# GEARS

# Objectives

- Explain design characteristics of gears
- Explain torque multiplication fundamentals
- Explain Overdrive fundamentals
- Explain Gear Operation

# Gears Purpose

- Transmit rotating motion
- Normally mounted on shaft
- Transmits rotating motion from one parallel shaft to another

# Interaction

- Gears and Shafts can interact three ways
  - Shaft can drive the gear
  - Gear can drive the shaft
  - Gear can freewheel on shaft

# Gear Design

- Gears must have same pitch to operate together
- Gear Pitch
  - The number of teeth per given unit of pitch diameter
  - To determine pitch: divide number of teeth by the pitch diameter of the gear

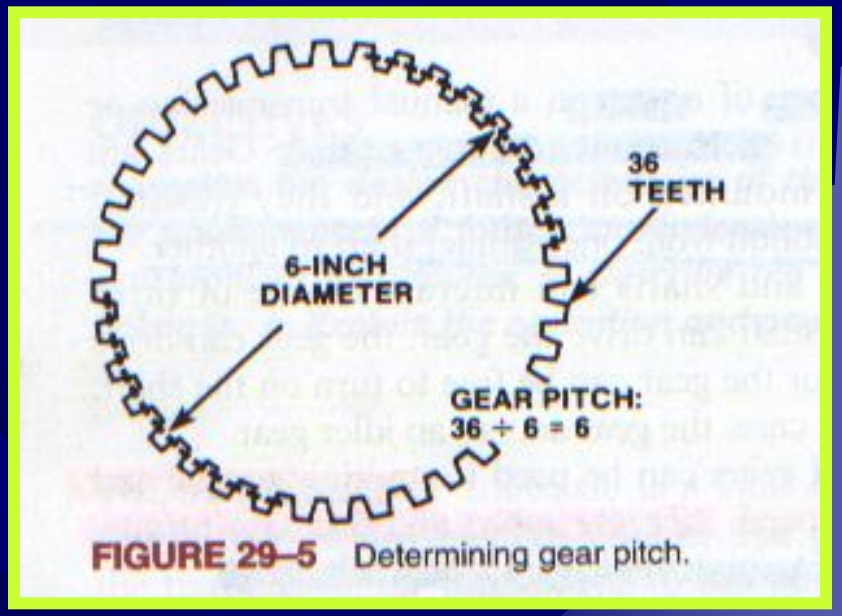


FIGURE 29–5 Determining gear pitch.

