Industrial Technology
Virtual Learning

9-12/Advanced Metals :mechanical fasteners

April 23, 2020

Lesson: April 23, 2020

Objective/Learning Target:

Students will identify different types of mechanical fasteners and their proper application.

Metal Fasteners

Fasteners

- *Metal assemblies are often held together with* fasteners, *hardware devices that mechanically join or affix two or more objects together.*
- *Assembling with most types of fasteners allows components to be repeatedly assembled and disassembled.*
- *This is important where a product is expected to undergo modifications, repairs, or where it may provide access into an assembly.*

Bolts

- *Threaded shafts that use a threaded nut to fasten metal together.*
- *Bolts are sized by length and thread.*
- *Bolts are stronger than screws.*
- *Bolts are classified by the type of head.*
  - *Stove bolts and machine screws (actually bolts) are turned with a screwdriver.*
  - *Hexagonal- and square-head bolts are held in place with a wrench while the nut is turned to tighten.*

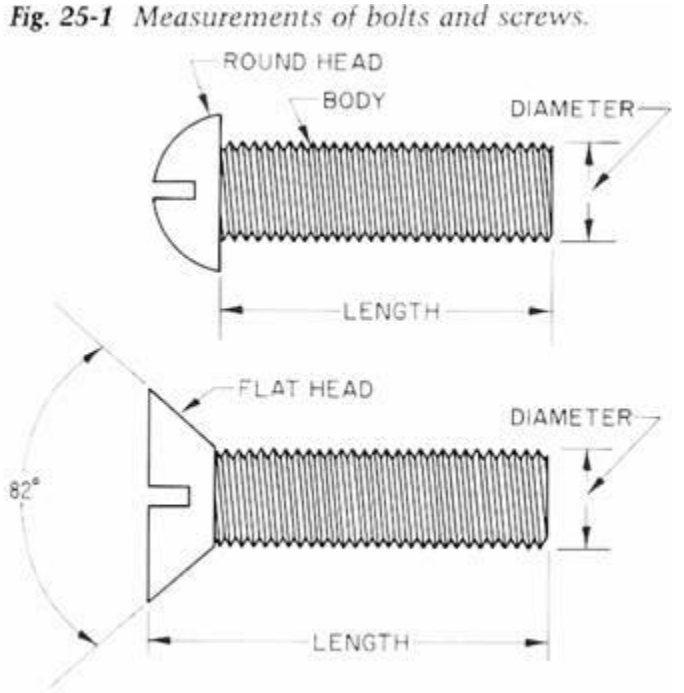
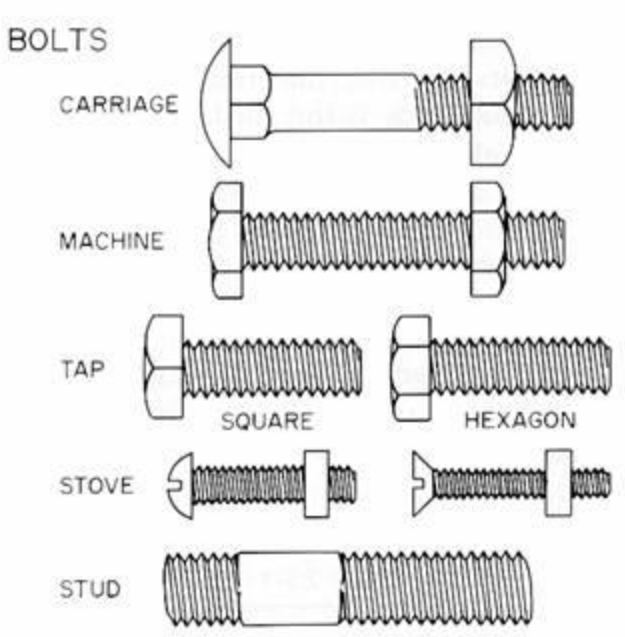


Fig. 25-1 Measurements of bolts and screws.

