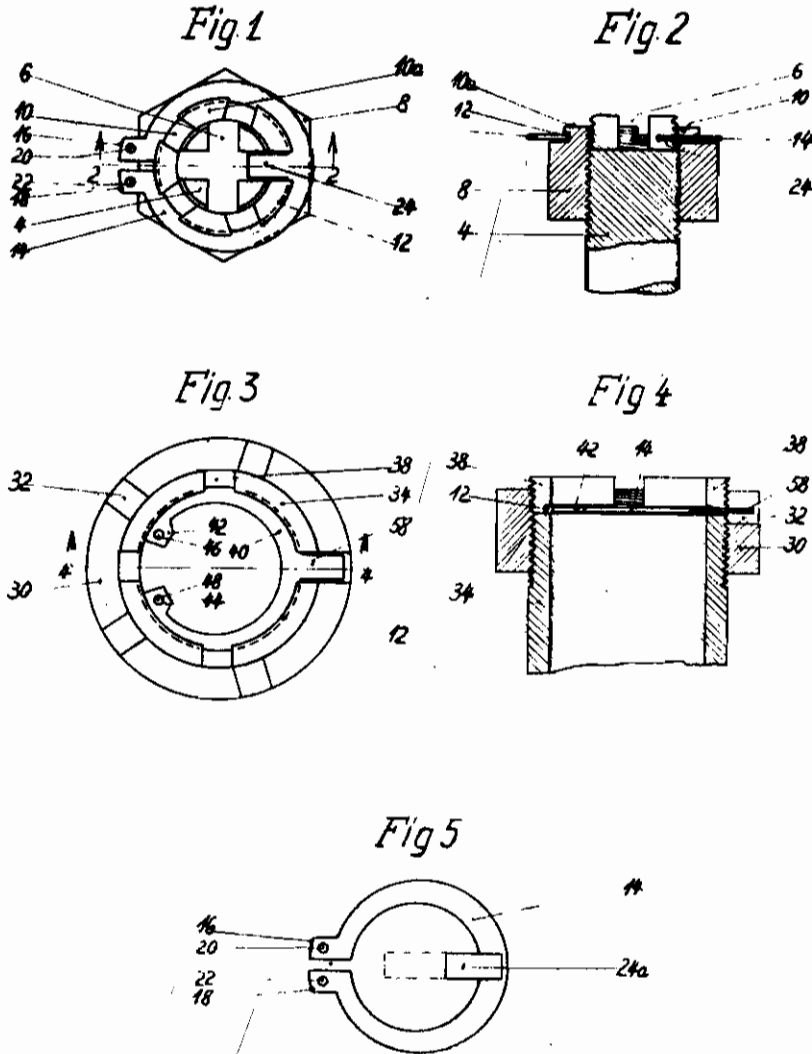


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SPREADING RING LOCK-WASHER
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SPREADING RING LOCK-WASHER

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This invention is directed to a lock-washer. More particularly the invention is directed to a lock-washer which is capable of being repeatedly used without injury.

In place of cotter pins, lock-washers formed as hooked spring rings are frequently used inasmuch as they can be sprung into place and used repeatedly without the permanent deforming such as takes place in an ordinary cotter pin. The conventional spring ring is of circular cross-section, and circular in plan with one end bent radially inwardly or outwardly and lying on the plane of the circle. The circular portion of the ring is seated in an annular groove in a nut, and the free radially extending end passes through an opening in the nut into a hole in the bolt. Such a spring lock-washer can be used repeatedly without damaging distortion. However, it has been discovered that while a lock-washer of this kind is satisfactory for connecting parts which are not subjected to movement or vibration, such a spring lock-washer is not satisfactory for moving or vibrating parts as there is always the danger the washer may spring out of the groove in the nut since because of its small cross-section it has but small holding force. Furthermore when the spring lock-washer is used in a connection which is subjected to torsion stress, the free end of the locking ring which projects through the nut into the bolt is likely to shear off because of its small cross-section. In addition there is always the chance that this free end will pull out of the bolt if the ring has a close good frictional fit in the groove in the nut.

It is the object of the instant invention to produce a lock-washer of novel shape which can be repeatedly used without harmful distortion.

Another object of the invention is to produce a lock-washer which will not spring out of place when the parts are subject to vibration, and which has a higher resistance to shearing stress than the previously known lock-washers.