# Tooth Design

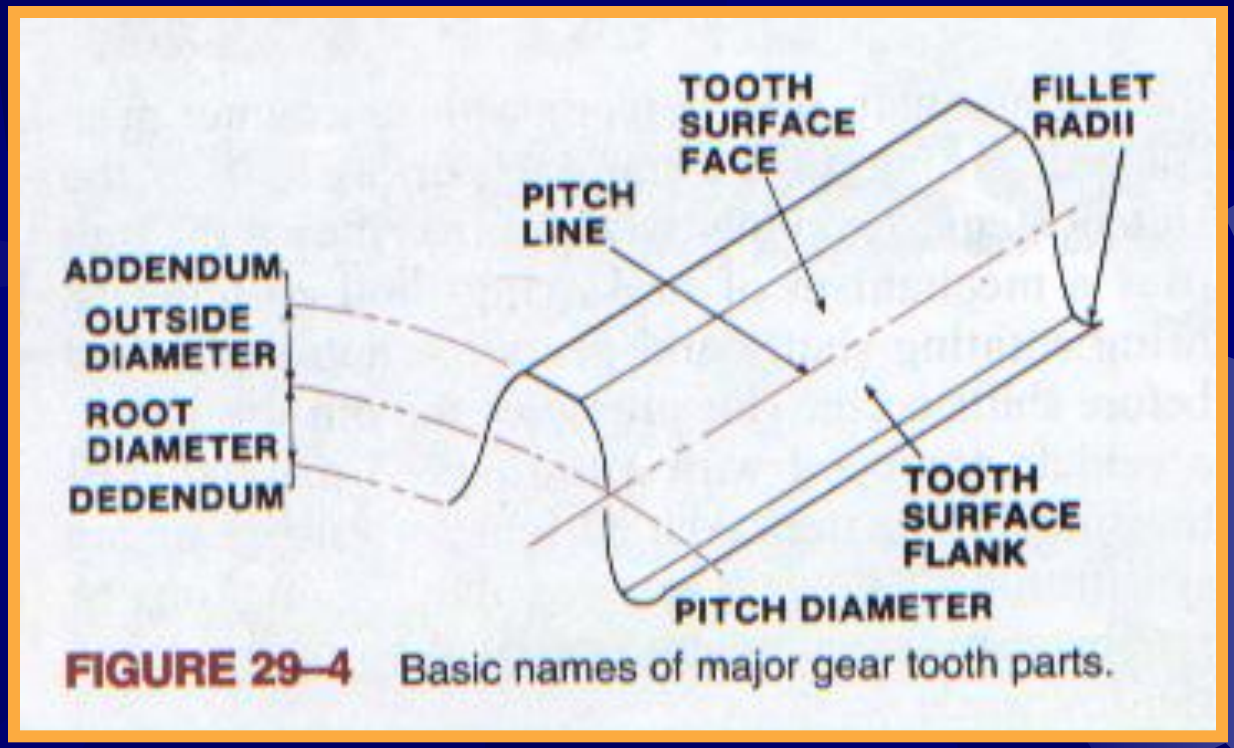
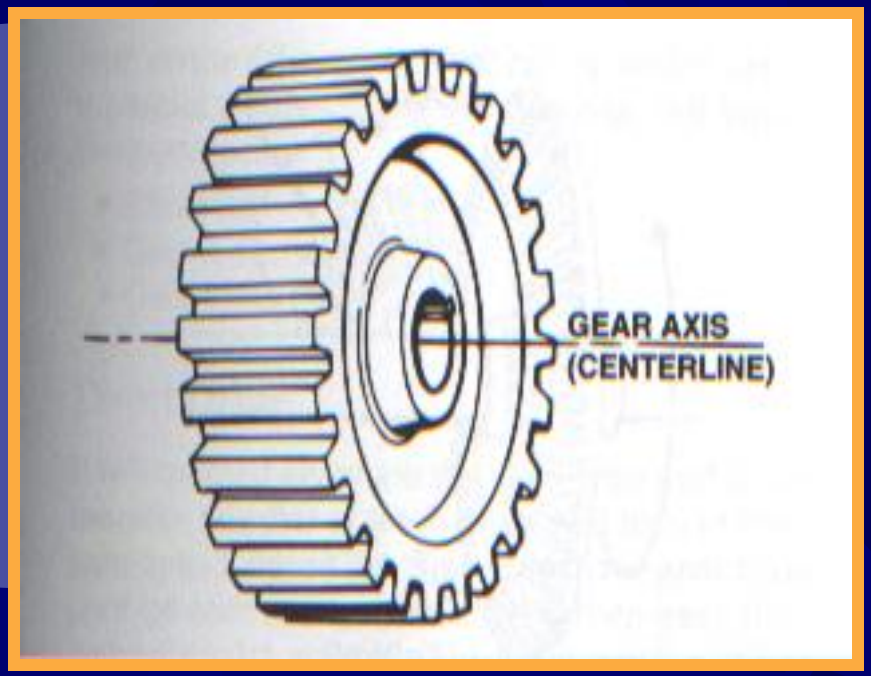



FIGURE 29–4 Basic names of major gear tooth parts.

