



Industrial Technology Virtual Learning

9-12 Advanced Metals : Joining metal

April 24, 2020



Lesson: April 24, 2020

Objective/Learning Target:

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.*

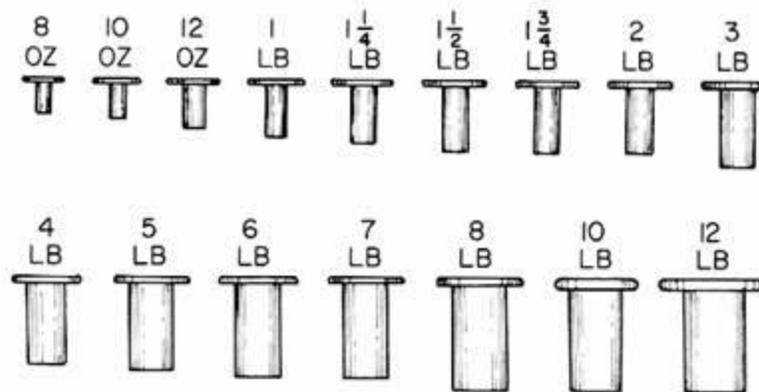


Fig. 25-30 Tinner's rivets (actual size).

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.

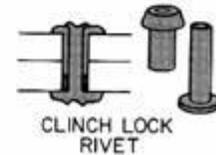
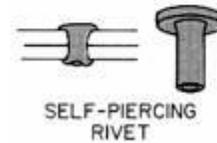
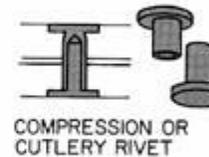
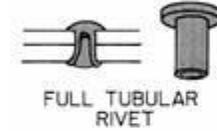
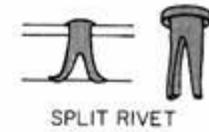
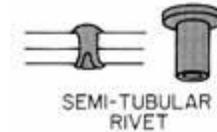
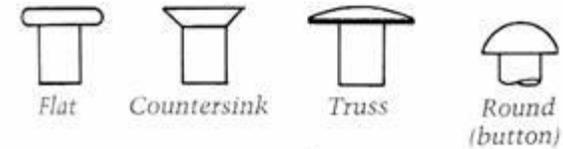
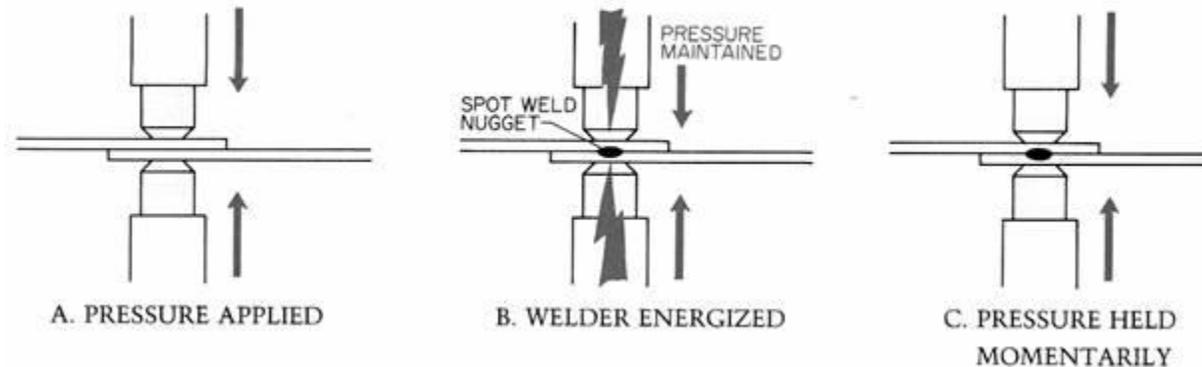


Fig. 25-28 Tubular and split rivets.

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.

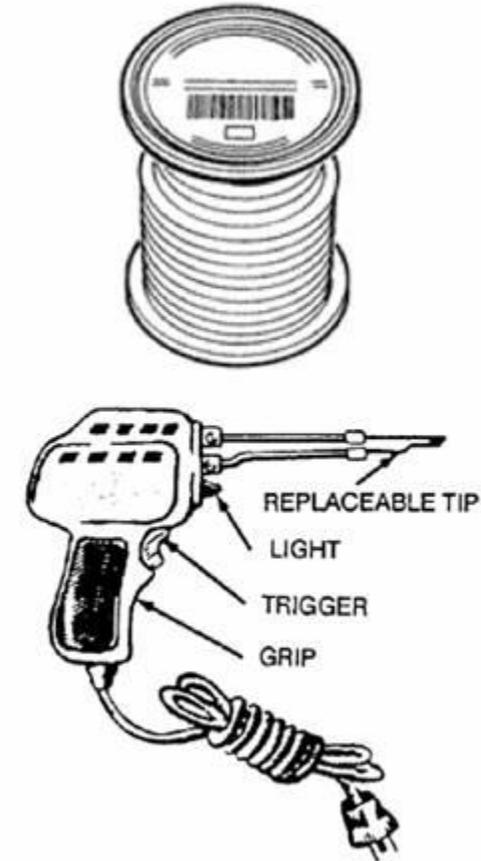


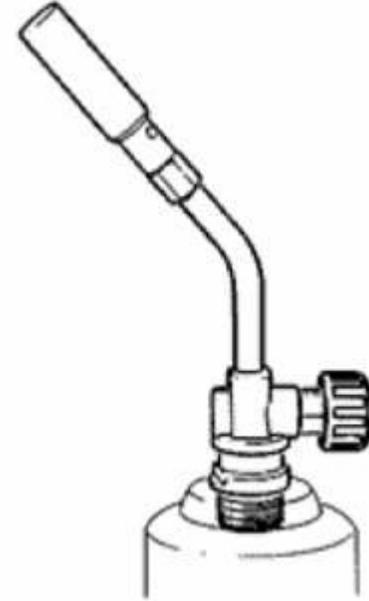
FIGURE 12-26. Soldering Gun.

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?
- 2.) name 3 materials rivets can be made of.
- 3.) What is another name for resistance welding?
- 4.) What is the difference between soft and hard soldering?
- 5.)
- 6.) Brazing filler rods are made of what 2 types of metal?