

arrangement disclosed in U.S. Patent No. 4,893,977. In this Patent a self-locking nut has some V or U-shaped grooves in the collar, the grooves being wide enough to prevent the above-mentioned disadvantages due to the closing of the slots. The disadvantages which the present invention aims to solve are not directly linked to this last Patent but rather to some other aspects as discussed below.

Since the helical spring with which the nut is equipped must be protected from oxidation, the solution has been to either phosphatize a spring made of spring steel, or to make the spring of stainless steel (when used in conditions above 250°C).

Now, it has been discovered that:

1. phosphating does not provide an adequate protection of the spring from oxidation;
2. making the spring of stainless steel generates other disadvantages, such as:
 - 2.1 excessive costs, justified only for types of nuts provided for use at high temperatures (above 250°C);
 - 2.2 use of such stainless steel springs are advisable only for nuts for use at temperatures greater than 250°C, since at lower temperatures it is preferable to use normal springs (made of spring steel) as they have better elasticity and consequently provide the nut with a greater locking torque;
 - 2.3 as an average, the springs in stainless steel provide the nut with a locking torque that is much lower than corresponding springs in spring steel.

It is an object of certain embodiments of the present invention to reduce or solve the above-mentioned disadvantages and alternatively or in addition provide a nut that has the following advantages:

- low costs;
- resistance to oxidation;
- usable at all temperatures.

It should be taken into account that embodiments of

the invention provide at least three ways in which the technique can be realised for high temperatures, above 250°C, using springs made of stainless steel with:

- a) a steel nut with low carbon content;
- b) a steel nut with high carbon content;
- c) a stainless steel nut.

The three nuts above, particularly nuts a) and b), have the disadvantage of becoming too engaged due to corrosion with screws or studs after being at a high temperature (400-500°C) for a predetermined time. With solution c) this phenomenon is less frequent, but it can sometimes generate other problems. For example, when trying to unscrew the nut, the stud may instead be unscrewed from its seat or, worse still, the stud itself may be sheared.

Even if such a problem occurs only once while adjusting or maintaining an engine (on which ten or more nuts can be assembled), this implies remarkable practical problems. If the stud is unscrewed from its seat, the replacement of the stud with another one having a larger diameter, for example due to tolerances, can be difficult. If the stud is sheared the problem is more serious since it is necessary to drill the stud and to disassemble the arrangement. This is particularly inconvenient since almost always these operations must be carried out at locations not easily accessible, in particular if the engine is mounted in a vehicle.

A further purpose of embodiments of the present invention is to solve these latter problems by providing a nut which is treated in such a way as to enable its easy disassembly without allowing uncontrolled and undesired loosening, which may cause a gas leakage with subsequent burning of a seal gasket, if present.

According to one aspect of the present invention there is provided a self-locking nut comprising an upper threaded collar equipped with longitudinal slots, the slots defining in the collar a plurality of circular arc

segments which are compressible by a hot-galvanized helical external spring, wherein the nut is provided with a copper coating.

The copper coating avoids welding between the nut and screw. The coppering protects the nut itself from corrosion (oxidation) and helps its disassembling in general, and, when carried out on stainless steel nuts, allows their disassembling without difficulties even after a long period at high temperatures (above 400-500°C).

The longitudinal slots are preferably U-shaped. It is preferred for them to be of such a width as not to allow mutual contact of the circular arc segments.

Preferably, the copper coating is formed by subjecting the nut to an electrolytic coppering treatment.

Preferably, if the usual operating temperature is to be less than 250°C, the helical spring is made of harmonic spring steel.

Preferably if the usual operating temperature is to be greater than 250°C, the helical spring is made of stainless spring steel.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawing which shows a self-locking nut in a perspective view.

Referring now to the figure, the self-locking nut is indicated at 1 and is screwed on a threaded rod, not shown, received internally of the nut.

The nut 1 is equipped with a collar 3 on which a helical spring 5 is wound to apply radial pressure to said collar 3 and, in turn, to the threaded rod on which the nut 1 is screwed. The radial pressure is applied to the threaded rod as a result of U-shaped slots 7, provided in collar 3.

The slots 7 define a series of circular arc segments 9 on the collar 3, each segment being equipped

with a small upper external rib.

On an upwardly facing surface of the nut 1, a hollow seat 13 is provided in which the helical spring 5 is housed. The spring 5 is wound on the collar 3 to radially compress the segments 9 against the threaded rod on which the nut 1 is screwed.

The spring 5 is made from steel which has been hot-galvanized before being assembled onto the segments. The temperature at which the device, in which the nut is provided, normally operates, determines the preferred spring material. For example where the operating temperature is less than 250°C, the spring is preferably made of harmonic spring steel. Where the operating temperature is greater than 250°C, the spring is preferably made of stainless spring steel.

The nut is subjected to an electrolytic coppering treatment. The coppering protects the nut from corrosion (oxidation) and in general allows improved disassembly of the nut. This is because the coating prevents the corroding together of the nut and stud. The advantages of the treatment are especially apparent where the nut is made of stainless steel. Even if the stainless steel nut is at a high temperature, at for example 400-500°C for a relatively long time, the coppering prevents significant corrosion and consequently the nut can still be removed from the rod without causing shearing of the rod or unscrewing of the rod from its seat.

Reference is made to the above-mentioned U.S. Patent No. 4,893,977 for further mechanical or structural details of the nut to which the present invention is applicable.

CLAIMS

1. A self-locking nut comprising an upper threaded collar equipped with longitudinal slots, the slots defining in the collar a plurality of circular arc segments which are compressible by a hot-galvanized helical external spring, wherein the nut is provided with a copper coating.
2. A self-locking nut as claimed in claim 1, wherein said copper coating is formed by an electrolytic coppering treatment.
3. A self-locking nut according to claim 1 or 2, wherein the helical spring is made of harmonic spring steel.
4. A self-locking nut according to claim 1 or 2, wherein the helical spring is made of stainless steel.
5. A self-locking nut as claimed in any preceding claim, wherein said slots are U-shaped.
6. A self-locking nut as claimed in any preceding claim, wherein said slots are of such a width as not to allow mutual contact of said circular arc segments.
7. A self-locking nut substantially as hereinbefore described with reference to the accompanying drawing.

