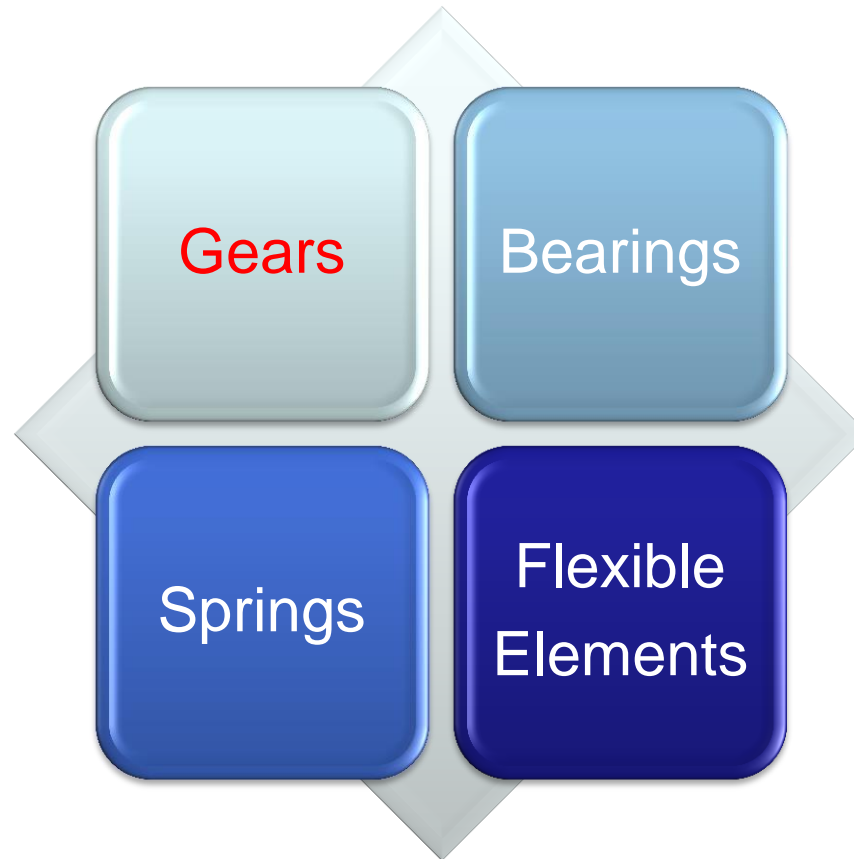


Mechanical Systems

Components

Components



Gears

Definition

(1) a mechanism that performs a specific function in a complete machine <steering gear> (2) : a toothed wheel (3) : working relation, position, order, or adjustment <got her career in gear> (4) : a level or pace of functioning <kicked their performance into high gear> **b** : one of two or more adjustments of a transmission (as of a bicycle or motor vehicle) that determine mechanical advantage, relative speed, and direction of travel

Source: Merriam-Webster on-line dictionary

Gears

Uses of a Gear – What Good Do They Do?

- 1.
- 2.
- 3.
- 4.

Gears

Types

- 1.
- 2.
- 3.
- 4.

Gears

_____ Gear



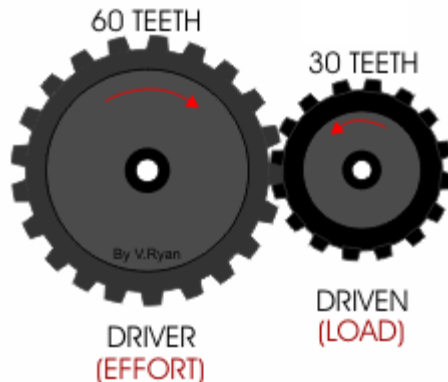
- Teeth are _____ to the axis of rotation.
- Transmits motion from one shaft to another parallel shaft.
- Mechanical Advantage can be obtained by using _____ of gears.

Gears

Mechanical Advantage

Gear Ratio and Velocity

Ratio =



Ratio = _____

For every rotation of the DRIVER the DRIVEN rotates _____ times.