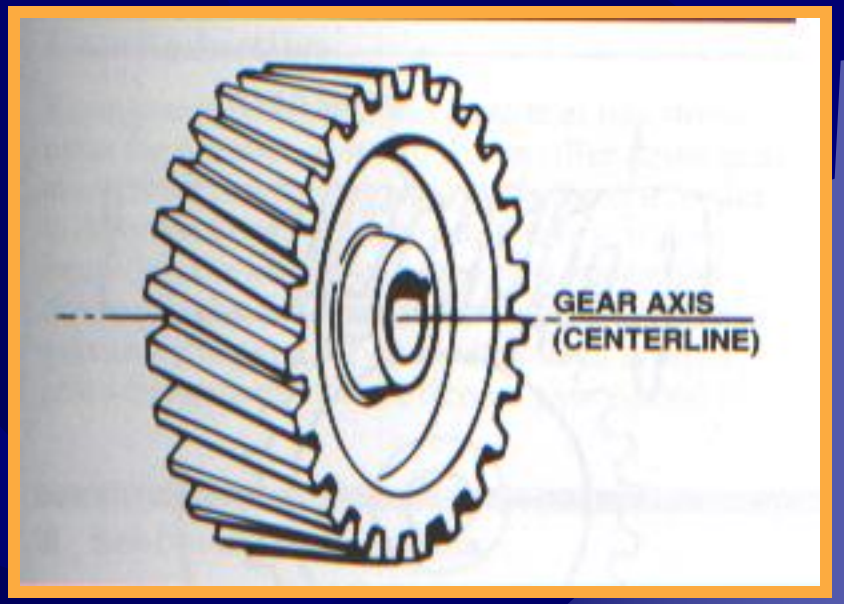
# Types of Gears



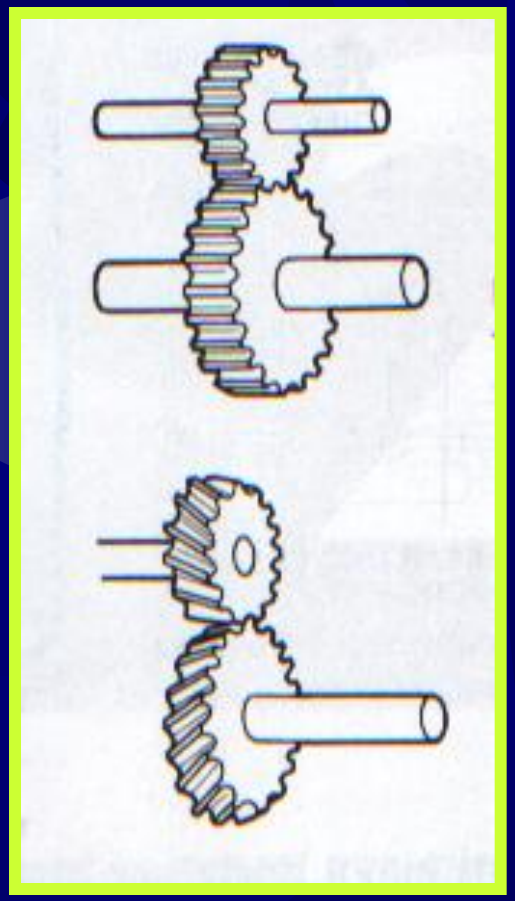

- Spur Gear
  - Cut Straight across
  - Spur gears only have one tooth in contact at a time
  - Minimizes chance of popping out of gear
  - Handles torque well
  - Used for Reverse

# Helical Gear

- Are quieter than spur gears
- Two teeth at a time contact
- Has a tendency to move shaft for and aft
- Are left and right handed
- Opposites on parallel shafts



