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**Keeping it Together:
The Increasing Demand for
Vibration-Resistant Fasteners**



Dr. Douglas E. Hersh

Inventor, The Goldilocks Ratchet Fastener

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Raffle:

Samples:

Test:

Put Your Name in the Hat!

Take a Sample Set

Push to Fasten - - Try to Remove

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Inventor, The Goldilocks Ratchet Fastener

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Fastener Failure

Preload Vibrational Input Micro-slippage

Why Vibration-Resistant Fasteners are Crucial for Electric Vehicle Performance



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ACCIDENTS AND DISASTERS



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**American Airlines Flight 191 (1979)
All 271 People Died**

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**American Airlines Flight 191 (1979)
All 271 People Died**

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**Hyatt Regency Walkway Collapse
(1981) 114 Dead, 200 Injured**

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**Hyatt Regency Walkway Collapse
(1981) 114 Dead, 200 Injured**

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US Army Black Hawk Helicopter Crashes (1982-1995)

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Eschede Train Disaster (1988)
101 People Killed

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Carnival Liberty Cruise Ship Fire (2015)

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Nipigon River Bridge Disaster (2016)

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Boeing 737 Max 9 Door Plug Blowout (2024)

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**COSTLY
DOWNTIME
AND LIABILITY**

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**Big Dig Ceiling Collapse (2006)
Over \$478,000,000 in Payouts**

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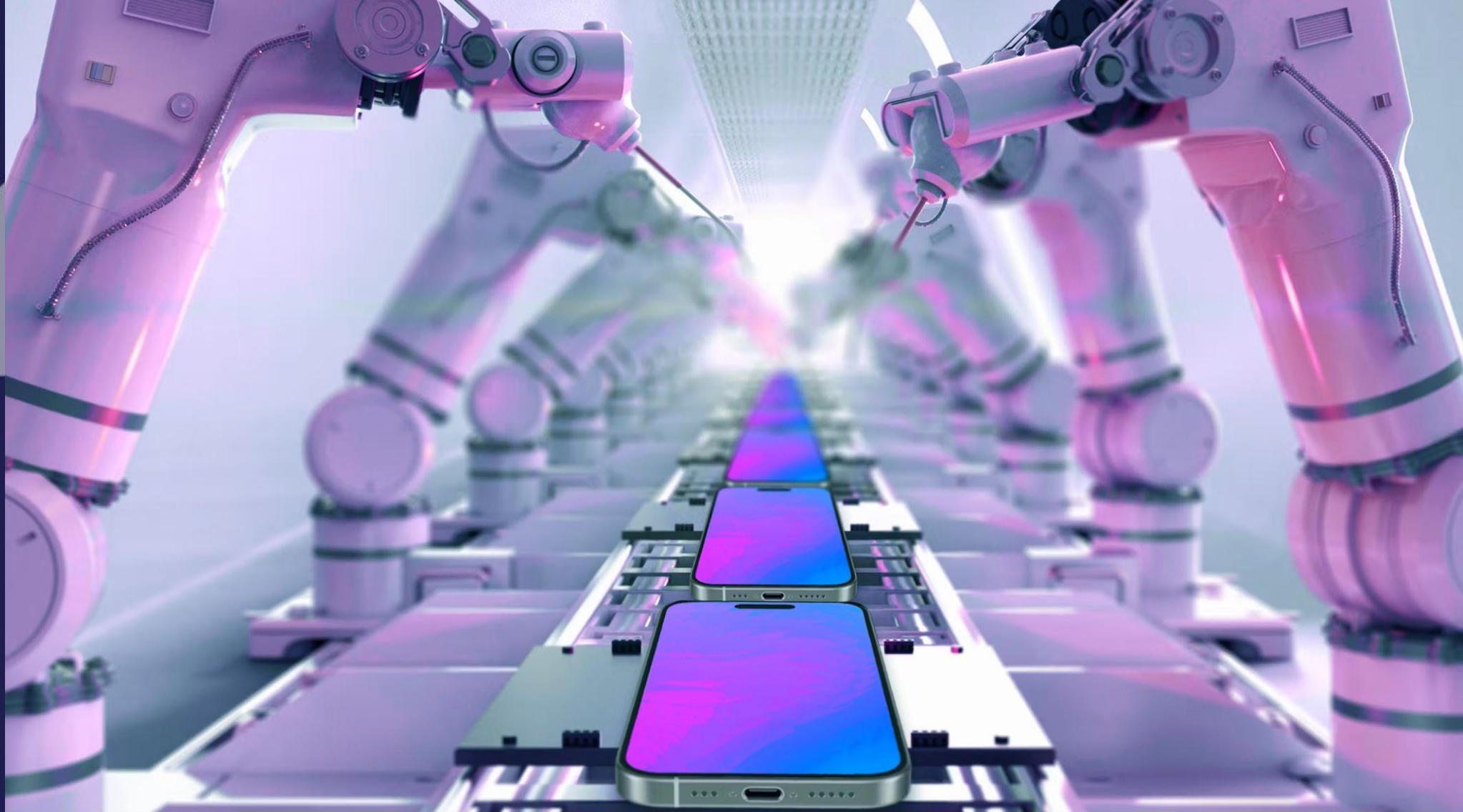
**Ford Seatbelt Anchor Bolt Recall
(2017) \$140 Million**

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**Dallas Crane Collapse (2019)
\$860 Million Fine to Greystar**

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Foxconn iPhone Assembly Line (2018)
\$5 Million

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**Amazon Fulfillment Center
\$2,300,000 per hour**

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A Brief History of Fasteners Prehistoric-Present

