

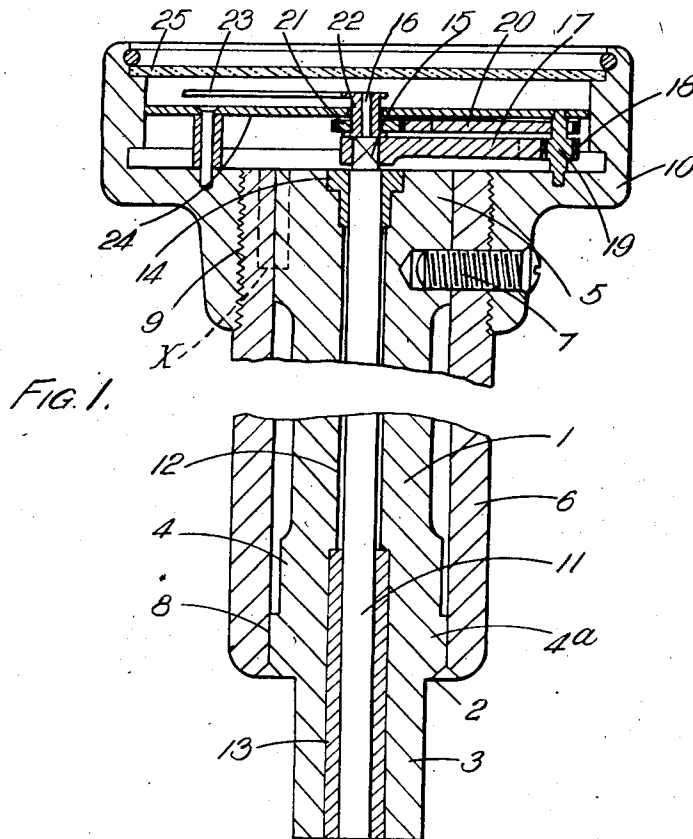
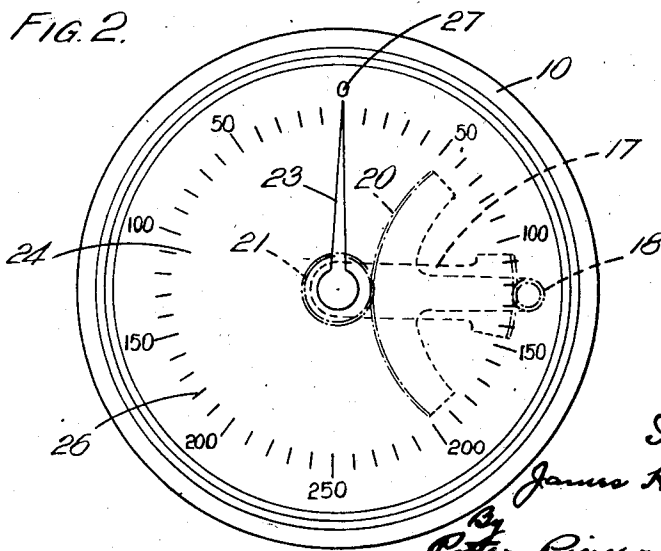
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MECHANICAL TORQUE INDICATOR

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MECHANICAL TORQUE INDICATOR

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4 Claims. (Cl. 265—1)

This invention relates to mechanical torque indicators and is concerned with the provision of apparatus which is more particularly, although not exclusively, intended for indicating the torque that is applied to nuts in screwing them home.

It is well appreciated that in, for example, securing the head upon an internal combustion engine, it is desirable that the nuts holding the head should be screwed down to approximately the same extent, so that there is an even bolting down of the head upon the block of the engine, since if some of the securing bolts are not as tight as others, it can happen that the head of the engine becomes distorted with the consequent mechanical deterioration of the engine. It has been proposed to construct a mechanical torque indicator of the spring type as a coupling unit for use between a wrench and a nut or bolt but the spring type construction does not operate equally well in both directions, i. e., if designed to indicate the torque when a nut of right hand thread is applied, it will not indicate the torque required for the removal of the nut or for applying a nut of left hand thread.

An object of this invention is to provide a torque indicating device that may be used between a spanner wrench and a nut to indicate the torque applied either in tightening or loosening a nut or bolt. An object is to provide a torque indicating device in the form of a mechanical coupling unit for use between a wrench and a nut or bolt, the device having surfaces for engagement by the wrench and a stud for engaging the nut or a nut-engaging element, and indicating mechanism at the end of the device opposite the stud, whereby the wrench does not prevent a reading of the indicated torque. More specifically, an object is to provide a torque measuring device including a sleeve having indicating mechanism at its outer end, a hollow torque tube secured at its outer end to the outer end of the sleeve, and having an inner end for application to the nut or other element that is to be turned, and a rod extending through the tube and secured to its inner end, the outer end of the rod being coupled to the indicating mechanism and the outer surface of the sleeve being shaped to receive a wrench or spanner.