What is the DRIVEN speed (RPM) if the DRIVER RPM is 1800 RPM?

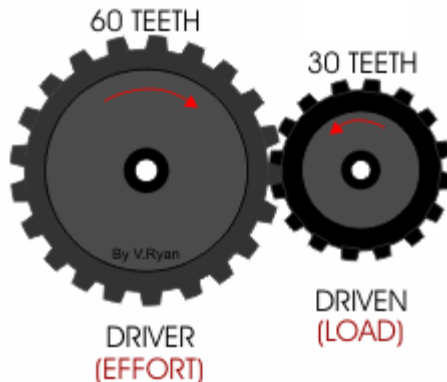
DRIVEN RPM = 1800 x ____
= _____

Gears

Mechanical Advantage

Gear Ratio and Torque

Ratio =



Ratio = _____

DRIVER Torque x ratio = DRIVEN Torque

What is the DRIVEN torque if the DRIVER has 100 in-lbs of torque?

DRIVEN Torque = 100 in-lbs x _____
= _____ in-lbs

Gears

_____ Gear



- Teeth are _____ to the axis of rotation
- Quieter than spur gears
- Can develop thrust loads
- Can transmit motion between _____ shafts



Gears

_____ Gear



- Teeth are formed on conical surfaces.
- Transmits motion between _____ shafts.

Image: www.howstuffworks.com

Gears

_____ Gear

- Can convert rotation into _____ motion.
- Worm teeth may be cut left or right handed – determines _____.
- High ratios



Image: www.howstuffworks.com

Gears

Applications

Spur Gear

- Conveyors
- Multi-spindle drives
- Indexing equipment

Helical Gear

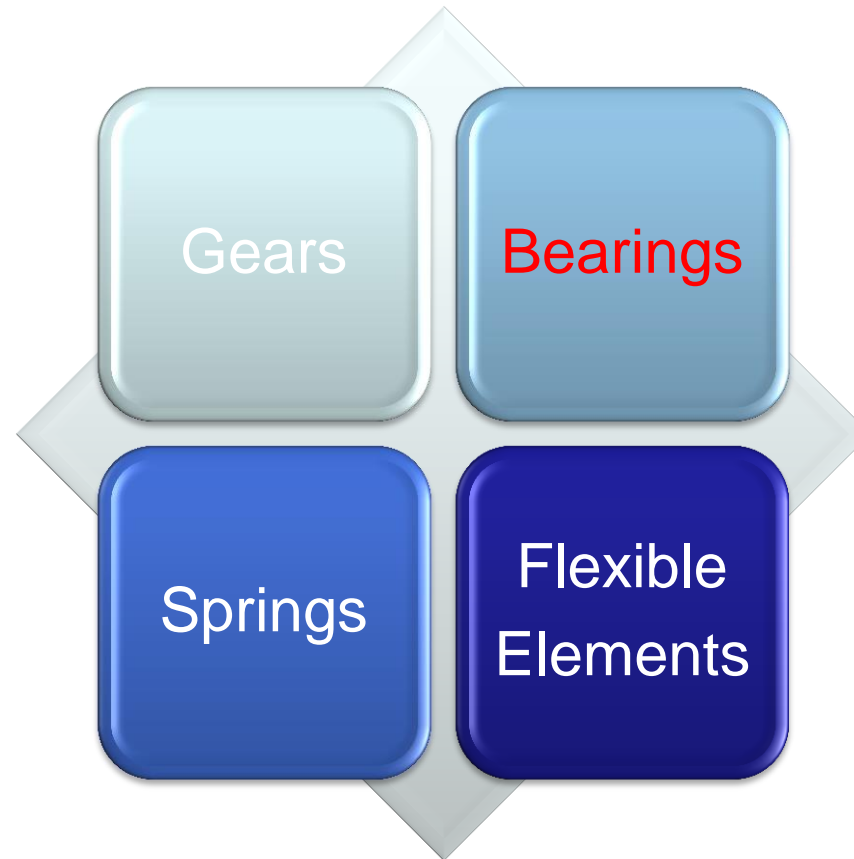
- Presses
- Machine Tools
- Material Handling

Bevel Gear

- Printing
- Bottling
- Steering

Worm Gear

- Packaging
- Pallet loaders
- Indexing
- Linear actuator
- Guitar tuning



Bearings

Definition

(1) a bearing in which the journal turns upon loose hardened steel balls that roll easily in a race; *also* : one of the balls in such a bearing

Source: Merriam-Webster on-line dictionary

Bearings

Uses of a Bearing – What Good Do They Do?