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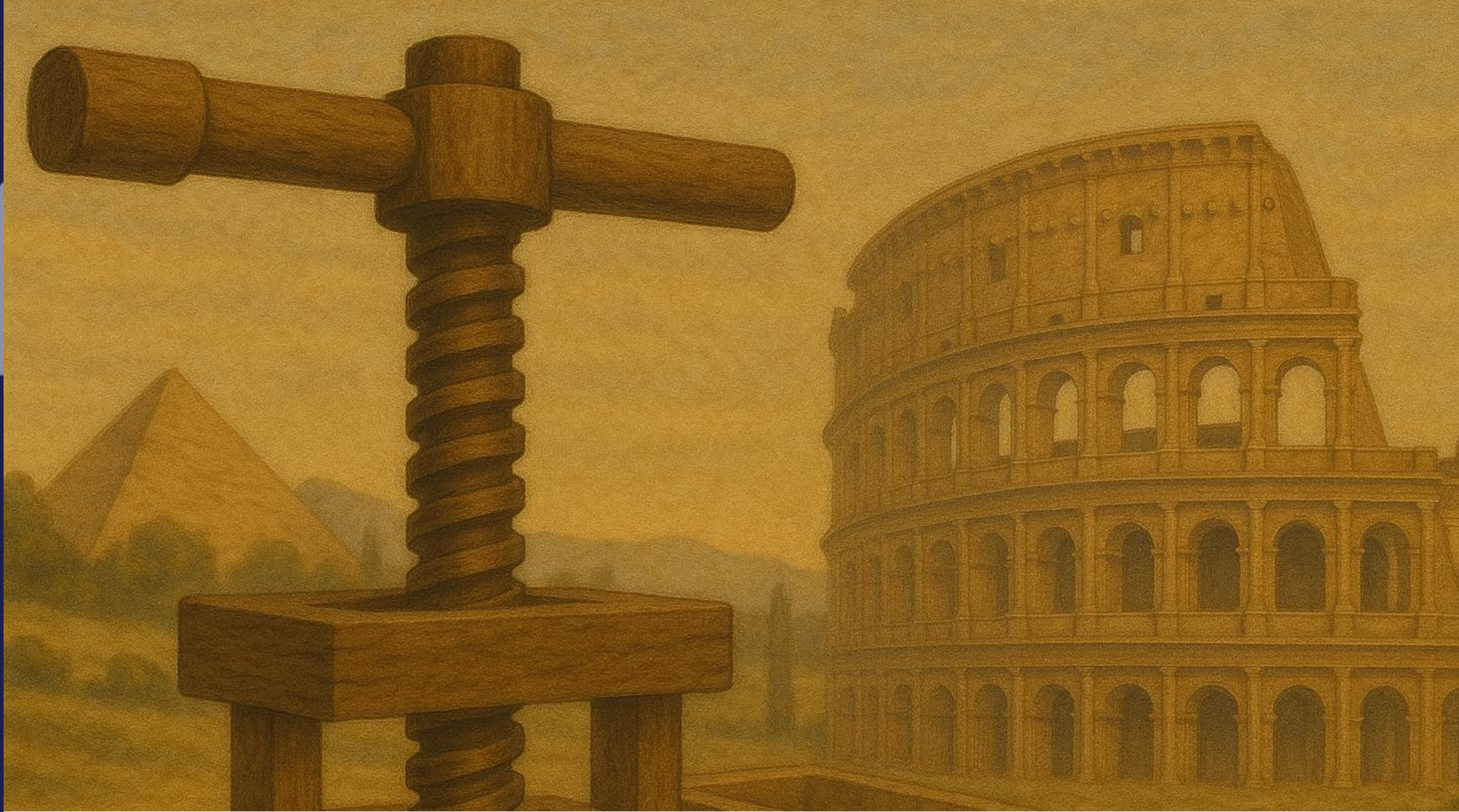


Prehistoric-Bronze Age Binding & Lashing

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Ancient Egypt and Greece Pegs, Nails, Clamps, and Joinery



Rome, 1st Century CE
Helical “Screws” used in Presses



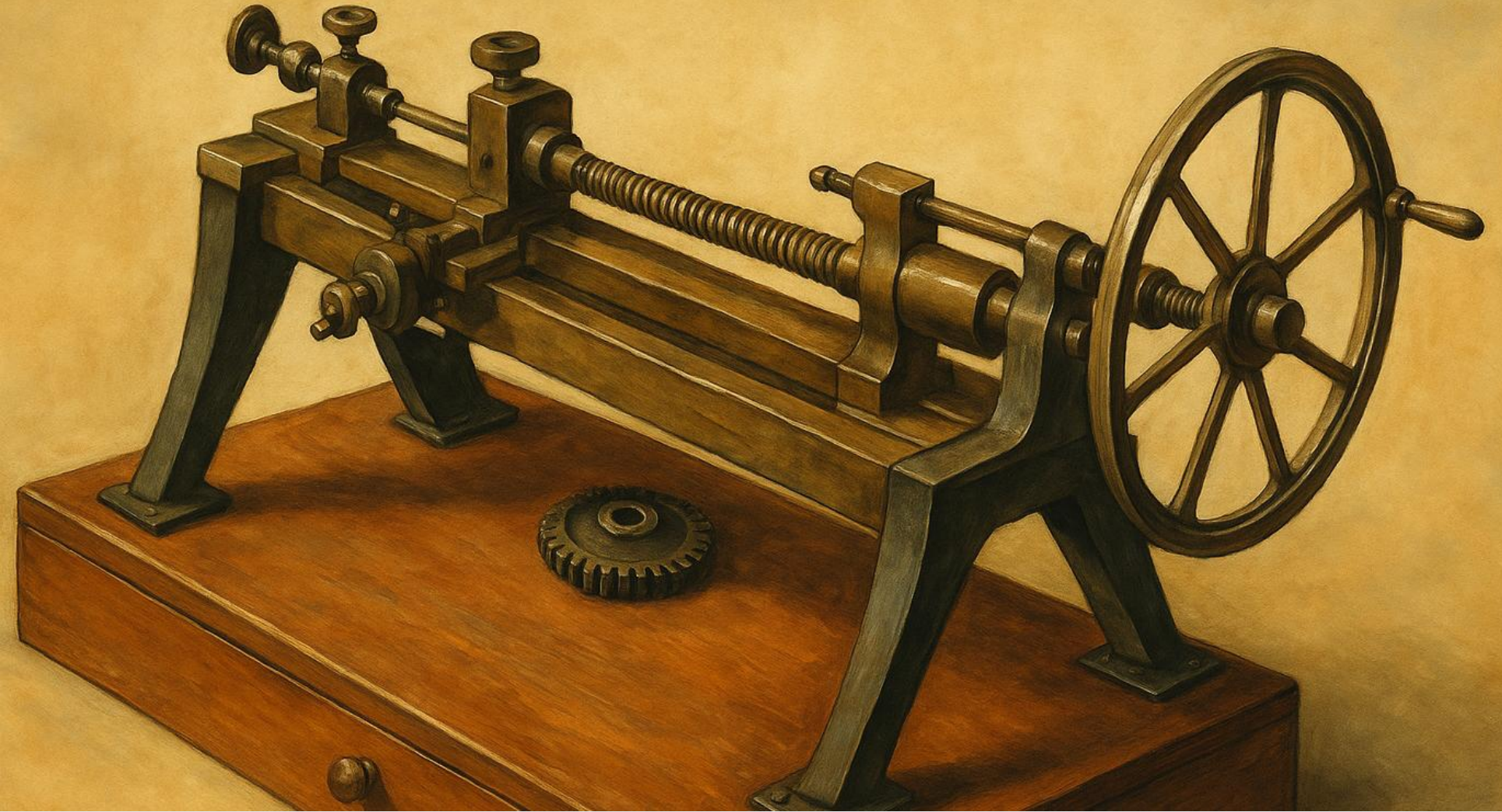
Middle Ages – Renaissance Hand-Cut Bolts and Nuts