These and other objects and advantages will be apparent from the following specification when taken with the accompanying drawing in which:

Figure 1 is a longitudinal sectional view of one example of torque indicating apparatus in accordance with the invention, part of the apparatus

having been broken away to facilitate the drawing, and

Figure 2 is a plan view showing the indicating scale of the apparatus.

Referring now to the drawing, it will be seen that the apparatus comprises a main torsion bar 1, the lower end of which, as seen in Figure 1, is shouldered at 2 to form a projecting shank 3. The latter is non-round in external shape and is intended to be engaged in the non-round cavity of a standard box-spanner head. Standard box-spanner heads are in common use in conjunction with wrench bars which fit in the heads in the same manner as does the portion 3 of the torsion bar 1. Above the shoulder 2 there is a portion 4 of the bar 1 which is also of non-round exterior appearance and which may be, for example, hexagonal. The portion 4 at its lower end has a part 4a of circular section, the purpose of which will be referred to more particularly hereinafter. The upper end of the bar 1 has a portion 5 which is also non-round and which may be hexagonal. Between its ends the bar 1 may be of circular reduced section as indicated in the drawing.

The bar 1 is surrounded over the greater part of its length by a sleeve 6 which is in section hexagonal or otherwise non-circular depending upon the external surface of the portions 4 and 5 of the bar 1. The portion 5 of the bar 1 fits closely within the sleeve 6 and is anchored thereto with the aid of a locking screw 7. The latter serves mainly as a locating pin, since the engaging peripheral surface of the portion 5 and the inner surface of the sleeve 6 are both non-round and are complementary. As indicated, both the engaging surfaces in question may appear as hexagons in section. Thus, when the bar 1 is in position within the sleeve 6 any relative angular movement between the portion 5 and the contiguous part of the sleeve 6 is substantially prevented. The lower end 8 of the sleeve 6 is machined out so as to present an internal annular surface to form a bearing to accommodate the circular portion 4a of the bar 1. In this manner the sleeve 6 at its lower end provides a bearing for the portion 4a at the lower end of the bar 1.

At its upper end the sleeve 6 is screwthreaded as at 9 and has a circular casing 10 screwed upon it. The locking screw 7 serves also to hold the casing 10 in a definite position upon the screwthreading 9 of the sleeve 6. The casing 10 houses the actual indicating mechanism of the indicating device and such mechanism is operated from a rod 11 which passes through

the centre of the bar 1. The bar 1 is for the purpose formed with a hollow 12, being bushed at 13 at its lower end to receive fixedly the lower end of the rod 11. There is also a bush 14 at the upper end of the internal bore 12, this latter bush serving only to provide a bearing for the rod 11. The rod 11 projects at its upper end from the top of the bar 1 and has a square section 15 which is reduced to a circular section 16. The square section 15 carries a rack arm 17, the rack teeth of which mesh with a pinion 18 which is fast upon a pin 19 journaled at one end in the material of the casing 10. The pin 19 also carries fixedly a further arm 20, the rack teeth of which engage a pinion 21 which is secured upon a sleeve 22. The latter is freely turnable about the pin 16 and carries a pointer 23. The indicating mechanism described, other than the pointer 23, is covered by a plate 24 which, incidentally, bears one end of the pin 19. The upper side of the casing 10 has a glass window 25 to permit the pointer 23 to be observed in conjunction with a scale 26, carried by the closing plate 24, see Figure 2. The scale, indicated generally at 26, has a zero 27 and increases in both angular directions from this zero up to a maximum indicated at 250. This scale may be graduated in arbitrary units, or there may be a calibration in usual units of torque, i. e., tons-feet or tons-inches.

