

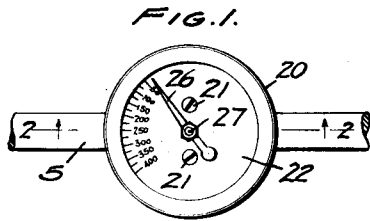
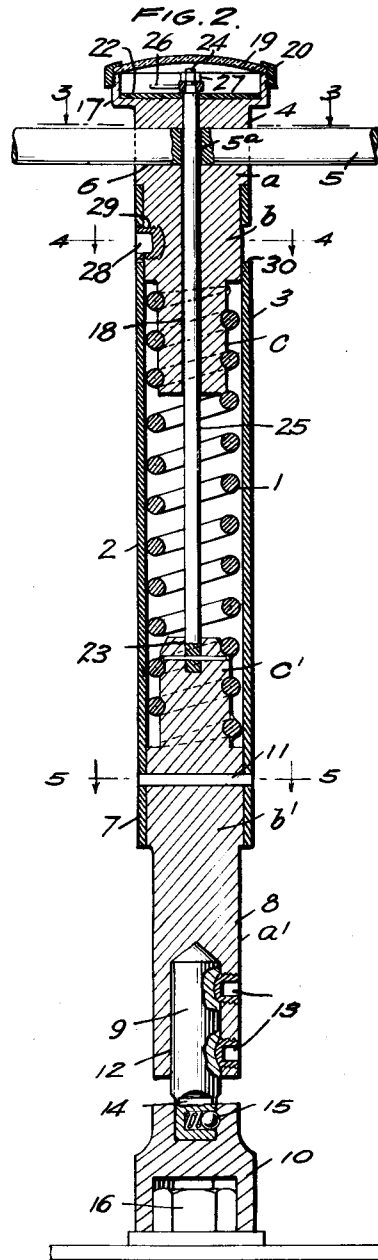
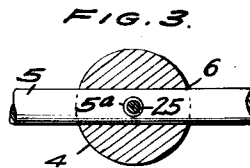
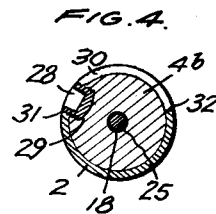
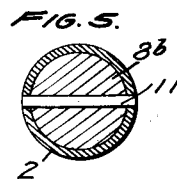
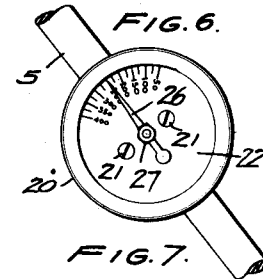
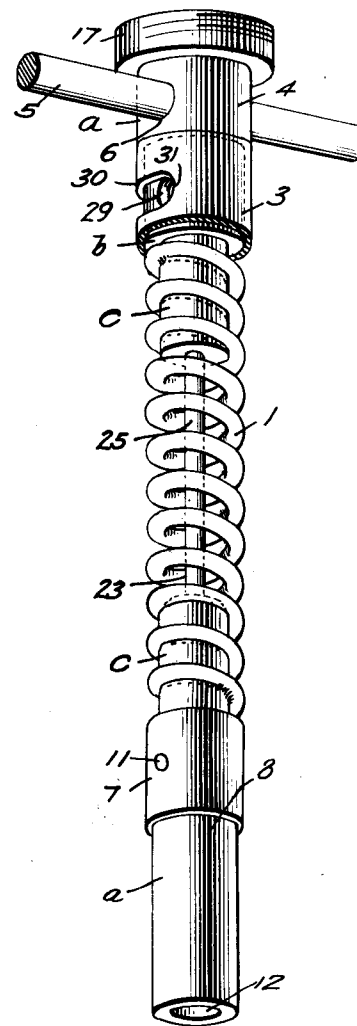
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TENSION WRENCH

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TENSION WRENCH

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6 Claims. (Cl. 265—1)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to a torque indicating wrench capable of general use but especially designed for tightening of engine cylinder hold-down nuts.

In assembling the cylinders of engines, particularly air-cooled radial engines, on the crank-case sections, it is required that the cylinder hold-down nuts be tightened to a specified torque in inch pounds. They must not be tightened by jerking but rather by slowly and smoothly applying the proper torque.

It is, therefore, the main object of the present invention to provide a special torque indicating wrench for tightening hold-nuts to the correct torque in accordance with the requirements above set forth.