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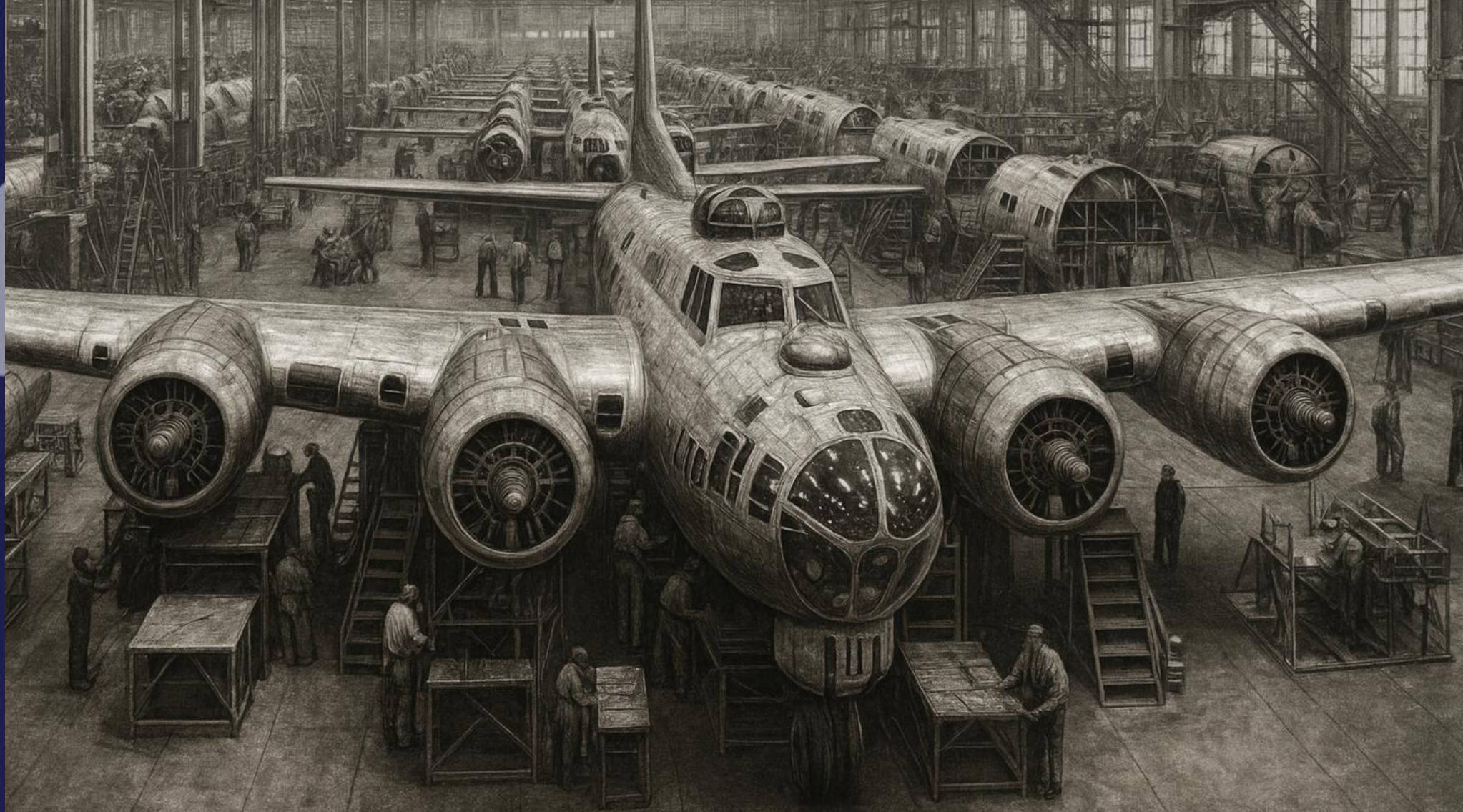
16th Century Precision Screws for Clockmaking

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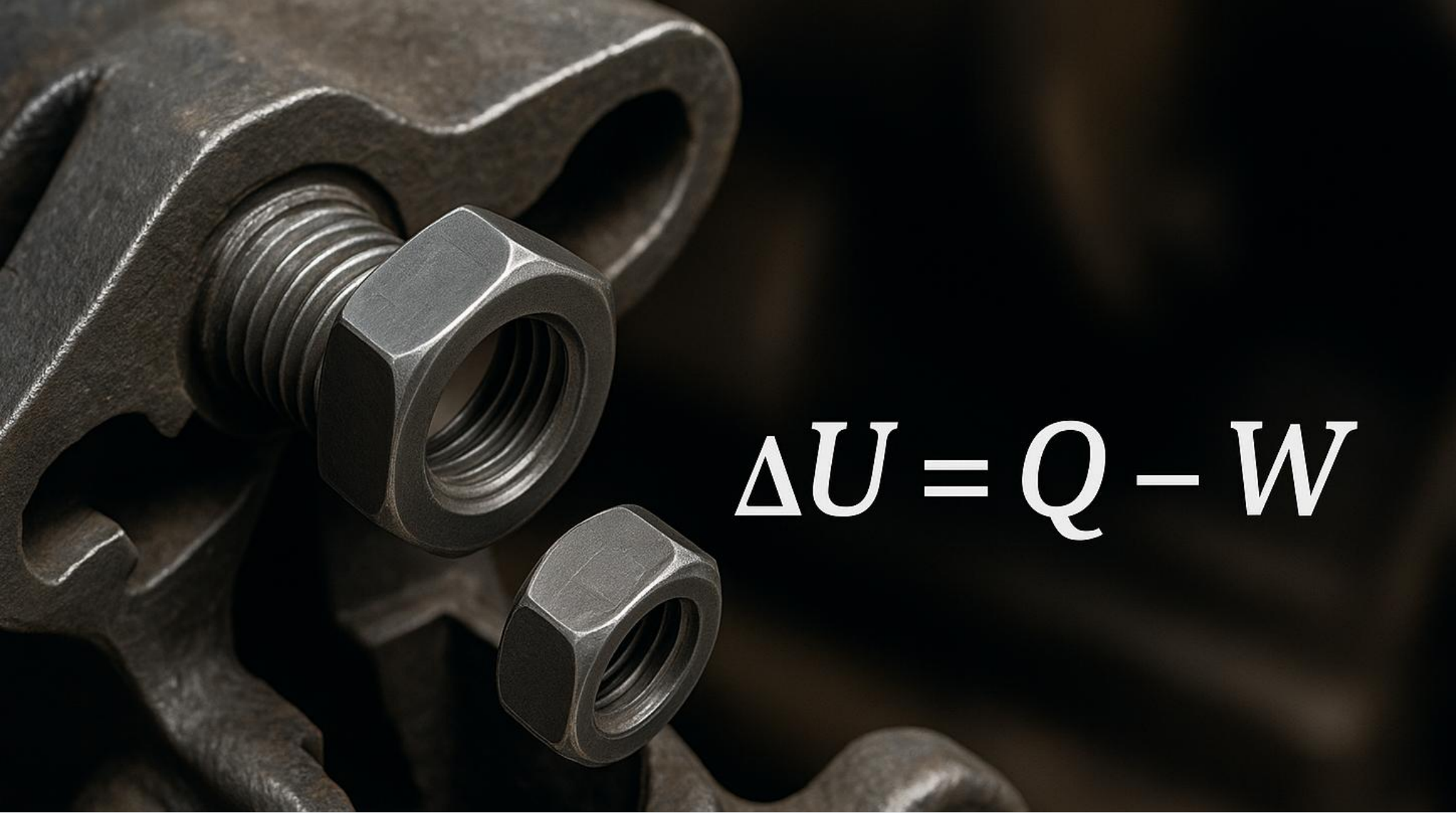