Reduces friction!



- 1.
- 2.
- 3.

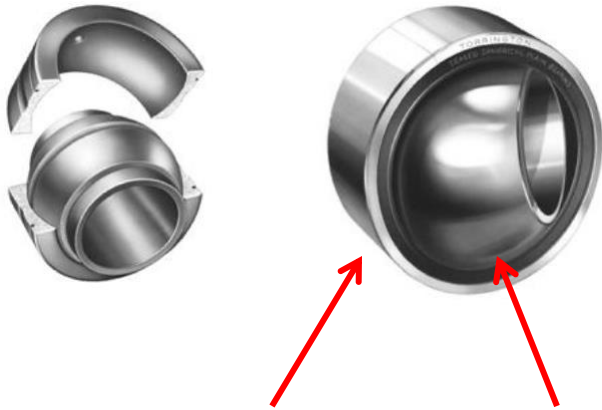
Bearings

Types of Bearings

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

Bearings

_____ Bearing



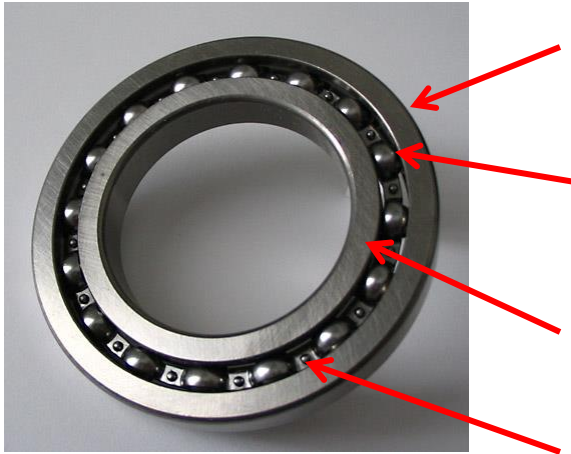
- Requires constant lubrication
- Used in low continuous speed applications
 - Centrifuge
 - Turbines
- Axles spins on a layer of fluid – typically oil