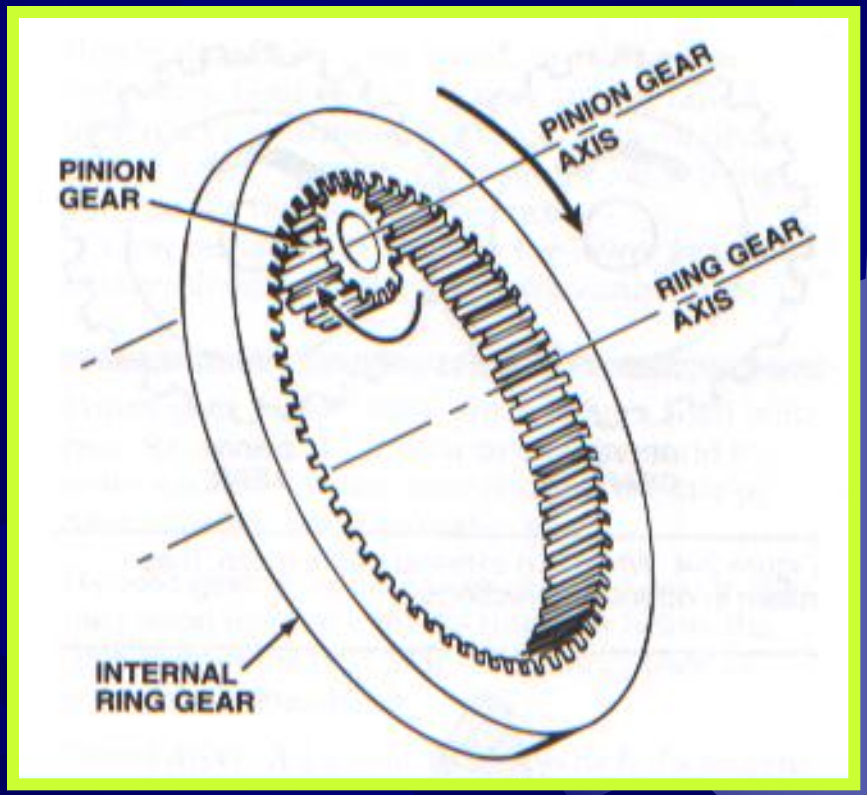
# Spur Gears vs. Helical Gears



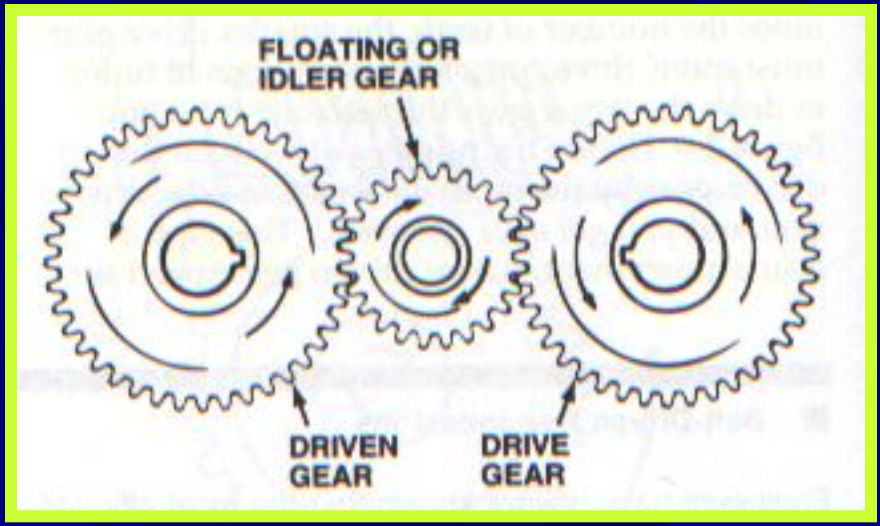
- Spur gears are straight cut parallel to shaft
- Helical gears are angle cut to gears axis of rotation

# Internal Gear Teeth

- Most gears are external. (teeth on the outside)
- Internal gear used with pinion gears
- External gear rotates same direction of internal gear
- External gear rotates opposite with another external gear



# Idler Gears




- Located between drive and driven gear
- Used in reverse gear trains
- Transfers motion without changing rotational direction