Additional and more specific objects of the invention are to provide a wrench of the type set forth which is simple in design, smooth in action, advantageous for use on aircraft engines in close places, accurate in indication, and capable of economical manufacture.

These objects and advantages are attained by the novel construction, arrangement, and combination of parts hereinafter more fully described and explained in connection with the accompanying drawing, wherein:

Figure 1 is a top plan view of the improved wrench.

Figure 2 is a vertical section on line 2—2 of Figure 1.

Figure 3 is a horizontal cross section on line 3—3 of Figure 2.

Figure 4 is a horizontal cross section on line 4—4 of Figure 2.

Figure 5 is a horizontal cross section on line 5—5 of Figure 2.

Figure 6 is a view similar to Figure 1 but depicting the handle member and dial displaced relatively to the pointer in indication of a torsional loading between the minimum and maximum.

Figure 7 is a perspective view of the wrench with parts thereof removed and with portions broken away to expose the torque spring assembly.

Briefly, the improved wrench embodies a handle assembly connected to the socket assembly by a helical spring so that when the handle is turned to tighten a nut or like object the motion thereof is transmitted to the socket, and hence

to the nut, by the twisting motion of the spring. A dial fixed to the wrench handle turns relatively to a stationary pointer fixed to the socket end of the wrench and thereby affords an indication of the spring tension or torque required in turning the nut or other object engaged in the socket of the wrench.

The helical spring 1 is housed within a cylinder or barrel 2 of appropriate length. At the end 3 of the barrel is a handle assembly including a cylindrical body 4 and a rod 5. The handle body has two end sections *a* and *c* and an intermediate section *b* of relatively varying diameters and it is inserted in the barrel with the largest or head section *a* in abutment with the end 3 of the barrel and the smaller sections *b* and *c* disposed inwardly of the latter. The head *a* has its lateral surface substantially flush with the corresponding surface of the barrel and has a diametrically transverse bore 6 for receiving the rod 5. This rod is substantially centered with respect to the head and extends outwardly of the bore 6 at relatively opposite sides of the head to serve as a hand lever for turning the handle relatively to the barrel; the outward extensions of the lever serving as convenient hand-grips. The rod is provided intermediate its ends with a diametrical orifice 5*a* for a purpose hereinafter explained. The intermediate section *b* of the body 4 is the journal part of the handle assembly and has a snug bearing fit in the handle end of the barrel for a depth adequate to firmly support the handle therein. The innermost end section *c* of the body 4 projects centrally from the inner extremity of the body section *b* and in spaced relation to the enclosing wall of the barrel. It is preferably of a length sufficient to be encircled by several of the coils at the adjacent end of the helical spring 1 and is spirally grooved to seat the encircling coils, the terminal one of which is fixedly attached thereto by tack arc welding or by other preferred means.

At the end 7 of the barrel opposite to the handle end 3, is arranged the socket assembly which includes the socket-supporting member 8, together with its shank 9, and the nut-engaging member 10. Member 8 is a cylindrical body having relatively long and short end sections *a'* and *c'* between which is a circumferentially enlarged section *b'*. The body 8 is engaged with the barrel-end 7 with the longer end section *a'* exposed for its full length beyond the said end of the barrel and the sections *b'* and *c'* enclosed within the latter. The barrel is fixed to the sec-

tion b' by suitable means 11 capable of being removed to permit separation of the barrel and socket assembly when so desired. Section b' has a snug fit in the barrel-end 7 and is of a length to internally support and reinforce the same over a substantial area. Section c' is of smaller diameter than section b' and is a cylindrical projection, on the inner face of the latter. It is encircled by several of the coils at the adjacent terminal or socket end of the helical spring 1, which, at the said end, is seated on and fixed to the projection c' in substantially the same manner as described and explained in connection with the corresponding projection c of the handle assembly. Section a' of the socket supporting member 8 is a carrier for the socket shank 9. The carrier and the shank may be a single integral unit or it may be composed of two separable parts. In the accompanying drawing, they are depicted as separable parts; the carrier 8 being provided with a hollow axial space or cavity 12 opening outwardly of its exposed end to receive the correspondingly shaped shank 9 which is firmly held therein by one or more screws 13. The shank has a squared end 14 to fit the squared recess in the nut engaging member or socket 10 which is retained on the shank by a conventional ball-and-spring lock 15. This construction and arrangement of the socket assembly is advantageous in enabling various types and sizes of sockets to be used interchangeably with the socket supporting member 8.