Industrial Revolution Maudslay Thread-Cutting Machine

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**World War Planes, Tanks, and Ships
Demand for Standardization**


$$\Delta U = Q - W$$

**Second Law of Thermodynamics
Helically-Threaded Fasteners Loosen**

NTSB FINDS LOOSE FASTENERS AT FAULT



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SPLIT LOCK WASHER



NYLOC NUT



DOUBLE NUT



SERRATED
FLANGE NUT



SAFETY WIRE



DUBBLE



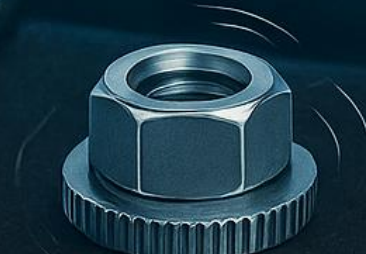
THREADLOCKER



DISTORTED-
THREAD NUT



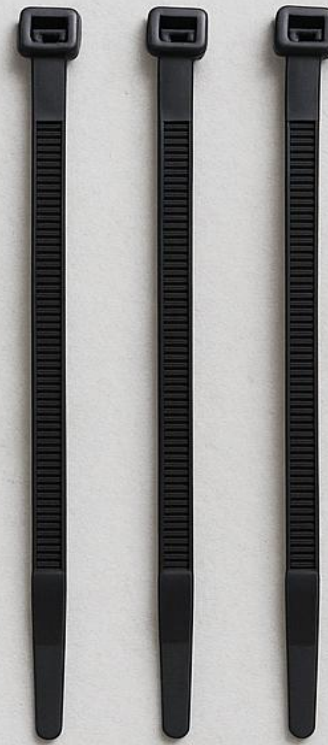
LOCK PLATE



Methods Used to Prevent Vibrational Loosening of Nuts off Bolts



**HOOK-AND-
-LOOP
FASTENERS**



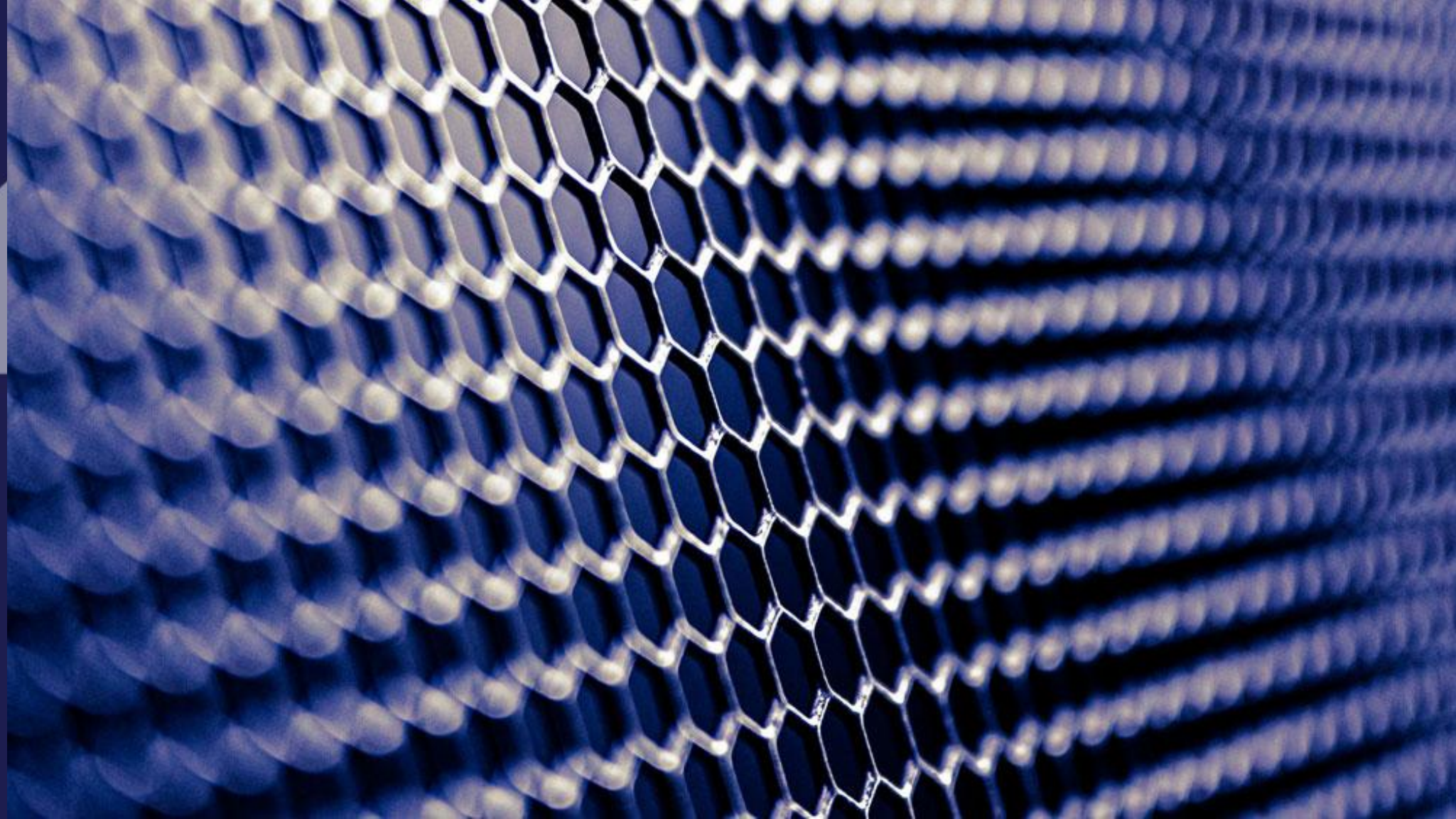