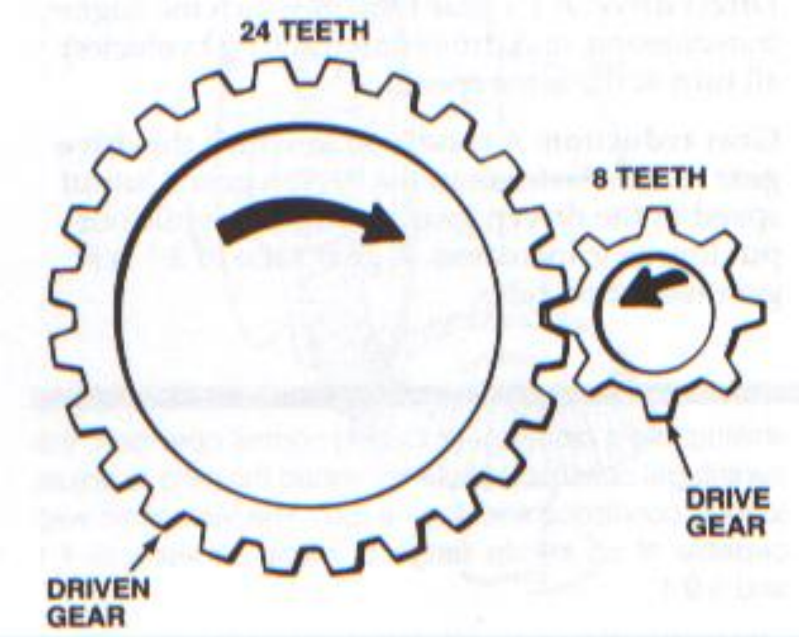
# Gear Ratios

- Can multiply torque and speed
- Can reduce torque and speed
- Same size and number of teeth = no change in output
- Equal size gears create equal output
- Small drive gear to larger driven gear = driven gear speed decreases
- Larger drive gear to smaller driven gear = driven gear speed increases

# Gear Ratio Calculations

- Gear Ratio can be found by dividing number of teeth on driven gear by the number of teeth on the driving gear.
- Ex:  75 driven teeth ÷ 45 drive teeth = 1.66 gear ratio

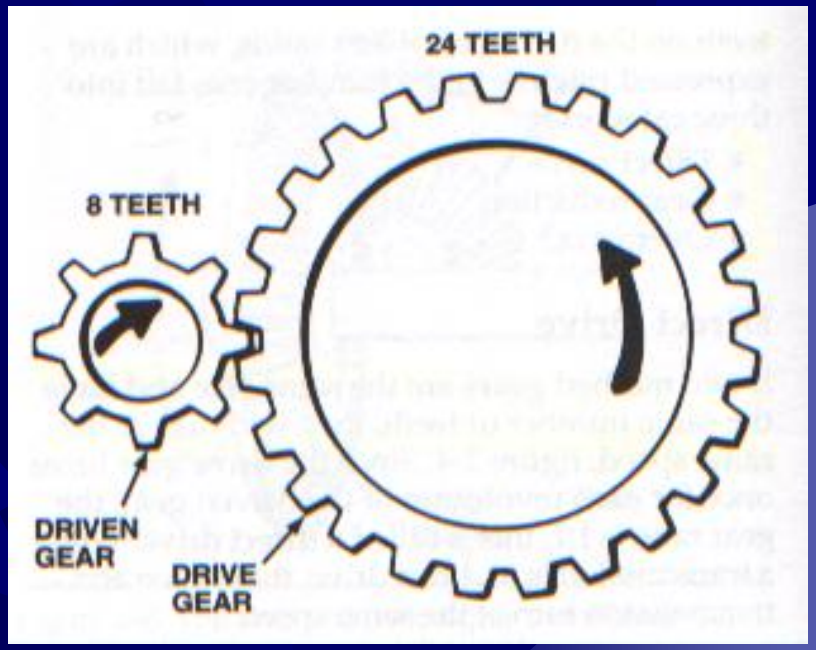
# Gear Reduction




- Speed decreases
- Torque Increases
- When speed is halved, torque doubles
- Most manual transmissions are speed reducing, torque increasing