Types of Bolts

- *Carriage bolt*
  - *Smooth round head & coarse thread that starts part way down the shaft.*
  - *Usually used to attach a wooden part to metal.*
- *Machine bolt*
  - *Hexagonal head & only partially threaded.*
  - *Used for precision attachment using threads to secure materials together.*
- *Tap bolt*
  - *Similar to a machine bolt but the whole body is threaded.*
- *Stove bolt*
  - *Round or flat head with coarse thread along the whole body.*
  - *General purpose fastener used when precision fit is not necessary.*
- *Stud bolt*
  - *No head and threaded on both ends.*
  - *One end is driven into material & the other end is left exposed so that other parts can be fastened to it.*



Types of Machine Screws

- *Machine & cap screws*
  - *Come with a variety of head & thread types.*
  - *Used for precision fit into thread holes in metal.*
- *Setscrew*
  - *Made with square heads or no heads.*
  - *Typically used for safety reasons to hold a sleeve, collar or gear on a shaft to prevent relative motion.*
- *Thumbscrews*
  - *Has one or two wings or a knurled head.*
  - *Used where a screw must be turned by hand using the thumb and a finger.*

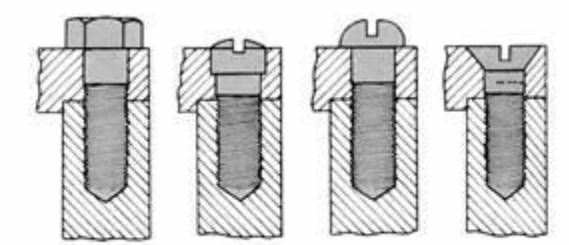


Fig. 25-4 *Cap screw heads. Note the different positions.*

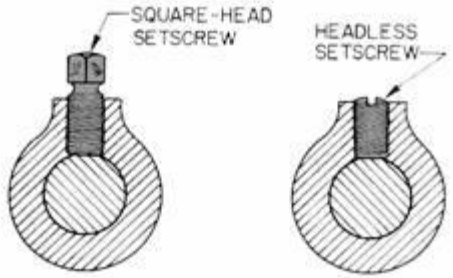


Fig. 25-5 *Headed and headless set screws.*

Sheet Metal Screws

- *Short thick screws that are* self-threading *(cut or form their own threads as driven into soft metals).*
- *Used in the economical assembly of sheet metal.*
- *Threaded all the way down the shank.*
- *Come in a variety of head types depending on application.*

Fig. 25-22 *Thread-forming screws.*

Fig. 25-23 *Thread-cutting screws.*

Lag Screw

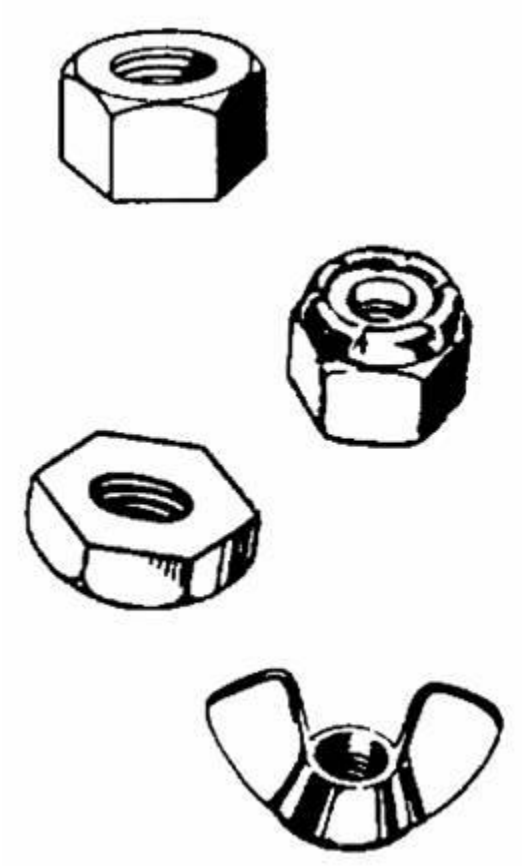
- *Bolt is a bolt head with a screw body.*
- *Has either a square or hexagonal head.*
- *Used in fastening where maximum holding power is needed (i.e.- holding a vice to to a workbench).*