**CABLE
TIES**



**MAGNETIC
FASTENERS**

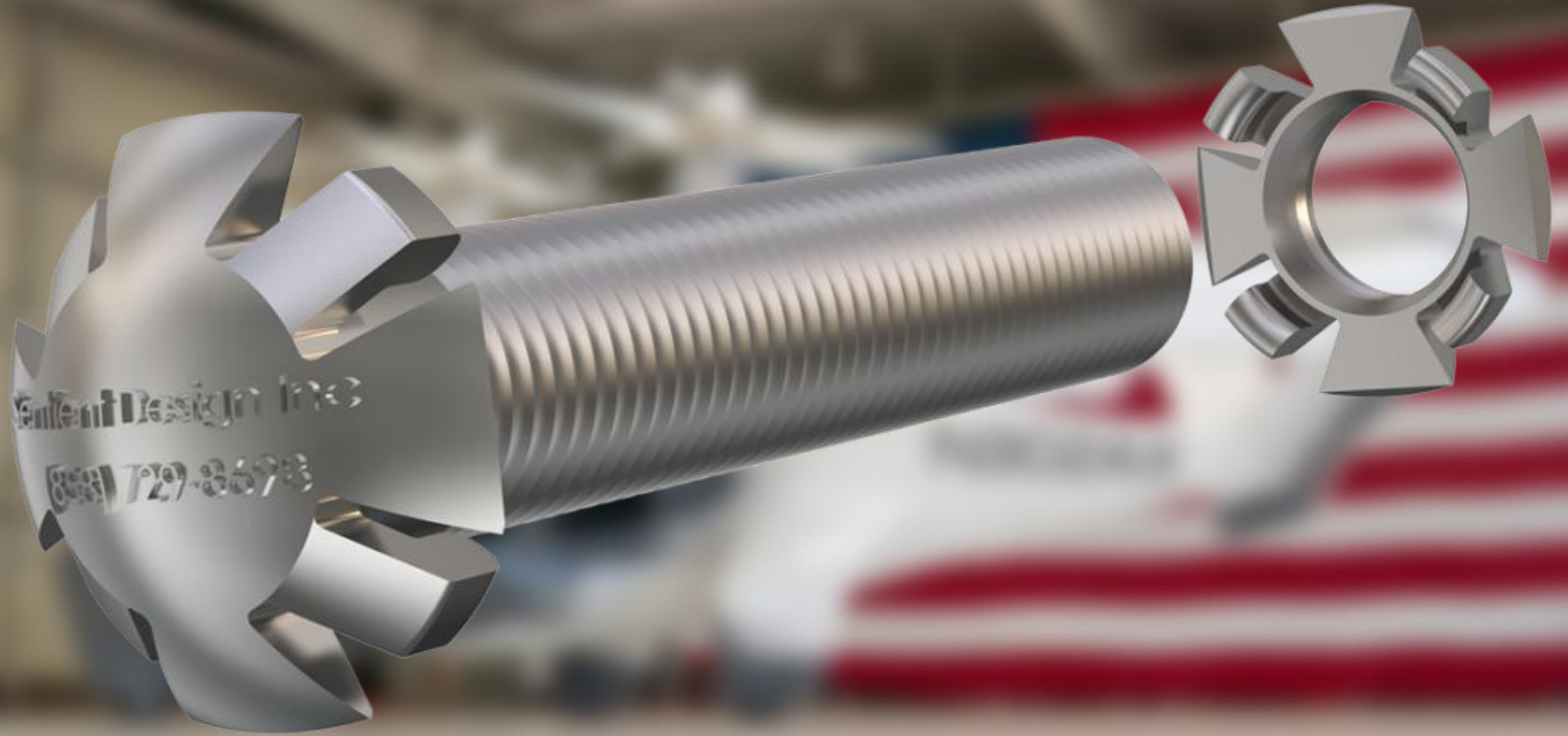
**20th Century
Innovative Fastening Solutions**

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**Early 21st Century
New Materials and Designs**

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**Fundamental Reinvention of the
Helical Thread to Prevent Loosening**

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21st Century Inventions

Smart Phones (2007)

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21st Century Inventions Electric Vehicles (2007)

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21st Century Inventions

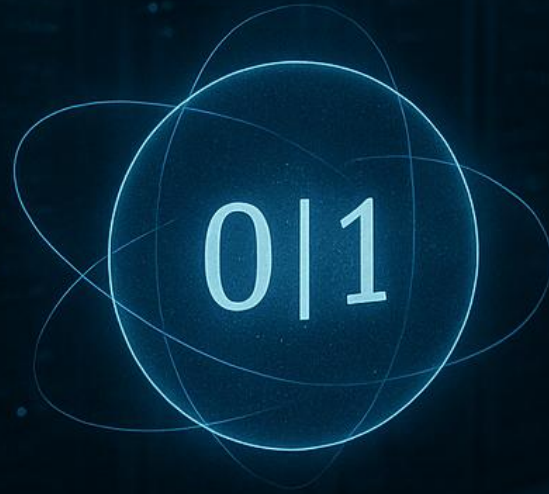
Blockchain, DeFi, & Bitcoin (2009)

