



# **Industrial Technology Virtual Learning**

**CTE**

**May 12<sup>th</sup>, 2020**



# Machine Technology 1

## Joining Metal May 12<sup>th</sup>, 2020

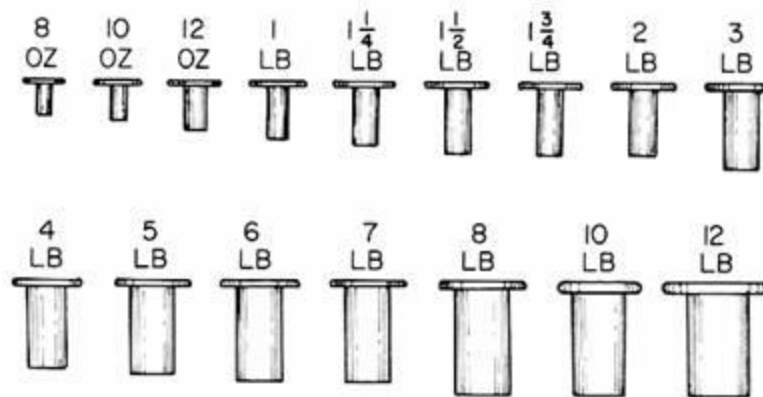
Objective: Students will identify different application and processes of joining metal.

# *Joining Metal*

- *As with wood, there are many ways of joining metal permanently.*
- *The method used will depend on the function of the product, the strength needed and the quality of the product.*
- *There are several ways of joining metal permanently.*
  - *riveting*
  - *soldering and brazing*
  - *welding*
- *The later two of these techniques rely upon heat.*
  - *With soldering and brazing, the two metals are joined by melting a second metal between them.*
  - *With welding, the two metals are melted and fused together.*

# Rivets

- *Metal pins that look like bolts with no threads.*
- *Used to hold pieces together permanently.*
- *Used when fastening metals together that are not easily welded, or where welding is not practical.*



*Fig. 25-30 Tinner's rivets (actual size).*

# Rivet Characteristics

- May be either solid or tubular.
- Made from different materials such as soft steel, aluminum, copper, and brass.
- Come with a variety of different shapes and heads.
- For application, rivets are placed in holes, pre-drilled in materials and fastened together.
  - With solid rivets, the headless head is pounded to form a head.
  - Hollow rivets are clinched at the headless end with a special riveting tool.

Fig. 25-27 Common rivet head types.

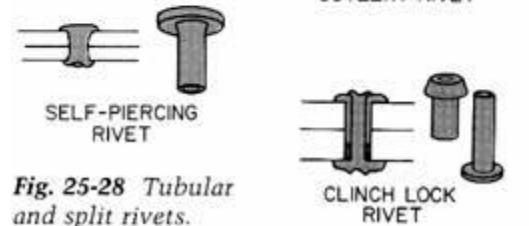
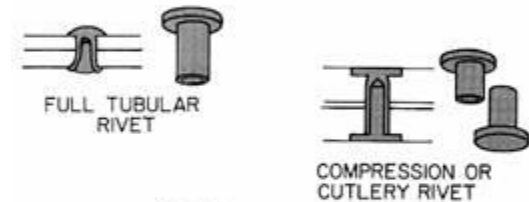
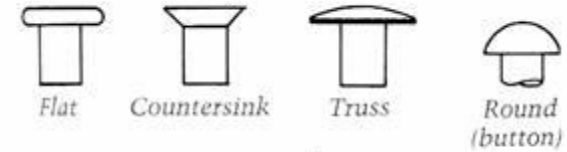
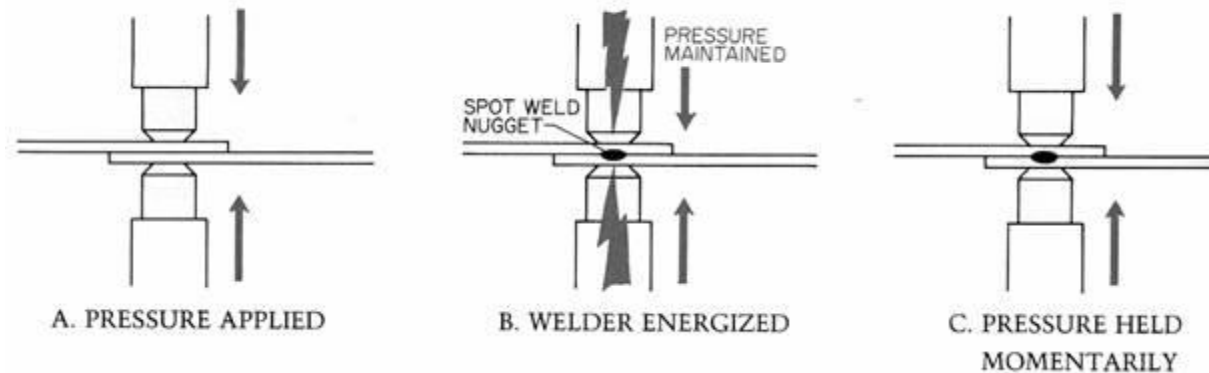


Fig. 25-28 Tubular and split rivets.