Generally these objects of the invention are obtained by forming a flat circular split spring ring which has a radially extending flattened portion engageable with recesses in both the bolt and the nut, and other radially extending projections adjacent the split in the ring for the purpose of opening the ring so that it can be placed in a groove in the nut. As the radially extending projection for fitting into aligned grooves in the nut and bolt has its greatest dimension in the direction of the applied torsional stress, it is much stronger than the previously known lock-washers of circular cross-section.

If desired this radially extending portion can be made thicker than the remainder of the ring to increase its resistance to shear. Furthermore, because of the flattened spring construction, the ring is resistant to radial distortion and there is little likelihood of the ring being displaced by vibrations.

The means by which these objects of the invention are obtained are more fully described with reference to the attached drawings in which:

Fig. 1 is a plan view of one form of the novel lock-washer applied to a bolt and nut;

Fig. 2 is a cross-sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a plan view similar to Fig. 1 showing a modified form of the washer;

Fig. 4 is a cross-sectional view of the line 4—4, Fig. 3; and

Fig. 5 is a plan view of still another form of the lock-washer.

In Figs. 1 and 2, the bolt 4 having longitudinally extending slots 6 which are radially directed in the cross-section of the bolt, has a castle nut 8 screwed thereon. At the juncture of the castellations 10a with the body of the nut, an annular groove 12 is formed.

As shown, the novel lock-washer 14 is seated in groove 12. This lock-washer comprises a flat circular piece of spring metal radially split to form two substantially radially extending free ends 16 and 18 projecting outwardly of the circle and having perforations 20 and 22 therein. Diametrically opposite the split is a radially inward extending tongue 24.

In applying the lock-washer to the nut and bolt, the nut is turned down on the bolt until one of the grooves 10 in the nut becomes aligned with a groove 6 in the bolt. The lock-washer is then opened by a tool such as a pair of pointed pliers, the ends of which are engaged in the perforations 20 and 22, and placed over the bolt and nut. Tongue 24 is inserted through the aligned openings 6 and 10 and the two halves of the washer are released so that the washer becomes seated in groove 12 in the nut. Because of the flat construction the washer is very resistant to opening forces and is kept tightly seated in groove 12 despite vibration or other moving forces. At the same time tongue 24 provides, by reason of its width, an increased resistance to shear over washers of circular section so that the nut can not turn off the bolt.

A modified form of the invention for use with hollow bolts is shown in Figs. 3 and 4. Nut 30

may be a conventional castle nut having the usual slots 32 between the castellations. Bolt 34 is hollow and has a groove 36 around the inner periphery thereof. Radially extending slots 38 through the bolt are in the same plane as groove 36.

The novel lock-washer 40 is composed of a flattened split ring having inward substantially radially directed free ends 42 and 44 provided with perforations 46 and 48, respectively. The opposite side of the ring has an integrally formed tongue 58 projecting radially outwardly of the ring 40. In placing this lock-washer into position the nut 30 is turned down on bolt 34 until a slot 32 in the nut becomes aligned with a slot 36 in the bolt. The ring 40 is then collapsed by means of a special tool, such as a pair of pliers with pointed ends engaging in the perforations 46 and 48, and inserted into the hollow bolt 34 until the tongue 58 pushes through the aligned slots 32 and 38. The pliers are then released so that the ring springs into place into groove 36.

In Fig. 5 a lock-washer is illustrated which has a thickened tongue for the purpose of giving additional resistance to shear stresses. This lock-washer is similar to the lock-washer 14 shown in

Figs. 1 and 2 with the exception that the tongue 24a initially has a longer length, as illustrated by the dotted lines, and is bent back upon itself to form a tongue of double thickness. If desired this thickened tongue can be constructed by welding or otherwise securing an additional piece of material to the ring. It is clear that the tongue 56 of the washer shown in Figs. 3 and 4 can likewise be thickened.

In both Figs. 1 and 3 the nut has an uneven number of slots, while the bolt has an even number of slots. Therefore, small turns of the nut on the bolt will bring slots into alignment. Of course, all slots are of equal width and slightly wider than the tongue on the washer.

It is thus apparent that the invention provides a lock-washer which is not permanently deformed by bending when put into place and consequently can be repeatedly used. The lock-washer is easily applied and held in a circumferential groove against longitudinal displacement, the flattened section being greatly resistant to outward springing, while the flattened tongue gives greater resistance to shear stresses than that heretofore obtained by lock-washers of circular section.

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