Rivets and Riveting
Instructor: Deb Jemmott ©2007, rev. 2011

Rivets are mechanical holding devices that join two or more elements by pinning them together with a wire or tube. The wire or tube is held in place by spreading then end, creating a “head” on both ends. The best rivets not only hold components together, but also serve as a design element in their own right, thus adding to the aesthetic value of the piece.

Two basic kinds of rivets are solid rivets and tube rivets. Both types may be created in many ways. Three basic methods are:

The **Flush Rivet** can be used as a “married metal” look, for example, copper rivets in a silver field. If the same metal is used, the rivet will virtually disappear.

The **Blind Rivet** may be used when it is important to show no rivet at all on one side of a piece.

The **Extended Rivet** uses a tube or other spacer between the two outermost elements being joined. This interior section can be a soft material, such as bone or wood, or left as open space. The tube supports the rivet wire, keeping it from bending during the riveting process.

**Basic Solid Rivet Procedure**

- Choose a rivet wire. A rivet shank must have enough material so the ends can mechanically hold the pieces together, generally 18ga wire at the minimum.
- Anneal the rivet wire.
- Make the rivet head. (See “How to Make A Rivet Head” on the next page). Rivet heads must function to hold the pieces together, but beyond that, the head can be used as a decorative element. “Found” rivets with heads already formed are plentiful, but you may have to use your imagination. A few possibilities are:

<table>
<thead>
<tr>
<th>Nails (copper or brass)</th>
<th>Model Train Parts</th>
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<tbody>
<tr>
<td>Escutcheon Pins</td>
<td>Doll House Parts</td>
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<tr>
<td>Earring Posts</td>
<td>Aeronautics Parts</td>
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<table>
<thead>
<tr>
<th>Flat Head</th>
<th>Round Head</th>
<th>Ball Head</th>
<th>Cone Head</th>
<th>Rosette Head</th>
<th>Split Rivet</th>
<th>Split Rivet</th>
<th>Button Head</th>
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<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Split Rivet</td>
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</tbody>
</table>
• Mark and center punch the site of the first rivet on the top part of the piece. A rivet should be at least one rivet diameter from the edge of the piece. This is especially important if only one rivet is being used to allow movement (called a “free rivet”). The wear of movement can cause the rivet to break through the joined elements. Remember that it takes at least two rivets to lock the elements in place.

• Find the appropriate drill bit for the size of the rivet wire. The rivet wire must fit tightly in the hole. If the hole is too big, the rivet will bend during the riveting process. To measure the wire and determine the appropriate drill bit, use calipers, a number drill gauge or a B&S gauge.

• Drill a hole at the site of the center punch mark. The drill bit must be kept perpendicular to the material.

• Place the top piece on the next component. Using the drilled hole as a guide, mark the placement of the hole on that second piece. Do the same for all of the elements to be riveted together using that same rivet.

How to make a Wire Rivet Head

• Anneal the rivet wire.

• If a lot of material is needed to make the head (flat, balled, rosette) melt a ball on the end of the wire.

• For any of the rivet heads that have a flat underside, rub bur-life or similar lubricant on the wire, slip the wire, balled end up into a steel or brass block with a hole the same size as the wire. Use a faceplate (a drill gauge with the numbers facing the rivet block works well) with the same size hole drilled in it, over the rivet block to both protect the block and to make the rivet easier to remove. DO NOT USE A DRAWPLATE!! Hammer on the end until it is the desired shape. The head may also be textured with stamps, chisels or hammers.

• For a domed or button head, use a concave setting tool such as a nail setter to help finish the hemisphere after hammering the wire’s end into that basic shape.

• For a split rivet, use a FINE jeweler’s saw blade to cut the head and/or tail in half or quarters or other sections.

Safety Notes

• Safety glasses or goggles should ALWAYS be worn when drilling metal.

• ALWAYS hold the item being drilled in a ring clamp or drill press vise – NEVER in your hands!
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- Center punch and drill the first hole in each of the pieces. Clean up the drill holes as necessary.
- Mark, center punch and drill all of the remaining rivet sites in the top piece.
- Line up all of the pieces to be riveted. If there are several, they may need to be clamped or double-side taped together to keep them from slipping during the drilling process. Place a temporary rivet in the first hole through all of the elements being joined to help keep them stationery.
- Drill a second hole through all of the pieces to be riveted. Choose the hole that is farthest away from the first one.
- Slip a rivet into the second drilled hole. This will help stabilize the pieces so the other rivets will line up properly.
- Drill through all of the pieces using the holes in the top piece as a guide.
- Separate the pieces and clean up any burs from drilling.
- Insert the first rivet and cut the rivet to the proper length. A good rule of thumb is to leave 1 to 1 ½ times the diameter of the wire above the surface of the piece to make the “tail.”
- File the end flat with a fine file.
- If the rivet head is shaped, it will need to be protected while forming the rivet tail. Find or make an indentation in a block of nylon, Delrin, steel or brass to accommodate the rivet head. This will support the rivet head so it does not flatten while the rivet tail is being formed.
- Spread the rivet tail by hammering in the center of the wire, then around the edge, back to the center, then around the edge and so on until the desired shape is achieved.
- Use a setting punch, decorative stamp or chisel to make the head and/or tail more decorative.

Washers

Joining thin or soft elements (fabric/leather/wood/bone) with a rivet can be tricky because the head can easily pull through these materials. Washers help prevent this by adding durable surfaces to the piece which help to spread the load of the rivet heads and lock them in place. Washers can also serve as protective elements especially on textured or delicate pieces so they won’t be damaged by a stray hammer mark. The hole(s) in the washer should

<table>
<thead>
<tr>
<th>B&amp;S</th>
<th>mm</th>
<th>in</th>
<th># drill size</th>
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<tbody>
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</tr>
<tr>
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<td>0.102</td>
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</tr>
<tr>
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</tr>
<tr>
<td>6</td>
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</tr>
<tr>
<td>4</td>
<td>5.19</td>
<td>0.204</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6.54</td>
<td>0.258</td>
<td>1/4&quot;</td>
</tr>
</tbody>
</table>
be the same size as the diameter of the rivet wire. Washers can be decorative as well as functional. Washers can be round or square or any other shape that would enhance the design of the piece.

**Tube Rivet Procedure**

Lengths of tubing, eyelets or grommets may be used to create a tube rivet. The electronics industry offers some wonderful small eyelets in brass, stainless and, occasionally, silver-plate. Tubing must be seamless for this process, as seamed tubing will split. Thin wall tubing may tear rather than curl over, so any tubing choice should be tested on a practice piece before using it on a finished piece.

- Choose an appropriate tube.
- Anneal the tube.
- A good rule of thumb for a tube rivet is ½ the size of the diameter of the tube above the surface of the piece on each side.
- File the end flat with a fine file.
- Place the tube in the rivet hole and set it on a flat surface. Insert a tapered tool into the tube and slowly work it in a circular motion to begin the flaring the end of the tube. Flip the piece over, and slowly work the other end of the rube in the same way. Sometimes a series of tapered tools should be used to achieve an even curl of the tube. Keep working both sides so the tube will roll evenly.
- Use dapping punches, small ball end hammers, plumb bobs, or progressively larger punches until the tube expands and begins to roll over.
- Use a small riveting hammer to complete the roll on the top of the tube. Be careful to not smash the rivet – it should have a nice, rolled head and tail.

As an alternative, you may also split the tube into sections with a fine blade in the jeweler’s saw, and then spread the tabs as with a split rivet.