Bolts, screws detailed video

https://www.youtube.com/watch?v=Lz2dRA7hjlQ

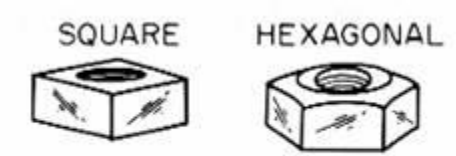
Nuts

- *Type of hardware fastener with a threaded hole.*
- *Usually hexagonal to permit tightening with a wrench but may also be square, knurled, winged or otherwise shaped.*
- *Along with a bolt, nuts are designed to capture and fasten objects together.*



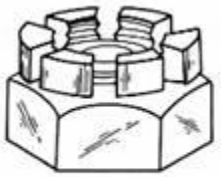
Type of Nuts

- *Machine screw nut (Hex nut)*
  - *Square or hexagonal shaped with fine or coarse thread.*
- *Jam nut (Lock nut)*
  - *Thinner than an ordinary nut.*
  - *Used as a lock to keep another nut from loosening.*
- *Castle nut*
  - *Has slots cut into the top of the nut that extend upward making it look like a castle.*
  - *A hex nut with a slightly reduced slotted cylindrical section on one end.*
  - *Used with a cotter pin to prevent loosening.*
- *Wing nut*
  - *A nut with two thin flat wings.*
  - *Used in place of a regular nut and can be turned with the thumb and forefinger.*



MACHINE SCREW NUTS


JAM NUT


CASTLE NUT

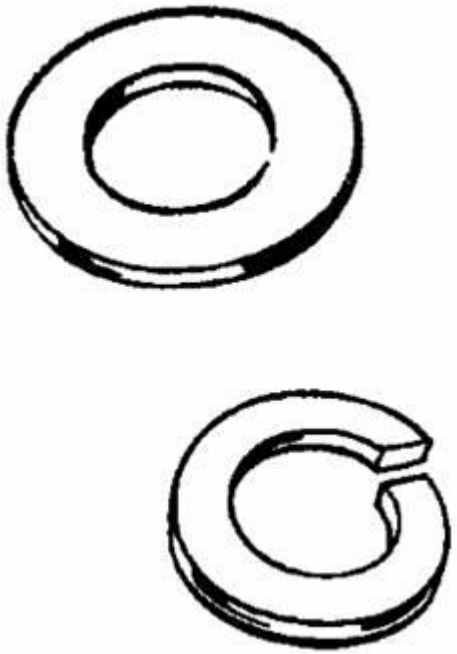
WING NUT

Types of nuts video

https://www.youtube.com/watch?v=dV7vkIjFCIA

Washers

- *Placed under the bolt head or the nut for a firmer fasten.*
- *Designed to protect the surface under a bolt or nut.*
- *Used to spread load of a mechanical connection out over a greater area.*



Type of Washers

- *Plain washers*
  - *Circular, small flat piece to widen the bearing surface of a bolt head or nut.*
  - *Measured by the diameter of the bolt that fits into it.*
- *Lock washer*
  - *Used to lock a nut or screw in place, prevent it from moving from vibrations.*
    - Helical spring - *looks like a coil from a spring that tightens when applied to prevent movement.*
    - Toothed – *has teeth that wedge into bearing surface when applied to prevent movement.*

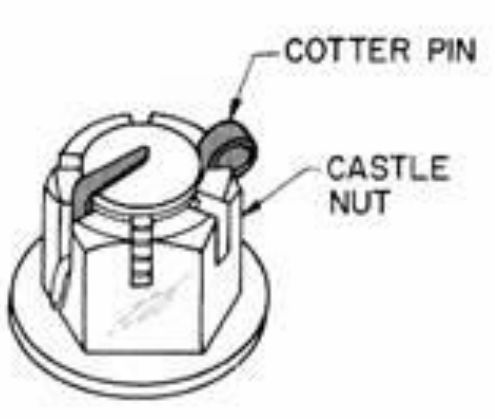
Fig. 25-12 *The shape of a plain washer.*