Source: <http://www.timken.com/AntiFriction/player.html>

Bearings

_____ Bearing



Solaris2006
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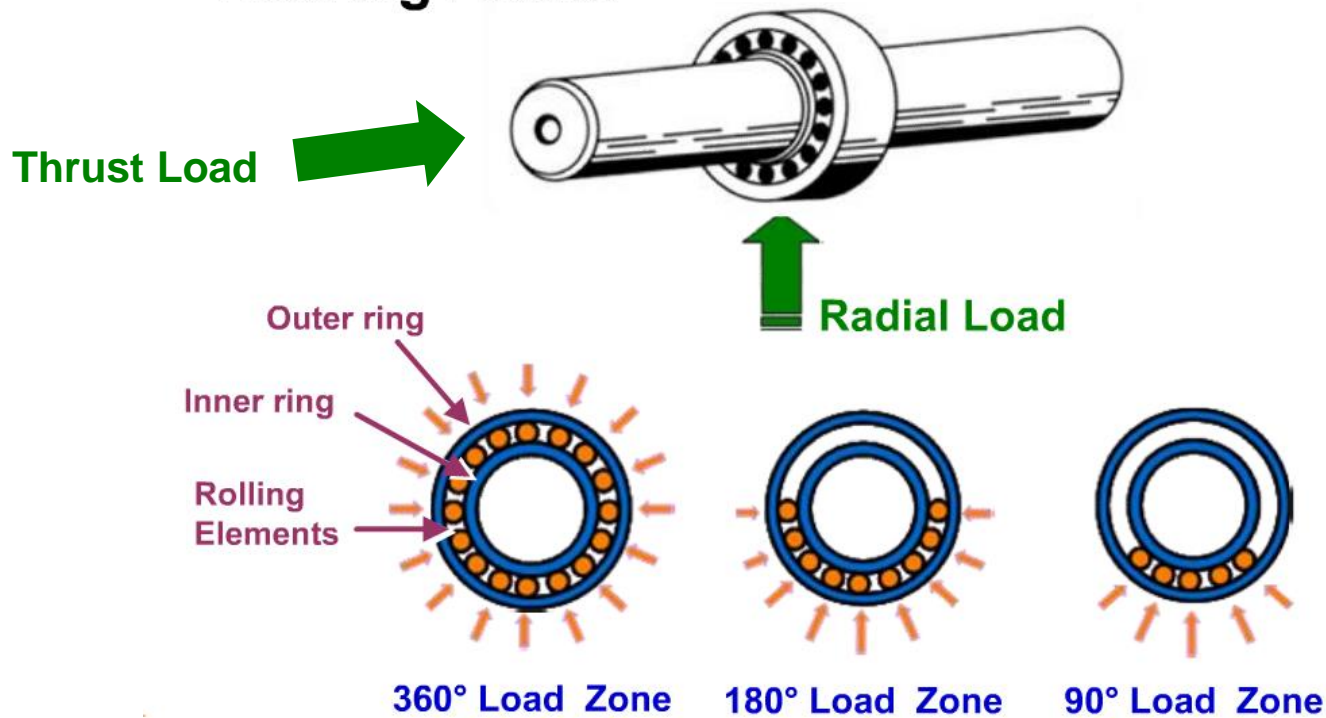
- Most common
- Simplest
- Highest speeds
- Point surface contact
 - Fast
 - Poor static load ability
 - Not adjustable
- Good for radial loads
- Poor for axial loads