In Figure 2 of the drawing, the wrench is shown applied to a cylinder hold down nut 16. When the handle body 4 is turned by pressure applied to the rod 5 a torque is transmitted, through the helical spring 1 in a twisting motion, to the nut 16 engaged in the socket 10. When the resistance offered by the nut is slight, or below the minimum of the range for which the wrench is designed, the nut and the wrench turn as a unit. But where the resistance offered by the nut is great or in excess of the minimum of the range of the wrench, the handle body 4 turns relatively to the barrel and the socket assembly which remains stationary with the nut until the torque force exerted by the twisting of the spring is sufficient to overcome the resistance of the nut. Cylinder hold down nuts are generally required to be tightened to a specific torque in inch pounds and in order that the wrench may be particularly adapted for this purpose it is provided with torque-indicating means.

The torque-indicating means includes a dial cup 17 fixed at the outer end of the handle body 4 and concentric with a narrow bore 18 extending axially through the body and the base of the cup. A transparent cover 19 is held in place on the cup by a flanged screw ring 20 as illustrated. Enclosed within the cup and fixed thereto by screws 21, or other suitable means, is a flat centrally apertured dial disk 22 having graduations thereon to give a reading of torque in inch-pounds. The wrench may be designed to indicate torque over any desired range within reasonable limits but in the present instance the dial is shown graduated to cover a range approximately of 50 inch-pounds minimum to 400 inch-pounds maximum. Suitably fixed at its end 23 to the projection c' of the socket supporting member 8 and extending longitudinally and centrally of the spring 1 with its opposite end 24 within the dial cup is a long slender rod or shaft 25. As is apparent from Figure 1 of the drawing, this shaft 25 extends through the axial bore 18

of the handle body 4 and also through the central orifice 5a of the hand lever 5 and the central aperture of the dial disk 22. The extension of the shaft through the central orifice of the hand lever prevents the latter from being displaced with respect to the head as long as this relation is maintained. Mounted on the end 24 of the shaft and projecting laterally thereof in cooperative relation with the graduated dial disk is an index hand or pointer 26. The shaft-end 24 is screw threaded to receive a nut 27 which is tightened against the pointer to hold the latter rigid with the pointer shaft 25.

The helical spring is placed under initial tension corresponding to the minimum torque of the selected range by rotating the head 4 relative to the member 8 an estimated number of turns. This minimum torque is substantially maintained by a stop built into the wrench and functioning above and below the registering range of the wrench to prevent excessive strain on the spring. This stop comprises a stop lug 28 screwed in an opening 29 in the side of the head section b and working in a circumferential slot 30 of a predetermined length formed in the side of the barrel 2. The dial 22 and the stop lug 28 are so correlated with the pointer 26 that when the lug is pressed against the end 31 of the slot by the force of the spring 1, the pointer is slightly outside minimum graduation on the dial. This relation of the parts is illustrated in Figures 1, 2 and 4 of the drawing from which it will be apparent that when the handle end of the wrench is turned in a clockwise direction relative to the socket end thereof, the spring is further tensioned to exert a torque on the nut. The dial, being fixed to the handle body, is likewise turned relatively to the pointer so that the position of the latter with respect to the graduation of the dial at any given instant indicates the applied torque. When the handle body 4 is turned in the clockwise direction, the lug 28 is correspondingly shifted along the slot 30 and abuts the opposite end 32 of the latter when the pointer is slightly outside the maximum graduation of the dial. To tighten a nut, the wrench is turned in the clockwise direction in the manner just described and any turning force of the handle assembly above the registering range of the wrench is transmitted to the socket end thereof by the abutment of the lug 28 against the end 32 of the slot and without any additional stress or strain on the helical spring. To "back up" or loosen a nut, the wrench is turned in the reverse or counterclockwise direction. In the latter case, however, the turning force of the handle assembly is transmitted to the socket end of the wrench by the abutment of the lug 28 with the end 31 of the slot and the loosening of the nut is accomplished, therefore, without any reverse twisting or strain of the helical spring.