Fig. 25-13 *The position of a helical spring type lock washer.*

Fig. 25-14 *Common tooth-type lock washers.*

Pins

- *Used to hold mechanical parts together or limit travel of moving parts.*
- *Cotter pin*
  - *Made of soft wire.*
  - *Placed through a hole in a bolt behind a castle nut to prevent the nut from turning.*
- *Tapered pin*
  - *Used to hold a collar or pulley against a shaft.*
- *Roll pins*
  - *Made from sheet steel that is rolled into a tube.*
  - *Driven into holes slightly larger than a standard hole size so they grip tightly when pounded in.*



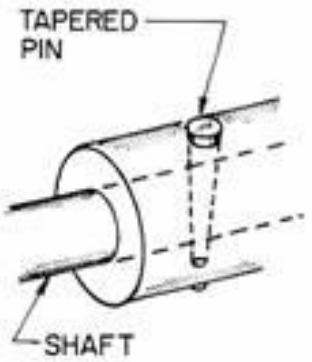
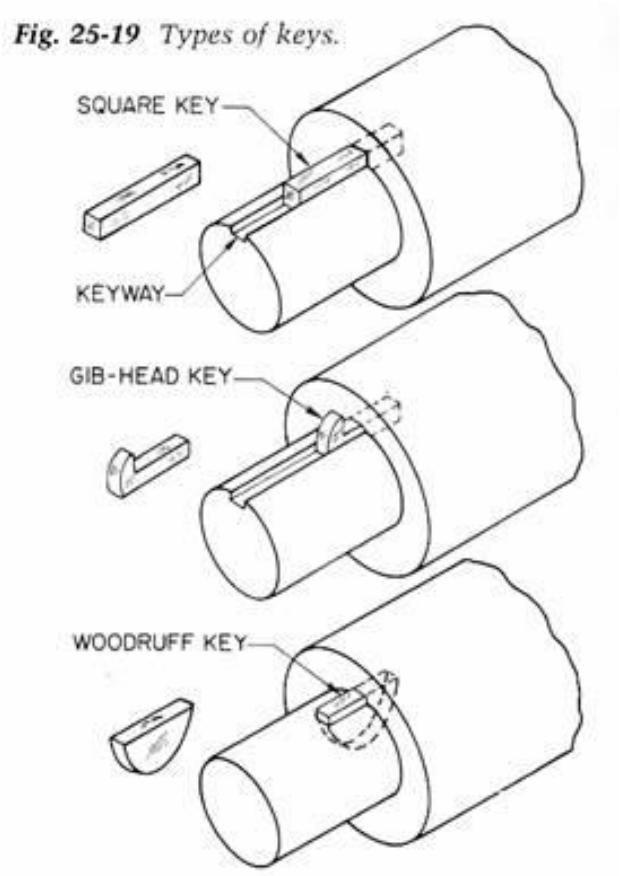


Fig. 25-18 An assortment of roll pins.

Keys

- *Used to keep pulleys and gears from moving on shafts.*
- *Half the key fits into the keyway (a slot on the shaft), the other half fits into a slot that is on the pulley or gear.*
- *Square key*
  - *Most commonly used.*
- *Gib-head key*
  - *Toothed key that is useful when you need to remove the key from one side of the pulley or gear.*
  - *Can be removed with a wedge.*
- *Woodruff key*
  - *Semicircular in shape and fits a matching semicircular pocket in the shaft.*
  - *Key becomes locked in position and cannot be knocked loose due to vibration.*



Review Questions

1.) what type of bolt has coarse thread that starts part way down the shaft?

2.) What is a machine bolt?

3.) What is the difference between a machine bolt and a tap bolt

4.) according to the video over bolts, what is the term for a bolt with an circular ring on the head end?

5.) what type of nut is designed to be tightened with the thumb and forefinger?