Torque in tightening

WORKSHOP HINTS AND TIPS

By Geometer

Torque is force applied to cause turning about an axis, and as such is a fundamental of mechanics. Every time a screw or nut is tightened (or an engine is run), whatever the size, torque comes into play. As with most things, it is of variable magnitude -that is, beginning at just perceptibly above zero and proceeding to formidable figures in " pounds feet."

In everyday mechanics, where the pound-foot applies, the unit is arrived at as at A . An arm 1 ft long with a 1 lb. weight on the end produces a torque of 1 lb. ft. The same ensues if the arm is shortened to 6 in. and the weight increased to 2 lb. The original 1 lb. ft is the product of 1 x 1 = 1, while the second is the product of ½ (ft) x 2 = 1.

For smaller torque values than the lb. ft, the " pound inch " is the unit, for a force of 1 lb. ft would be much too large on many occasions. Thus, an arm 6 in. long with a 1 lb. weight on the end produces a torque of 6 lb. in.; and the same arrives using an arm 1 in. long and a weight of 6lb.

A spring balance is just as effective as a weight; and the weight can then be read on the scale-and need only be multiplied by the length of the arm to obtain the torque applied.

Spanners, screwdrivers and similar tools are instruments for applying torque;. and though they may vary in dimensions according to the size dealt with, the final result depends on the " beef" with which they are used. An experienced practical mechanic might dismiss torque as a " lot of theory," but instinctively adapts himself to its requirements, tightening adequately, but not using the same force on small bolts as on large ones.

On an open spanner as at B, for example, a torque of 1 lb. ft would shear bolts in small model sizes, and would prove totally insufficient in the case of big-end bolts or cylinder head nuts on cars.

Where applicable, a torque wrench removes the guess-work or the need for experience in tightening-particularly for important bolts and nuts like those mentioned-and manufacturers can specify definite tightening values, and employ largely unskilled labour.

The principle of the wrench is as at *B*, where the portion with the scale is on the nut, and the force from the handle is applied to a spring (as in the case of a spring balance). The handle is simply pulled round until the required reading is obtained, and in practice the spring is housed in the handle

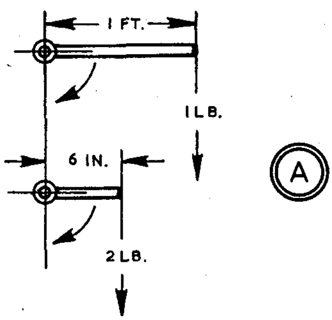
Too much torque in tightening will strain or break bolts and studs, strip nuts and setscrews, while too little will reduce the grip between surfaces, with the risk of parts loosening, or joints blowing out-cylinder head gaskets, for instance.

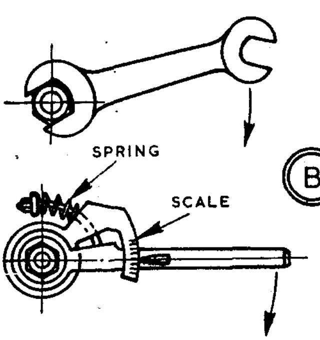
With a nut needing to be split-pinned, an awkward case can occur with the hole in the bolt or stud lying midway between two slots in the nut, on line X-Y, as at C. Turning back would reduce the torque, with the danger of parts loosemng, while further tightening would risk straining the bolt or stud unnecessarily. The solution is to remove the nut and carefully tile its underside for pulling up to the next slot.

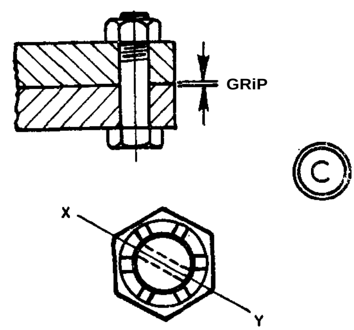
In all sizes of bolts and screws, but particularly small ones, it is important that torque should be applied to tighten components, and not to overcome excessive friction Otherwise the " feel " may be lost on spanner or screwdriver, with disastrous results.

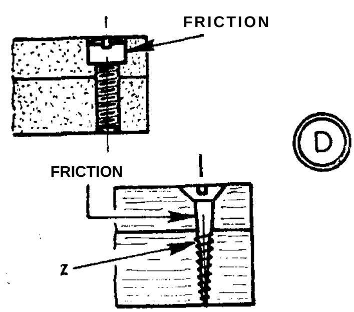
Threads must be of sufficient length, and nuts and screws fre-erunning It should be ensured that metal screws cannot " bottom " in blind holes, and that recesses fo r cheesehead cannot cause friction, as at *D.*

Clearance holes should be drilled to relieve friction on the plain parts of wood screws, and core holes drilled for the threaded portions of long screws, or shearing is possible at position Z. ❑









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