# Spot Welding

- Form of resistance welding done with a spot welder.
- High current at a low voltage passes through a spot on two pieces of metal (usually sheet metal) for a short period of time.
  - Resistance to the flow of current through the metal at the spot causes heat, which melts the metal and makes a spot weld.
- Most frequently used to weld metal joints but sometimes used to weld sheet metal to small diameter rods or small flat bars.

Fig. 26-27 The sequence of steps in spot welding.



# Soldering

- *Process of fastening two metals together with solder, a non ferrous metal that has a lower melting point than the parts being joined.*
- *Parts being joined are heated until the solder, when brought into contact with them, melts and flows between the surfaces.*
- *When the solder solidifies, it adheres (sticks) tightly and forms a strong bond between the two surfaces.*

# Soft Soldering

- Occurs at temperatures below 800 degrees Fahrenheit.
- For general work, a solder called rosin core 60-40 (60% tin, 40% lead) is often used.
- Solder often comes in a coil of wire 1/16" in diameter but can come in other pre-cut shapes, sizes, and forms.
- Heat for soft soldering is applied using soldering gun or a soldering copper.

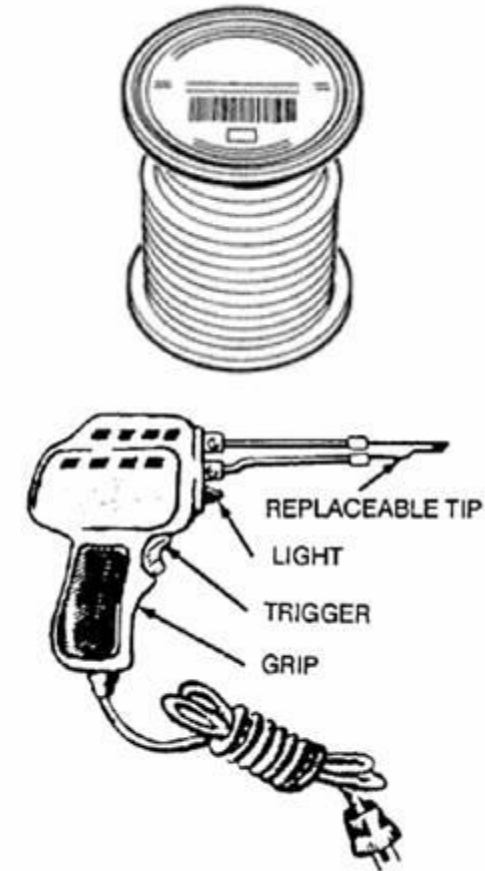


FIGURE 12-26. Soldering Gun.

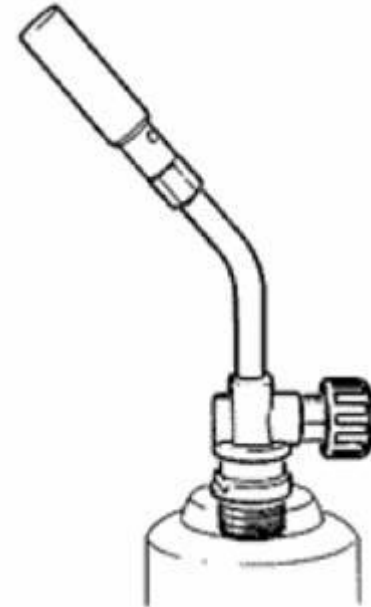


*Soldier video link*

<https://youtu.be/Fu5G48BKe04>

# Hard Soldering

- *If solder melts above 800 degrees Fahrenheit, it is called hard soldering.*
- *Used where a strong joint is needed or where the parts will be used in greater heat than the melting point of soft solder.*
- *The most widely used hard solders are silver alloy solders that come in ribbons, sheets, wire, or pre-cut pieces of various shapes and sizes.*
- *Often used in jewelry and art metalwork for joining copper, silver, and gold.*
- *Heat for hard soldering is applied directly with the flame of a torch.*



# Brazing

- *Hard soldering processing where the filler material flows into the joints using capillary action (the natural tendency of a liquid to be drawn in between two close fitting surfaces).*
- *Filler material used is brazing rods (60% copper, 40% zinc).*

# Oxy-fuel Brazing Technique video link

<https://www.youtube.com/watch?v=OL-2yNndGC0&t=435s>

# Review Questions

1. of the 3 listed ways to permanently join metal, which 2 require heat?
1. name 3 materials rivets can be made of.
1. What is another name for resistance welding?
1. What is the difference between soft and hard soldering?
1. Brazing filler rods are made of what 2 types of metal?