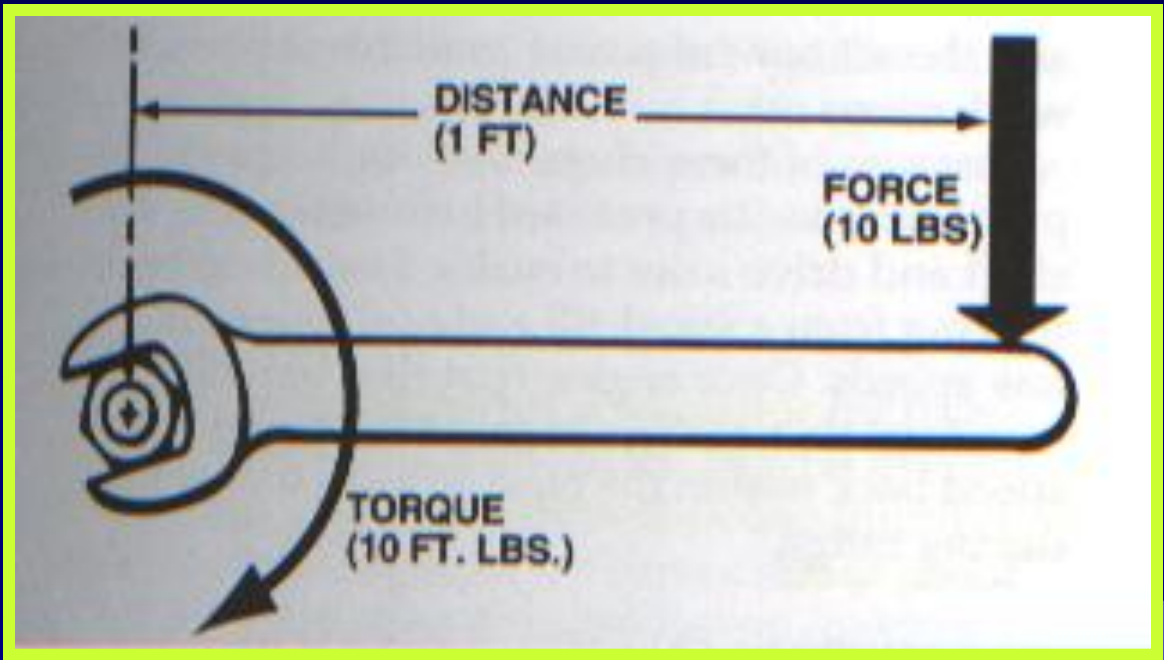
# Gear Overdrive

- Speed Increases
- Torque decreases
- When speed is doubled, torque is halved
- Used for fuel milage
- Factory overdrives vs. Aftermarket overdrives