In the use of the apparatus described, as already indicated, a standard box-spanner head is placed on the shank 3 in the same way that these heads are used in connection with wrenches. The head is then placed over the nut that is to be tightened and a spanner is applied to the exterior of the sleeve 6, which has already been explained to be preferably hexagonal. A torque is exerted upon the sleeve 6 with the aid of a spanner such torque being transmitted to the top of the sleeve and thence to the top portion 5 of the torsion bar 1. The other end of the torsion bar 1 is effectively connected with the nut that is being tightened, and said nut receives a working torque through the torsion bar 1. According to the magnitude of the torque that it transmits, the torsion bar 1 will undergo torsional deflection. It will be observed that the rod 11 is secured to the torsion bar 1 only at the lower end of the latter. Thus, the top end of the rod 11 will have a relative movement with respect to the top end of the torsion bar 1 depending upon the extent of the torsional deflection experienced between the ends of the bar 1. The casing 10 carrying the scale formed on the plate 24 is anchored to the upper end of the torsion bar 1. Hence there is a relative movement between the pointer 23 and the scale 24 to an extent proportional to the torsional deflection experienced by the bar 1. Actually, the movement of the pointer 23 will be magnified according to the gear ratio in the transmission from the portion 15 of the rod 11 to the actual driving centre of the pointer or needle 23. According to the direction in which the torque is transmitted to the nut, so the pointer moves clockwise or anti-clockwise over its associated scale.

As will be appreciated several modifications may be made to the construction of apparatus described above. In particular, it may be found convenient to have, in addition to the pointer 23, a dead pointer which is carried round by the pointer 23 but which remains in any position to which it is brought by the pointer 23 as the latter moves away from its zero setting. This

would have the advantage that it could at once be seen to what extent a torque has been applied in the tightening of a nut. The dead pointer could also be used for simplicity of working, so that the latter could be set before using the apparatus, and the live pointer 23 then brought round until it coincides in its reading on the scale with the setting of the dead pointer.

The hexagonal surface of the portion 4 of the bar 1 is made of such dimensions that it does not fit closely within the hexagonal hollow of the sleeve 6. In this way a predetermined extent of movement of the bar 1 in relation to the sleeve 6 is allowed, but there is a definite positive limit to such relative movement, the limit being defined by contact of the hexagonal portion 4 with the flats of the hexagonal internal surface of the sleeve 6.

Other constructional modifications may be made. Thus, it may be found desirable to modify the actual form of the torsion bar 1. In the description above it has been stated that the portion 5 of the torsion bar has an external shape which may be hexagonal in order to fit into the hexagonal hollow of the sleeve 6. In practice the broaching that may be necessary in order to produce the fit of the one element into the other may be found unwarranted expense. In this case, both members could be machined out circular and a shear pin employed, which shear pin occupies an aperture indicated at X in dotted lines in Figure 1. By correct proportioning of the shear pin C a sufficient resistance could be obtained to allow of the construction indicated. The lower portion 4 of the torsion bar 1 may also be modified in several ways in order to obtain the desired limit effect and thereby to limit the twisting movement of the bar relative to the enclosing sleeve.

What I claim and desire to secure by Letters Patent of the United States is:

1. A torque indicating device comprising a sleeve having between the inner and outer ends thereof external surfaces for receiving a spanner, a torque member within said sleeve and having its outer end secured to the outer end of the sleeve, the other end of said torque member extending beyond the inner end of said sleeve and being non-cylindrical for application to an object to be rotated, and indicating mechanism including a scale plate secured to the outer end of said sleeve beyond the spanner-receiving external surfaces thereof and a pointer coupled to the inner end of said torque member.

2. A torque indicating device as claimed in claim 1, wherein said torque member is a torque tube, and a rod extends through said tube and has its inner end secured to the inner end of the torque tube, the outer end of the rod being connected to said pointer to actuate the same.

3. Apparatus for indicating the torque that is applied to an object comprising a hollow torsion bar one end of which is adapted to be applied to the object, a sleeve co-axial with the torsion bar and fixed to the end thereof removed from the object, said sleeve having faces adapted to receive the normal wrench or spanner of the user, a rod disposed centrally of the hollow torsion bar and fixed to the end thereof adapted to be applied to the object, gearing operated by the relative rotation between the rod and the sleeve, a needle or pointer operated by such gearing, and a calibrated dial disposed close to the needle to give reading of such relative rotation.

4. Apparatus for indicating the torque that is

5 applied to an object comprising a hollow torsion bar one end of which is adapted to be applied to the object, a sleeve co-axial with the torsion bar and fixed to the end thereof removed from the object, said sleeve having faces adapted to receive the normal wrench or spanner of the user, a rod disposed centrally of the hollow torsion bar and fixed to the end thereof adapted to be applied to the object, gearing operated by the relative rotation between the rod and the sleeve, a needle or pointer operated by such gearing, and a calibrated dial disposed close to the needle to give reading of such relative rotation, and stops whereby relative rotation between the torsion bar and the sleeve is prevented after a predetermined amount of deflection of the torsion bar. 5

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