Source: <http://www.timken.com/AntiFriction/player.html>

Bearings

Ball Bearing

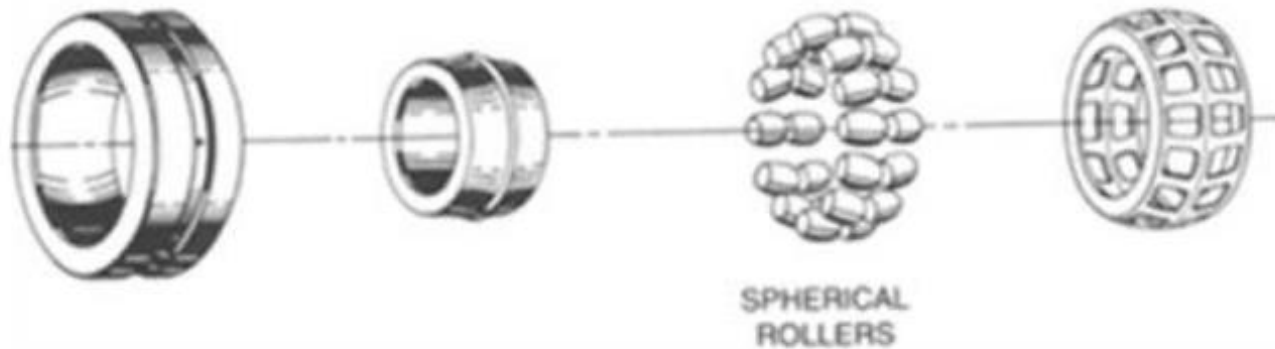
Bearing Loads



Source: <http://www.timken.com/AntiFriction/player.html>

Bearings

_____ Bearing

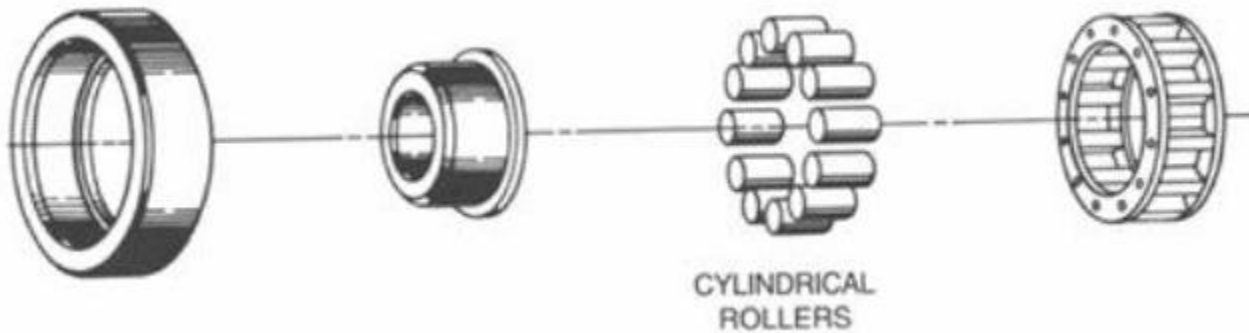


- Self aligning
- Tolerates _____
- Large cross section
 - Line contact
 - Good for high radial loads

Source: <http://www.timken.com/AntiFriction/player.html>

Bearings

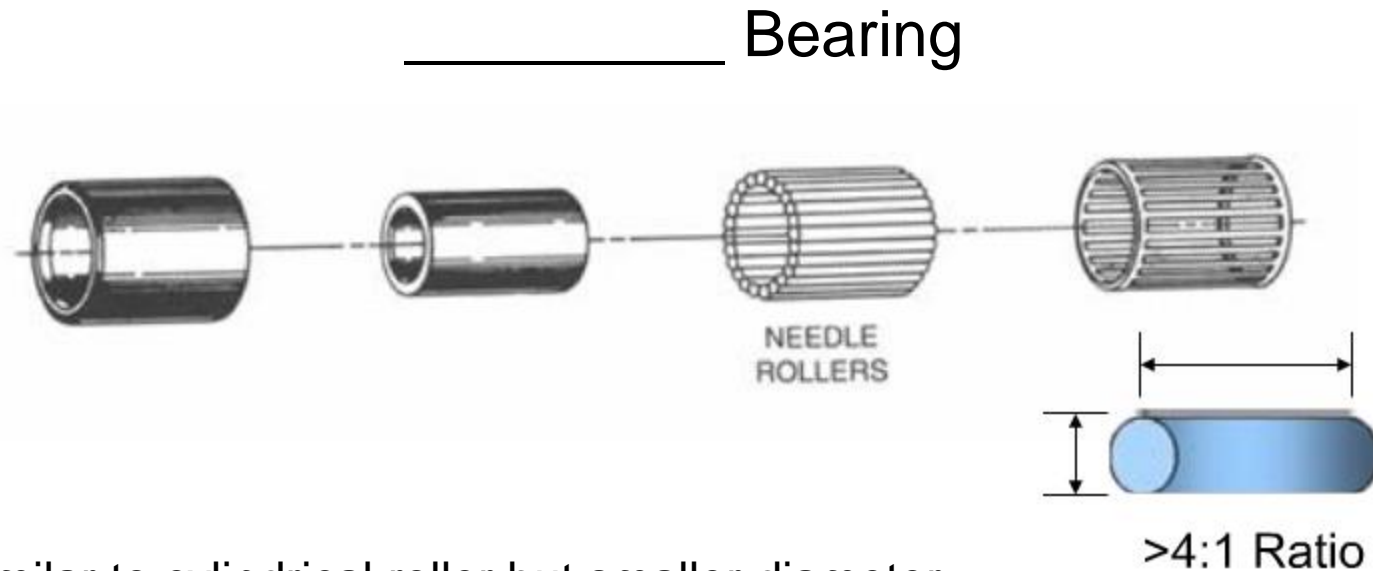
_____ Bearing



- Straight rollers
- Low tolerance to _____
- Line contact
 - High radial loads
 - Some axial loading ok (10% of radial)