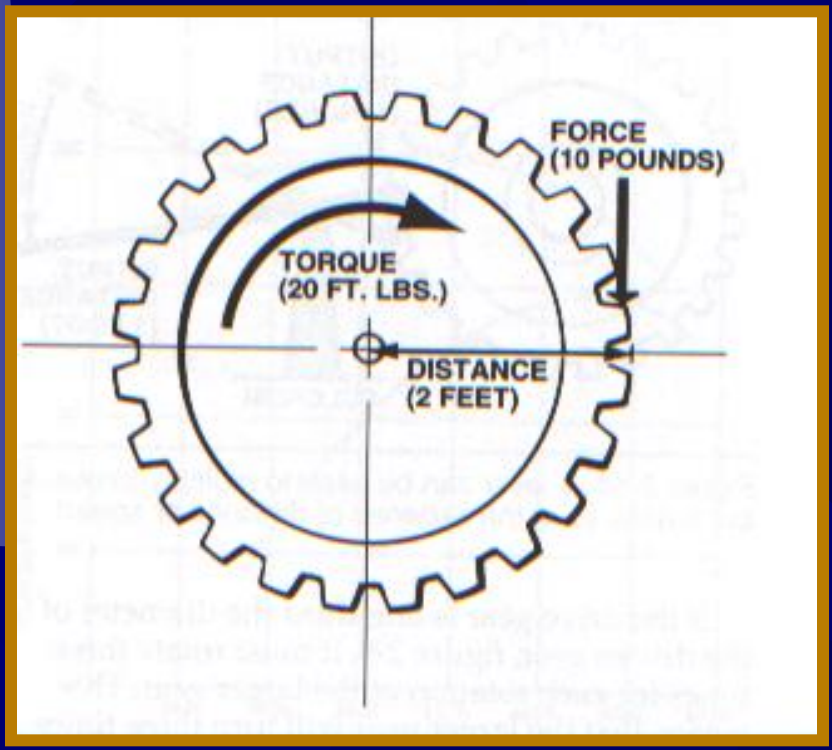
# Torque

Page 740



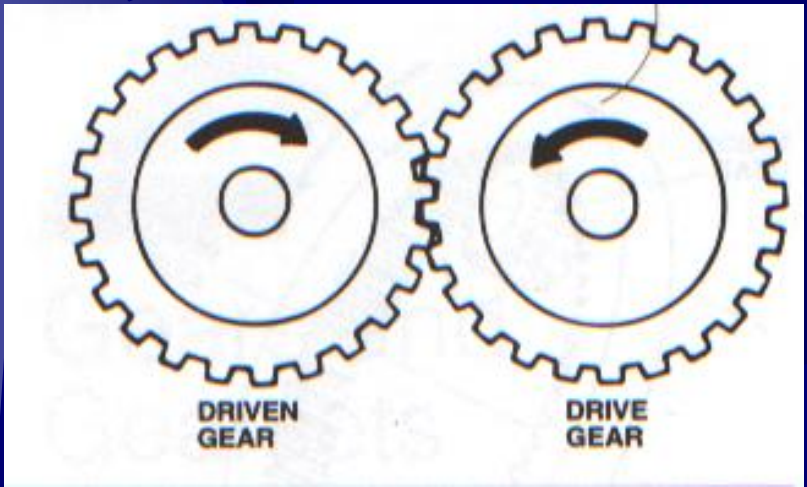

- Torque is calculated by multiplying force applied by the distance of the force from a center of a pivot point.
- Gears apply torque
- Ex: 10 ft lbs applied to 1 foot drive gear to a 2 foot driven gear = 20 foot lbs torque

# Torque Multiplication




- Used for lower gears in a manual transmission equipped car
- 4:56 = low gears
  - For Acceleration
- 2:56 = high gears
  - For mileage