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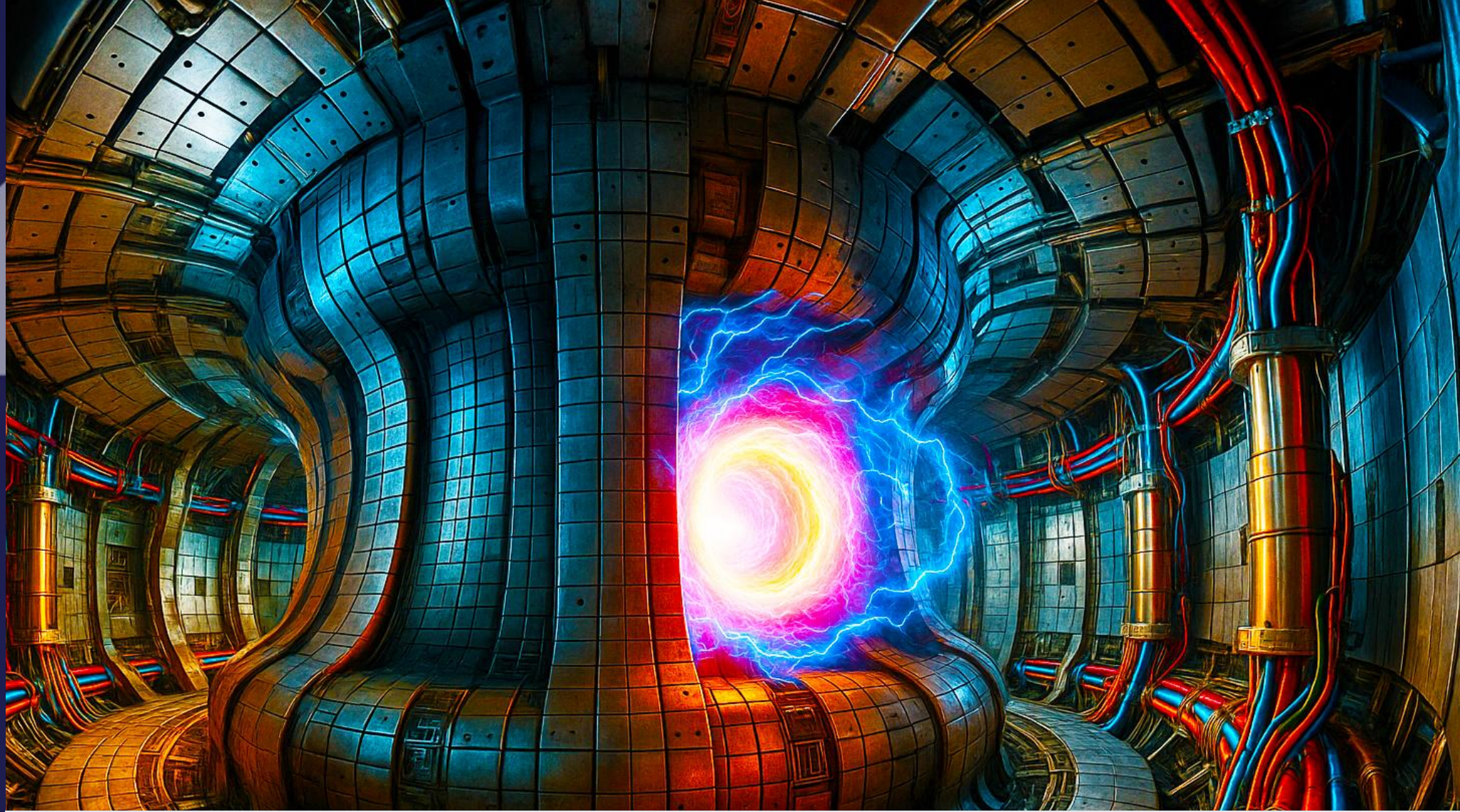
21st Century Inventions Reusable Rockets (2015)

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21st Century Inventions Quantum Computing (2019)

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21st Century Inventions

Nuclear Fusion & Tokamaks (2021)

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21st Century Inventions

Robotics and Smart Automation

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21st Century Inventions

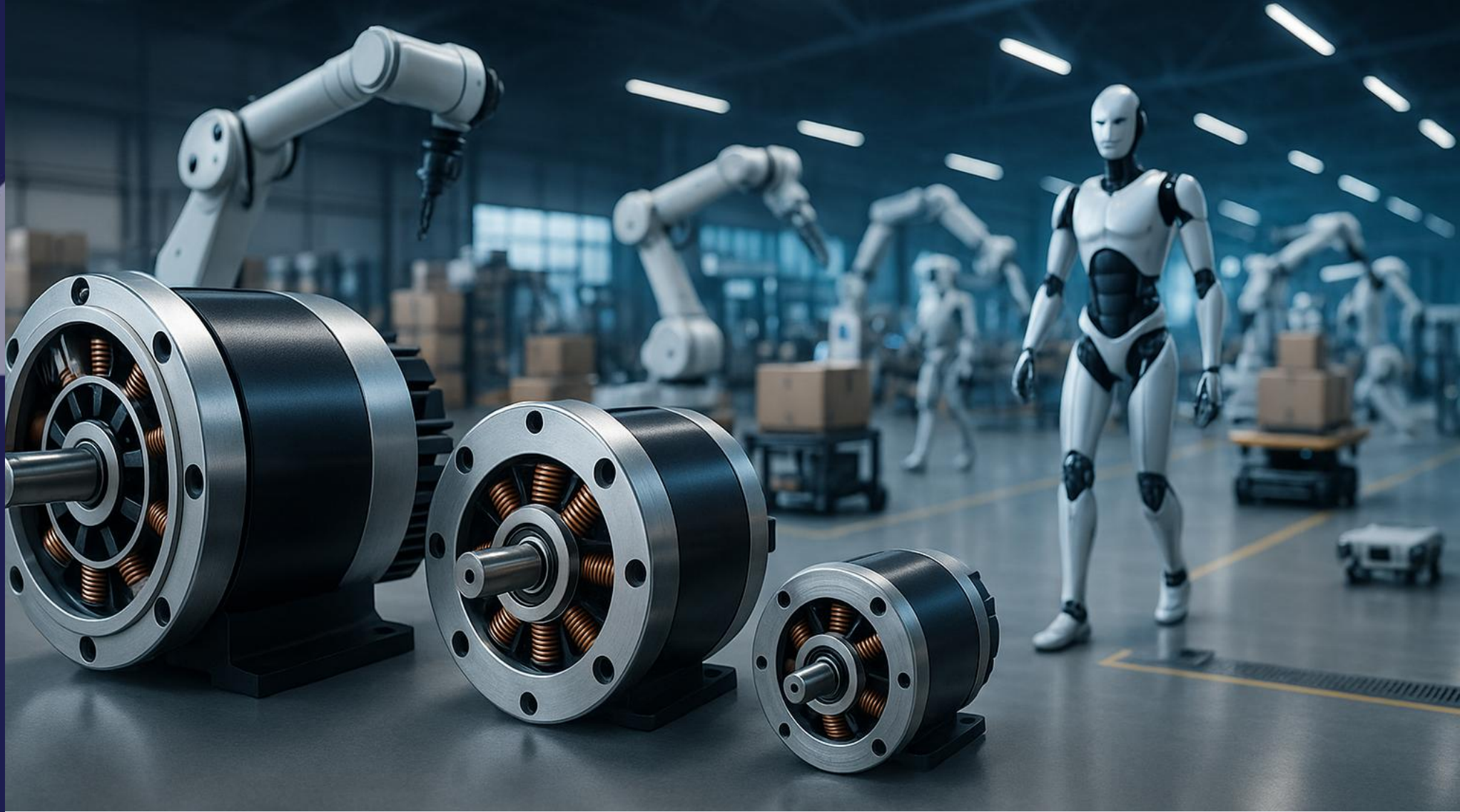
Generative Artificial Intelligence

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Fourth Industrial Revolution Late Upper Paleolithic - 2045