Source: <http://www.timken.com/AntiFriction/player.html>

Bearings

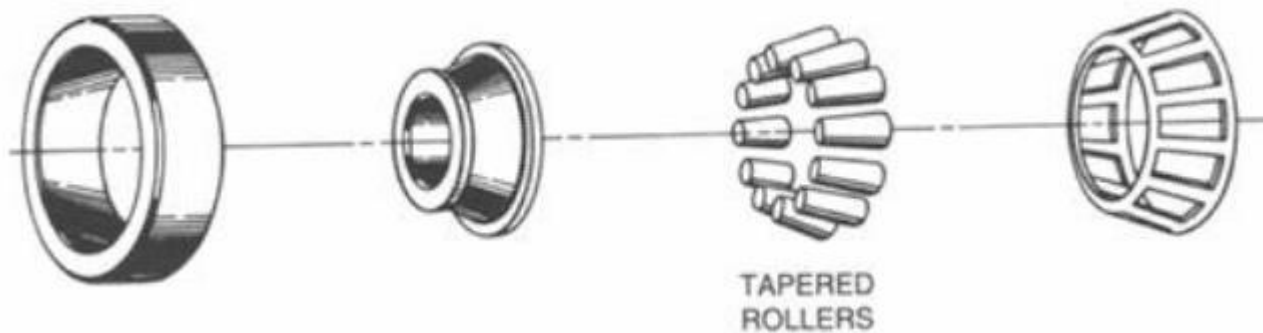


- Similar to cylindrical roller but smaller diameter
- Low cost
- Higher radial loads than ball or roller bearing
- Thin cross section
 - Suitable for large shafts
- Light duty

Source: <http://www.timken.com/AntiFriction/player.html>

Bearings

_____ Bearing

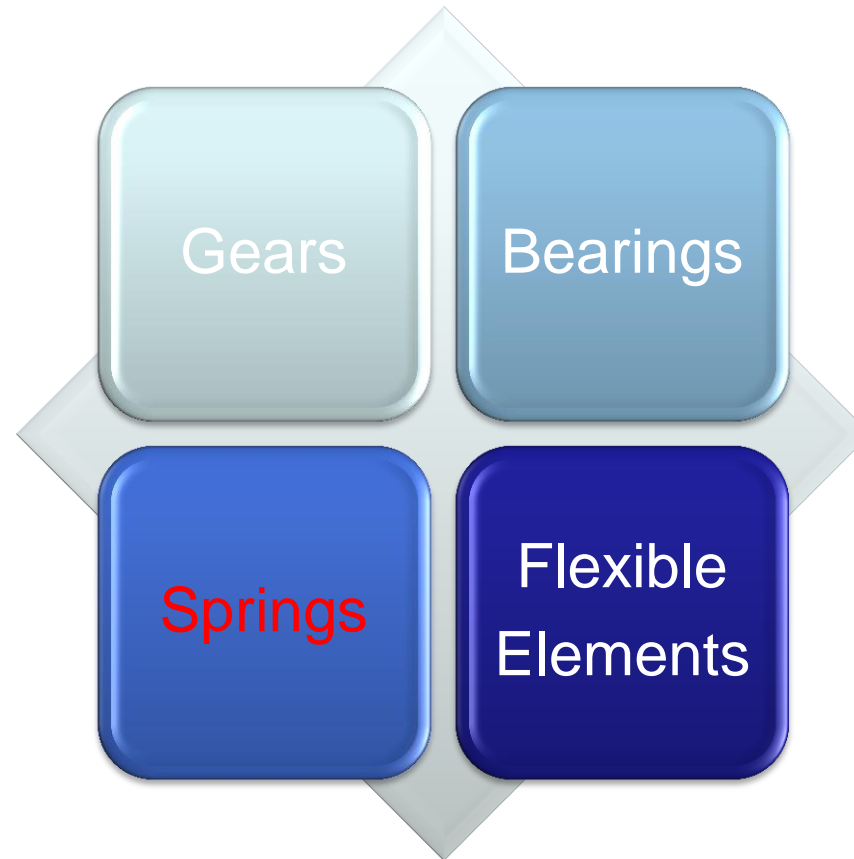


- Line contact
- Good for heavy _____ and _____ loads
- Adjustable
 - Radial
 - Axial
 - Maximizes machine performance and extends bearing life



Amount of clearance between inner and outer raceways.

