantially flat leaf or plate spring 42 loosely seated and supported at its ends in the closed end of the housing 10 has its intermediate portion in resilient engagement with the flange-like portion 30 of the driven member 20 and normally holds this member in contact with the driving member 14. It is particularly noted that the spring engages and exerts pressure on the member 20 at a centrally disposed point in its axis of rotation.

The handle 12 is of tubular construction and the bore therein is threaded at its inner end at 44 to receive a threaded plug 46 having a pointed forward end 48 for engaging the serrated periphery 50 of the bushing 14 to secure it from rotation relative to the housing. The outer end of the plug is provided with a polygonal socket 52 for receiving a wrench projected inwardly of the handle. The outer end of the handle is closed by a plug 54 carrying and normally held in place by a spring pressed ball 56 engaging within an annular groove 58 in the handle. The driven element 18 is provided at its outer end with a driver of any desired configuration, the driver herein illustrated being a square stud 60 for engaging the square socket of a member to be tightened.

The wrench parts are conveniently assembled by first inserting the element 18 within the bore 16 of the bushing and locking it in place by means of the ring 24. The stem 28 together with the balls 35 are then assembled within the bore 32. A spring 42 having been placed in the housing, this assembly is then inserted therinto and the bushing threaded inwardly until the portion 30 of the element 20 contacts the spring. When the bushing is rotatably adjusted to the desired position it is secured against further rotation by threading the point 48 of the set screw 46 into contact therewith as illustrated in Fig. 11.

It will be apparent that the spring exerts outward resilient pressure against the element 20 and that the force of this pressure is entirely taken by contact of the lugs 36 with the inner end of the bushing. The lugs are adapted to drop into the correspondingly spaced recesses 38'-40' in the bushing wherein the lug faces 38-40 are held in contact with the bushing faces 38'-40' by the spring. Rotation of the housing and bushing normally rotates the driven elements 18 and 20 therewith but, when the torque therebetween is sufficient to overcome the engagement at said faces, the lugs climb up the inclined faces 40' and permit rotation of the housing and bushing without rotating the elements 18 and 20. Rotation of the bushing inwardly of the housing increases the spring pressure on the element 20 and outward rotation thereof decreases such pressure, and such rotations correspondingly increase and decrease the torque setting of the wrench. The wrench is set by such rotary adjustment of the bushing to operate at the predetermined inch pounds of torque required and the bushing is then locked in its adjusted position by tightening the plug 46 into contact with the bushing. The plug 46 can be constructed to operate only with a special key whereby preventing unauthorized tampering with the wrench after setting.

It will be apparent that the wrench is fool-proof and functions accurately to give the desired predetermined tightening without any at-

tention from the operator since the housing will turn idly relative to the driven elements 18-20 when the predetermined tightening has been effected. Attention is also particularly called to the fact that the part 20 floats freely longitudinally of and within the part 18 on the balls 35 which serve also to hold these parts with great accuracy against relative rotation. The driver 60 is carried by the element 18 which has its stop shoulder 22 in engagement with the outer end of the bushing thereby causing all pressure or thrust exerted by the operator on the wrench during its use to be taken by this stop. Use of the wrench can therefore in no manner affect the operation of the spring or the accurate functioning of the tool at the predetermined torque for which it is set.

The frictionless ball spline connection provided between the elements 18 and 28 by the balls 35 rolling in the raceways 34 is of particular importance in the accurate functioning of the tool when close tolerance work is required. It will be apparent that the inch-pounds torque at which the surfaces 40' slide relative to the surfaces 40 is dependent primarily upon the compressing of the spring 42, but the element 28 must also be moved longitudinally relative to the element 18. Any undue friction between these elements would act substantially to vary the predetermined torque at which the tool is set to operate. The ball spline provides a substantially frictionless spline connection which places the entire torque load on the spring 42 and thereby renders accurate the functioning of the tool in accordance with the setting of the load on the spring.

Particular attention is directed to the small number and simplicity of the parts comprising my improved wrench and to the ease of assembly and adjustment. Attention is also directed to the simple supporting of the flat spring 42 loosely at its rounded ends 62 in the housing. Use of the wrench causes only a slight flexing of the spring and sliding contact of the lugs 36 against the inner end of the bushing whereby providing for continuous operation and accurate service over long periods of time.

Having disclosed my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. A torque wrench comprising the combination of a chambered body, a driven member therein having a centrally disposed portion extending outwardly of the body and a cooperating portion non-rotatably connected to the first portion, said cooperating portion and body having co-engaging and non-positive driving faces disposed about said centrally disposed portion, a substantially flat plate spring disposed rearwardly of and having its intermediate portion in contact with the driven member at its axis of rotation, said spring being supported in the body at spaced points remote from said intermediate portion and normally operative against the driven member to hold said faces in engagement with a predetermined resilient pressure.