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Fourth Industrial Revolution Brushless Direct-DC Electric Motors

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Fourth Industrial Revolution Advanced Manufacturing

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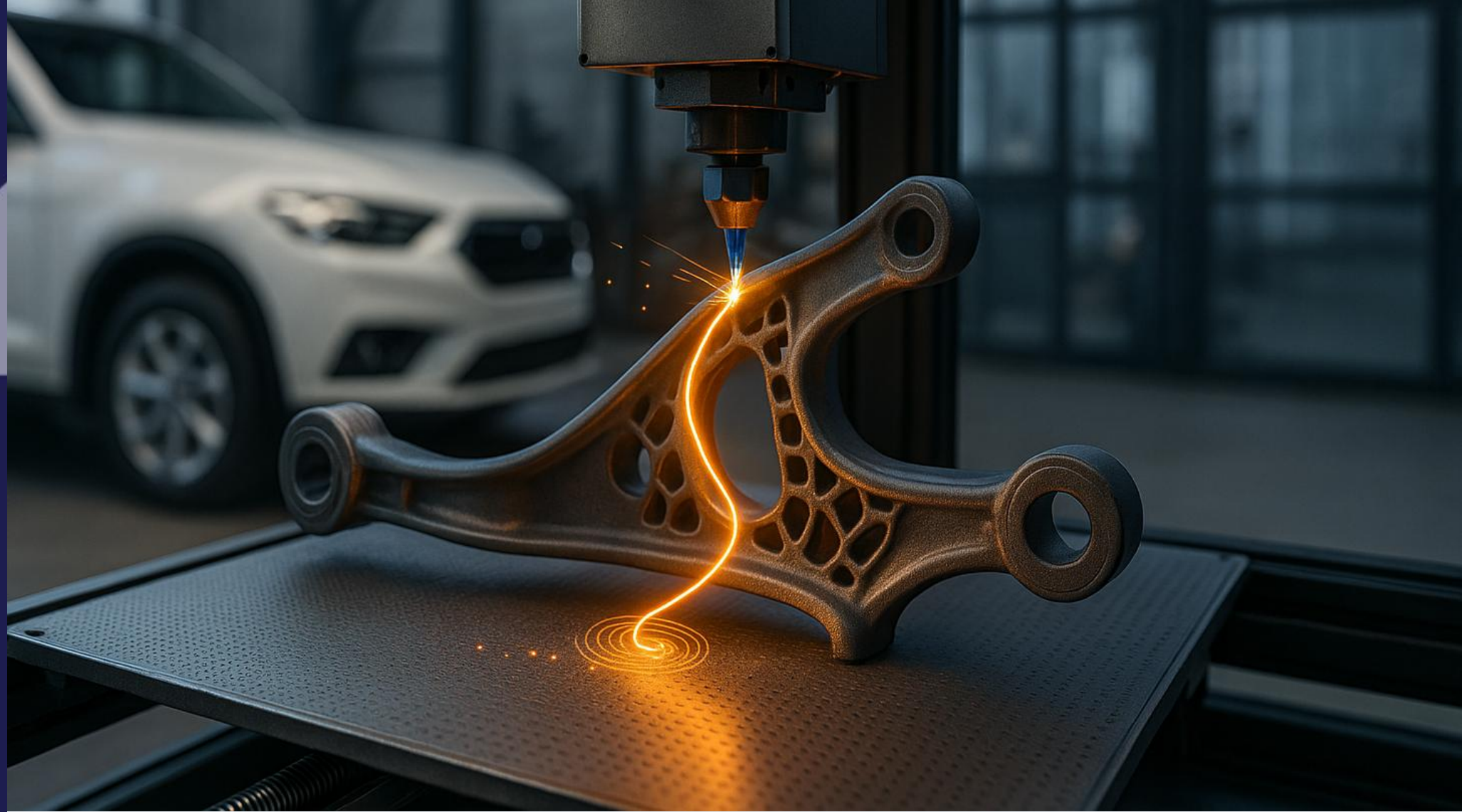
**Increasing Demand
Electrification Everywhere**

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**Increasing Demand
Higher Operational Speeds & Loads**

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**Increasing Demand
Additive Manufacturing**

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**Increasing Demand
Advances in Materials Science**

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**Increasing Demand
Increasing Miniaturization**

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Increasing Demand Cyber-Physical Systems

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Increasing Demand **Global Logistics & Supply Chain**

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**Increasing Demand
Smart Mobility & Aerospace**