Source: <http://www.timken.com/AntiFriction/player.html>



Spring

Definition

1 a : a source of supply; *especially* : a source of water issuing from the ground **b** : an ultimate source especially of action or motion

2 : spring tide

3 : a time or season of growth or development; *specifically* : the season between winter and summer comprising in the northern hemisphere usually the months of March, April, and May or as reckoned astronomically extending from the March equinox to the June solstice

4 : an elastic body or device that recovers its original shape when released after being distorted

5 a : the act or an instance of leaping up or forward : bound **b (1)** : capacity for springing : resilience **(2)** : energy, bounce

6 : the point or plane at which an arch or vault curve springs from its impost

Spring

Uses of a Spring – What Good Do They Do?

- 1.
- 2.
- 3.

Spring

Types of Springs

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.



TENSION/EXTENSION



COMPRESSION



TORSIONAL

Spring



- Fixed at one end
- Adjustable fulcrum
 - Changes spring constant

Spring

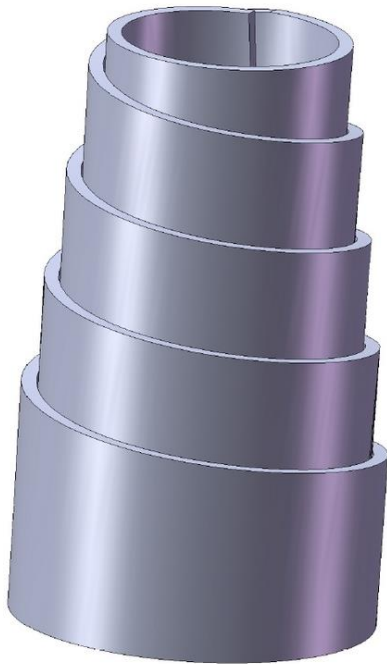
_____ or _____



- Can be extension or compression
- Wire wrapped around a core



Spring



- Flat steel wound on the flat
- Coils fit inside each other
- Can serve to dampen disturbances

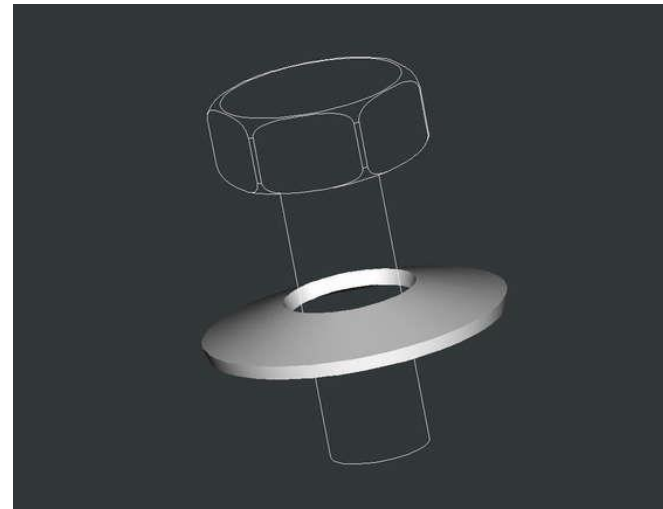
Spring

- Arc shaped length of spring steel
- Secured at both ends
- Load is attached to middle of leaf



Spring

- Coned disk spring
- Hole in center
- Can be nested



Cite: Shigley, Joseph et. al. "Mechanical Engineering Design" 7th International Edition. 2004.
Photo: Wikipedia

Spring



- Split spring steel

Spring

Effects on Springs

1. Stresses
 - a. Comprised of torsion and shear (coil)
2. Curvature Effect
 - a. Stress on the inside of the bend (coil)
3. Stability
 - a. The point at which a spring will buckle
4. Critical Frequency
 - a. The 'wave' effect if spring is secured at on end.
 - b. Natural frequency where resonance can occur – causes damage.
5. Fatigue Loading
 1. How often the spring is exercised