From the foregoing, it will be seen that the wrench is characterized by simplicity in design and absence of large and protruding parts such as would interfere with the proper use of the wrench in close places. It is smooth in action, without tendency to grab, and holds its calibration more satisfactorily than other types, such as hydraulic types which may change through leaks and temperature variations and clutch types which may change through slippage due to oil or moisture collecting on the friction faces. Various changes and substitutions in respect to shape, size, dimensions, etc., of the parts of the wrench may be resorted to without departing

from the principle and scope of the invention as defined in the following claims:

Having thus described the invention, I claim:

1. A torque registering wrench having in combination a shaft, a handle member turnable on the said shaft, a socket-bearing member fixed to the shaft on one side of the handle member, an index fixed to the shaft on the opposite side of the handle member, elastic torque-transmitting means coupling the handle member with the socket-bearing member, a scale fixed to the handle member in cooperative relation with the index, and coating means on the said handle and socket-bearing members functioning immediately above and below the registering range of the wrench to limit the relative movement of the said members to one direction only.
2. A torque indicating wrench having in combination a helical spring, a socket assembly on one end of the spring for engagement with an object to be turned, said socket assembly including a spindle extending axially of the spring, a handle assembly on the other end of the spring for applying a torsional twist thereto, said handle assembly including a body having an axial bore through which the said spindle extends and a transverse bore intersecting the said axial bore, a rod in said transverse bore and extending outwardly of the said body, said rod having a transverse orifice therein for the extension of the said spindle therethrough, and means for retaining the body upon the said spindle.
3. A tension wrench having, in combination, a barrel, a substantially solid member at each end of the barrel, each member having a snug fit in the barrel for a distance to internally support and reinforce the latter over a substantial area and at its inner end having a short central projection in laterally spaced relation to the enclosing wall of the barrel, one of said members being fixed to the barrel and the other member being free to be turned within the barrel, a helical torque-transmitting spring enclosed within the barrel with several of the coils at one end encircling and fixed to the central projection of the fixed member and several of the coils at the other end similarly arranged with respect to the corresponding projection of the turnable member, a nut-engaging element secured to the fixed member of the barrel, and hand grips on the turnable member of the barrel for turning the same for applying a torsional twist to the said spring.
4. A tension wrench comprising coaxial members relatively rotatable about their common axis, means on one of said members for engagement with an object to be turned, means on the other of said members by which rotational movement may be imparted thereto, a torsion spring between and positively connected to each of the said rotatable members, said spring being pre-wound to a predetermined torque load, a calibrated dial on one of the rotatable members having a minimum graduation indicating the pre-loading on the spring and having a maximum graduation indicating a maximum allowable loading on the spring, an index on the other rotatable member in cooperative relation with the said dial, and means for limiting relative movement between the members including stop

means provided on the members to operate at each end of the allowable relative movement to prevent any relative movement between the members tending to load the spring beyond the maximum amount of allowable load indicated by the maximum graduation of the scale or tending to decrease the load on the spring below the minimum graduation of the said scale.

5. A torque registering wrench comprising a hollow cylinder having a circumferential slot adjacent one end thereof, a handle member journaled in the said end of the cylinder to be rotated relative thereto and having a stop lug projecting into the said slot adapted by its abutment with either end of the slot to prevent relative turning movement between the cylinder and the handle member, a nut engaging member fixed to the cylinder at the other end of the latter, a flexed helical torque transmitter spring connecting the handle member with the nut-engaging member and under a predetermined initial torsion normally holding the cylinder and nut-engaging member angularly displaced relative to the handle member with the said stop lug in abutment with one end of the said slot, a calibrated dial on one of the said members having a minimum graduation corresponding to the predetermined initial torsion of the spring and having a maximum graduation corresponding to the higher limit of a selected scale range, and an index on the other member in cooperative relation with the said dial, said dial and index being so correlated with the lug and slot that when the lug abuts one end of the slot the index coincides with the minimum graduation on the scale and when the lug abuts the other end of the slot the index is on the maximum graduation on the dial whereby to prevent varying the load on the spring beyond the limits of the scale.

6. A torque measuring wrench having, in combination, a pair of axially spaced relatively rotatable members, one of said members being adapted to be engaged with a piece of work and the other member being adapted to have rotational movement imparted thereto, an axially disposed shaft carried by one of said members and rotatably extending through the other of said members, a helical torque-transmitting spring having one end connected with one of said members and its other end connected with the other of said members so that it tends to hold said members in axially spaced relation, said spring being pre-wound to a predetermined torque load, torque-indicating means including a calibrated element carried by said other member and having minimum and maximum graduations indicating the pre-loading and the maximum allowable loading on the spring and an indicator element operatively connected with the said shaft and disposed in registering relation to the calibrated element, and a coupling element secured to one of the relatively rotatable members and rotatably interlocked with the other of said rotatable members to prevent axial separation of the said rotatable members while restricting relative rotation of said members to within the indicated load range of the torque indicating means.

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