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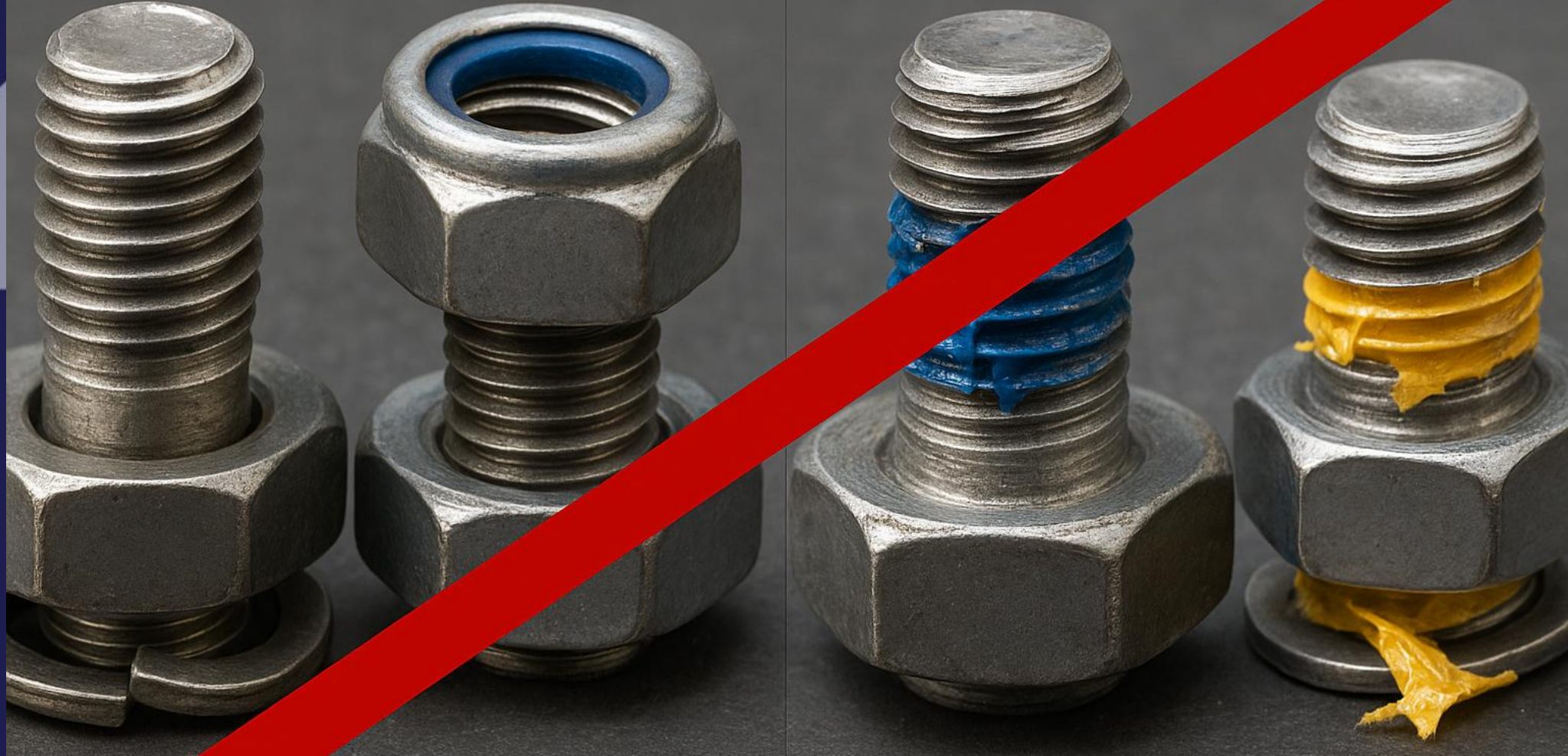
Increasing Demand **The Circular Economy**

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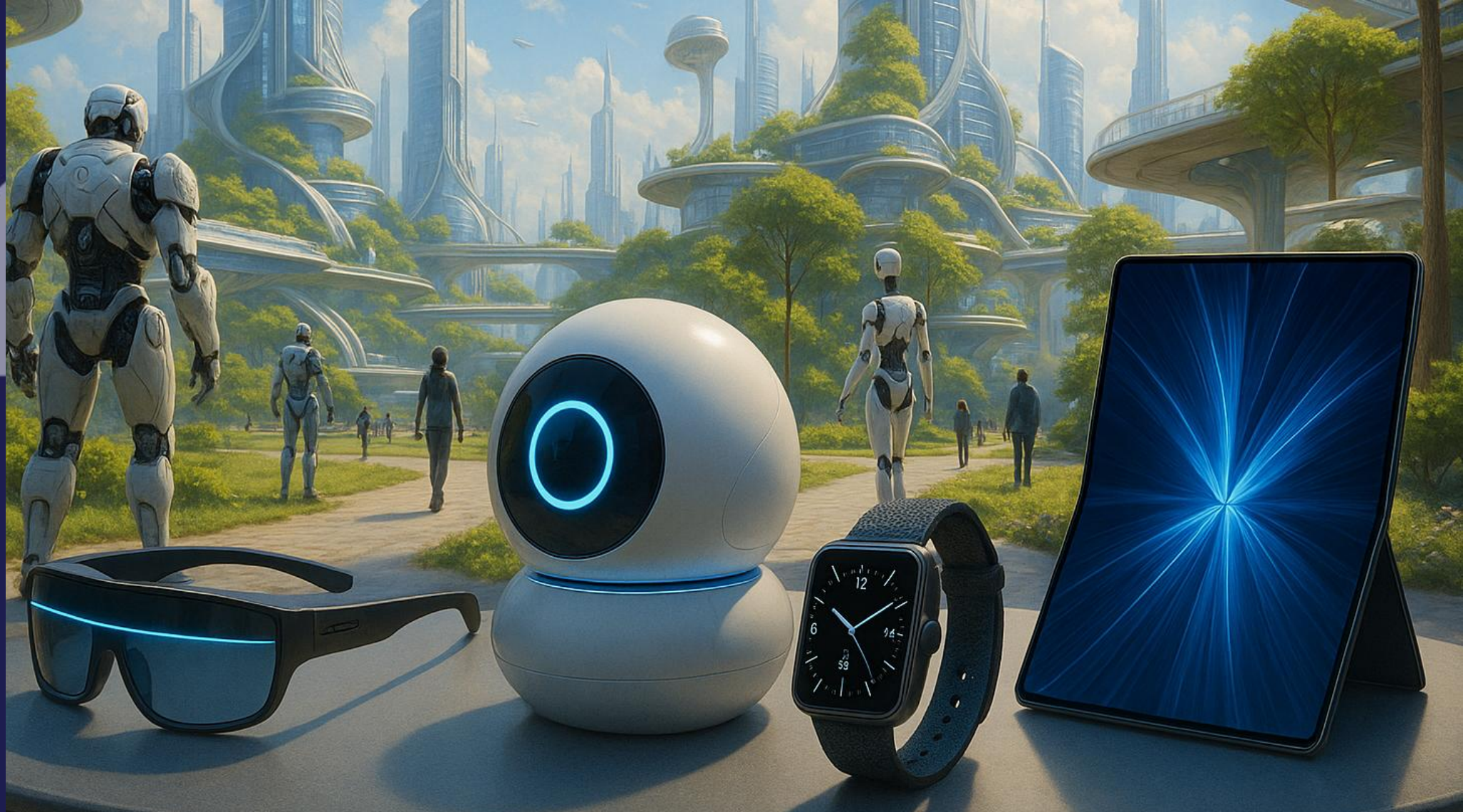
Vibrational Loosening A Systemic Threat to Industry 4.0

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Vibrational Loosening
Traditional Solutions Not Scalable

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Next-Gen Solutions for the 4IR

Vibration Resistant, Smart Preload, Self-Adjusting

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**Riding the Wave
And Fastening the Future**

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Thank You!



Dr. Douglas Hersh
Inventor, the Goldilocks Ratchet Fastener
Booth #1221





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Questions?

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Thank you!

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