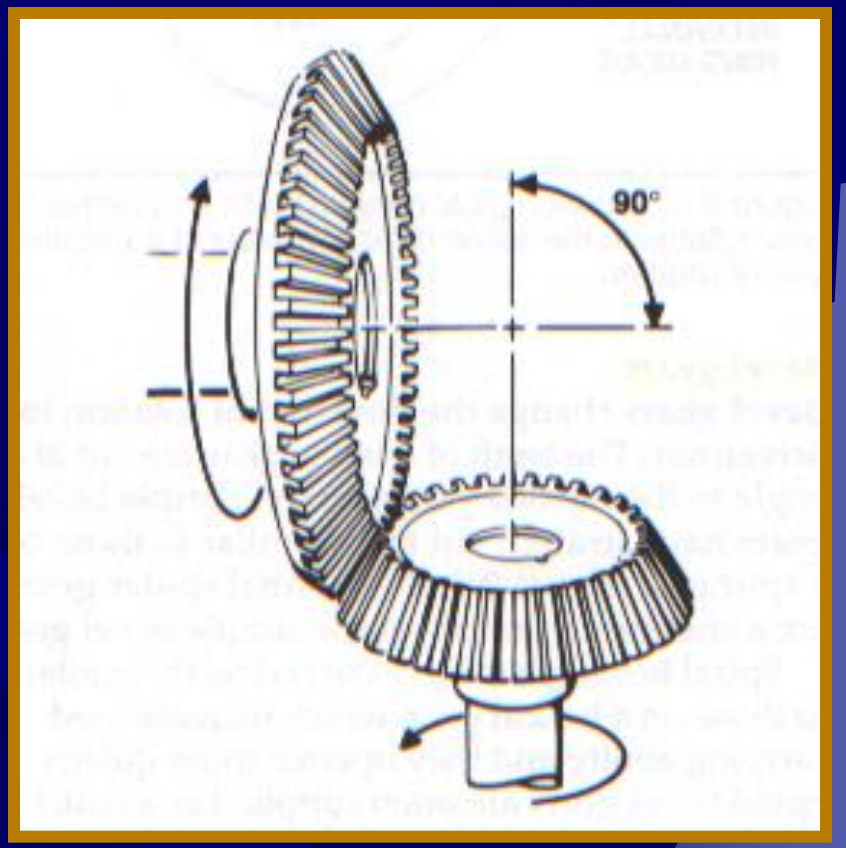
# External Gears




- When two external gears mesh, they rotate in opposite directions

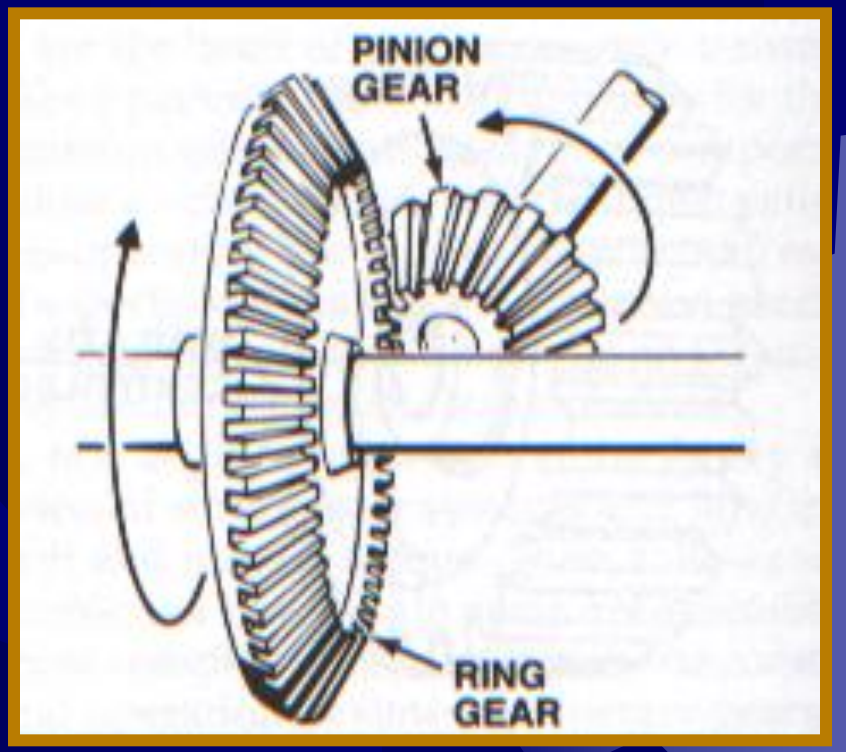
# Bevel Gears

- Change the direction of rotation
- Spider gears are straight cut bevel gears
- Transfer motion between two shafts at an angle to each other

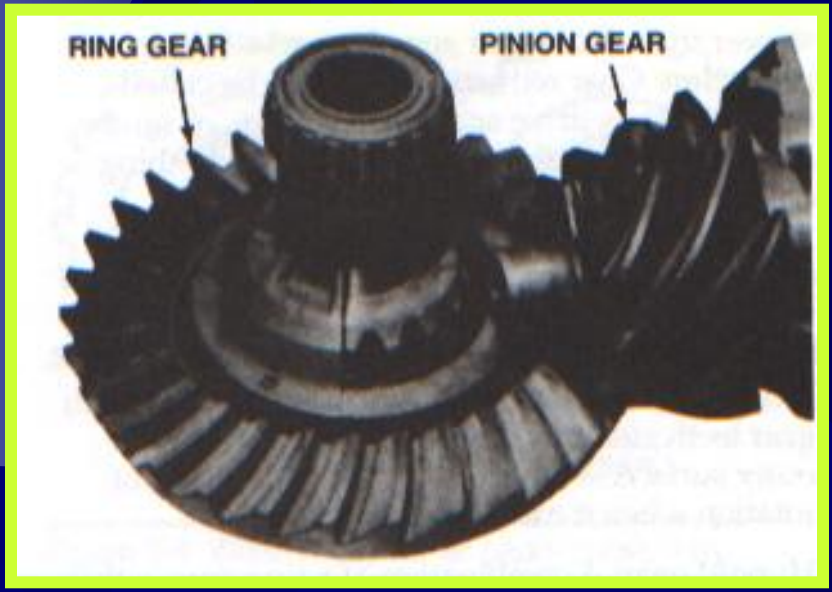


# Ring and Pinion

- BEVEL GEARS
- Used as a final drive in RWD vehicles



# Ring and Pinion Final Drive



# Worm Gear

- Drives a spur gear
- Provides maximum tooth contact
- Used in recirculating ball steering boxes
- Speedometer cable drive mechanisms