2. A torque wrench comprising the combination of a housing open at one face, a bushing threaded into the housing at said open face and having a centrally disposed opening there-through, a driven member having a centrally disposed portion extending outwardly through said opening and a relatively non-rotatable portion in engagement with an inner wall of the bushing, the bushing and member having co-

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engaging and non-positive driving faces at said inner wall, resilient means within the housing operative against the second named portion of the driven member and normally holding said driving faces in predetermined pressure contact, and releasable means carried by the housing and engaging the bushing for holding the latter against rotation, the resilient means and said driving faces being adapted to prevent relative rotation between the bushing and driven member up to a predetermined rotary torque therebetween and being adapted then to permit such relative rotation.

3. The torque wrench defined in claim 2, plus means splining said two portions of the driven member together and permitting relative movement thereof longitudinally, and stop means on opposite ends of said centrally disposed portion of the driven member for engaging the bushing and preventing longitudinal movement thereof relative to the bushing.

4. The torque wrench defined in claim 2, plus a ball bearing splined engagement between said two portions of the driven member permitting free relative axial movement thereof, and co-engaging stop shoulders on the bushing and said centrally disposed portion of the driven member for limiting inward movement of said portion relative to the bushing.

5. The torque wrench defined in claim 2 in which said resilient means is a plate spring so located in the housing that inward rotary movement of the threaded bushing increases said pressure.

6. The torque wrench defined in claim 2, plus means holding said centrally disposed portion of the driven member against longitudinal movement relative to the bushing, means splining said two portions of the driven member together and permitting longitudinal movement of the second named portion in the said centrally disposed portion, and means for adjustably varying the intensity of said predetermined pressure.

7. A torque wrench comprising the combination of a cup-like housing open at one face, driven means within the housing and extending outwardly through said open face, a bushing threaded into the housing at said open face, the bushing and said means having co-engaging ratchet-like inclined faces, a resilient member in the housing rearwardly of the bushing normally holding said inclined faces in their closest engagement by pressure against said driven means, and releasable means for securing the bushing against rotation in the housing, the resilient member permitting separation of said means and bushing and relative rotation thereof only when a predetermined rotary torque is exerted between the bushing and driven means and threading of said bushing into the housing being adapted to increase said predetermined torque.

8. A torque wrench comprising the combination of a tubular housing open at one face, a bushing threaded into the housing at said open face, a driven member having a portion within the housing in engagement with the inner end

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of the bushing and another relatively non-rotatable portion extending outwardly of the housing through the bushing, the bushing and member having co-engaging ratchet-like inclined faces at their engaging contact, a spring rearwardly of the bushing normally pressing the first named portion of the driven member into said engagement with the bushing, a handle carried by and extending laterally outward of the housing, and screw threaded means within the handle for engaging and preventing rotation of the bushing in the housing, rotation of the housing and bushing being adapted to rotate the driven member only until the torque therebetween is sufficient to overcome the action of the spring and threading of the bushing inwardly of the housing being adapted to increase the pressure of the spring on the driven member.

9. A torque wrench comprising the combination of a cup-like housing open at one face, a bushing threaded into the housing at said open face, a driven member having a centrally disposed portion extending outwardly of the housing through the bushing and a flange-like portion non-rotatably connected thereto and in engagement with the inner end of the bushing, the bushing and member having co-engaging ratchet-like inclined faces at their engaging contact, a substantially flat plate spring seated in the inner end of the housing and normally pressing the flange-like portion of the driven member into said engagement with the bushing, and releasable means for securing the bushing against rotation in the housing, rotation of the housing and bushing being adapted to rotate the driven member only until the torque therebetween is sufficient to overcome the action of the spring and threading of the bushing inwardly of the housing and toward the spring being adapted to increase the pressure of the spring on the driven member.

10. A torque wrench comprising the combination of a body having an opening through one wall thereof, ratchet-like inclined faces carried by said wall and disposed about the opening, a rotary driven member having one portion provided with ratchet-like inclined faces opposed to and engaging the first named faces and a relatively non-rotatable portion extending forwardly and outwardly of the body through said opening, a plate spring carried by the body rearwardly of the driven member and disposed over its axis of rotation, said spring being operative on said one portion of the driven member at its said axis to hold its said inclined faces in resilient contact with the first named inclined faces, and screw threaded means for varying the pressure intensity of said resilient contact, rotation of the body about the rotary axis of the driven member being adapted to rotate the driven member therewith only until the torque therebetween is sufficient to overcome said resilient contact and thereafter permitting rotation of the body relative to the driven member by relative sliding movement of said inclined faces.

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