

An Innovative Ratchet Fastener That Cannot Screw Loose

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On the Shoulders of Giants

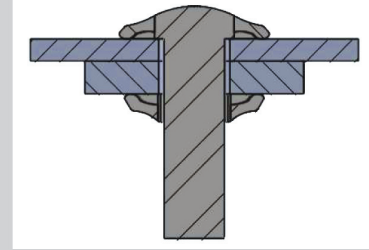
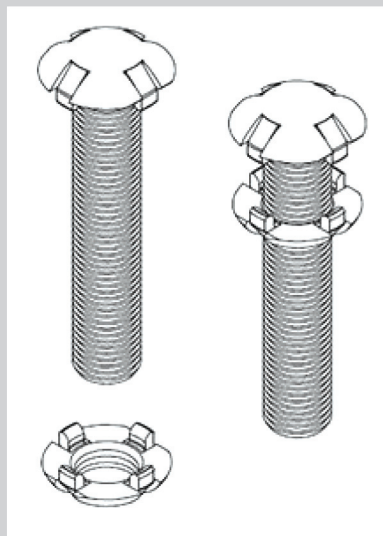
Have you ever heard of Archytas of Tarentum? Back in 400 BC, he laid the foundation for modern fasteners by inventing the helical thread. But just as what goes up must come down, we also know that when helically threaded fasteners screw loose, things fall apart.

Screwed By Tradition

The helical thread is a genius design. It fastens by tightening in one direction and unfastens by loosening in the other. Yet shear forces and axial movements at the interface between the fastener and the clamped components result in small relative motions called microslip that gradually reduce the fastener's preloaded frictional force and cause microscopic deformation of the threads. Over time this causes the nut to spin off the bolt. In short, all helically threaded fasteners are prone to vibrating loose. And that's not their only problem. Helically threaded fasteners are plagued by many additional issues. To assemble and disassemble, one part must be turned in relation to another and tools are generally required to do this. From a manufacturing standpoint, the time, energy, and cost involved in tightening nuts onto bolts is multiplied by the number of fasteners used in the product. Tightening bolts stretch their shafts and deform their threads, substantially weakening them. Moreover, handling helically threaded fasteners in tight spaces and in non-terrestrial environments can be quite challenging. Try torquing a bolt deep undersea or in zero gravity and Newton's Third Law of Motion will make your head — and your entire body — spin.

A Faster Fastener that Stays Fast Forever

An entire industry involving lock washers, adhesive thread lockers, nylon inserts, and other solutions has arisen to work around the shortcomings associated with traditional nuts and bolts. Now an entirely new class of fastener comes to market with the Goldilocks™ unique biomimetic design. This deceptively simple technology harnesses the power of one-way friction through mutually interacting ratchets in the nut and the bolt. Its integrated rack-and-pawl system allows the nut to be pushed onto the bolt and prevents it from being pulled off, thereby providing high clamping force for critical parts under load. Because its threads are annular rather than helical, vibration can turn the parts but never screw them loose. The system is further preloaded by mutually opposing spring tensioners built into both the head and the nut. This makes the system extremely tight when fastened and keeps it tight despite cyclic loading. The United States Patent and Trademark Office awarded its first utility patent (USPTO 11,499, 585 B2) on 11/15/2022 and its second patent (USPTO 11,867,220 B2) on 1/09/2024.



Additional patents are currently in the pipeline.

Benefits

The Goldilocks™ ratchet fastener resists vibrational forces and cannot spin loose. A heavy-duty push-on solution, it is not subject to the types of shaft and thread failures commonly seen in helically threaded systems. Goldilocks™ fasteners can be made from a variety of materials including lightweight plastics, advanced composites, and metals. It is faster and easier to secure and, in many applications, requires no tools. Thus, it is more economical to manufacture and to use. Moreover, it will not come loose unless you want it to, at which point it can be cut off at chamfers set into the nut or bolt and easily removed. And because the bolt head is not slotted, it is highly tamper-proof.

Market Applications

The industrial fastener market is currently estimated at over \$95 billion. Additional industries shown in Table 1 below suggest that the total addressable market for this new class of fastener is equivalent to the total GDP of the United States. What is your application? Contact us to see how we are a fit for you.

INDUSTRY	ESTIMATED VALUE IN 2024
Construction	\$13.6 Trillion
Medical Devices	\$3.0 Trillion
Automotive	\$2.9 Trillion
Defense	\$2.5 Trillion
Consumer Hardware	\$1.5 Trillion
Consumer Electronics	\$1.3 Trillion
Aerospace	\$1.0 Trillion
Shipbuilding	\$250 Billion
Robotics	\$60 Billion
Drones	\$50 Billion

Table 1: Markets for Goldilocks™ fasteners and their Estimated Values

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