



### **READ THIS BEFORE YOU BEGIN**

Read all instructions and familiarize yourself with the parts and assembly steps.

These instructions assume that your wagon has been assembled and team and wagon have been painted to your liking. The neck yoke and singletrees are assembled per wagon kit instructions but not glued in place.

Deciding on a setting for your wagon and team should be done prior to harnessing. Having a prepared placement for the wagon assembly minimizes handling and possible damage. Position of front axle, pole and horses need to be determined.

The instructions also assume you are using Xeodon Design draft horse and driver figures. If you are using other figures you will need to determine what modifications may be required to adapt them to these instructions.

Instructions are provided for a two-horse hitch. If you intend to try a four-horse hitch contact Xeodon Design for additional information.

The majority of harness detail has been cast into the horse figures. Only the Traces and loops, Neck Yoke Straps and Reins will need to be added. The drawing on page two identifies the various components that will be fabricated to harness the horses.

Traces and Neck Yoke straps are simulated with black paper. Art paper available at craft stores, such as Michael's in the US works well. Be sure the paper has a smooth surface and a tight fiber structure. About 0.2 mm (.007 inch) thickness is good. Metal loops will be used to fix Neck Yoke Straps to the Neck Yoke. These loops are called Jump Rings and are available in Craft Stores and Jewelry Supply companies. A ring that is 2.4 mm in diameter is preferable but a larger size could be used. If you cannot find these rings instructions on making your own are included at the end of this document.

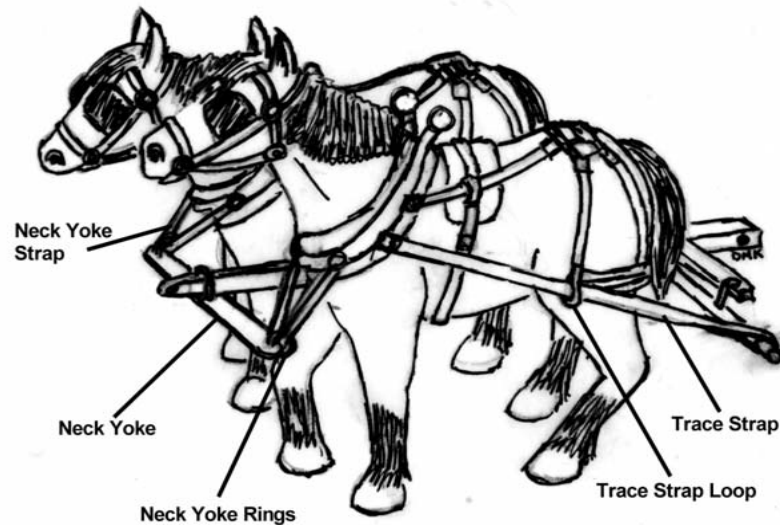
Reins are simulated with the waxed thread used for rigging model ships. Micro-mark is a good source as are hobby shops or ship model suppliers.

The method of harnessing described in these instructions has been simplified from actual prototype practice. Feel free to add any additional level of detail you may want. There is a wide range of information on horses and harness in books and on the Internet.

### **TOOL AND SUPPLIES**

X-Acto type hobby knife and sharp blades  
Ruler with at least 1/32 (0.5 mm) divisions or vernier/dial calipers  
Small Flush Cut Pliers, Needle Nose Pliers, Tweezers  
Pin Vise  
Drill - #72 (0.025 dia.)  
Drill - 1/16 (0.062 dia.)  
Magnifier  
Fine Sandpaper  
Thin, quick-setting Cyanoacrylate adhesive  
Brass wire .062 dia.  
Brass Wire .020 dia.  
Double sided tape or Spray Adhesive  
Acrylic Matte Medium

## Harnessing Instructions for Wagon Kits



### PREPARE HORSES AND ASSEMBLY SURFACE

Brass rod is inserted in the bottom of the horse's hoofs to support and position the wagon assembly while building up the harness as well as for installation on the final site.

Drill a 1/16 diameter hole about 1/16 deep in the bottom center of at least two hoofs of each animal. I prefer one front and the opposing rear hoof. Be careful not to drill thru the top of the hoof. Cut pieces of brass wire about 3/8 inch long and cement into holes in the hoofs with CA adhesive.

A block of pink or blue insulation foam or foam-core can be used as a working base. Cut the foam about an inch larger per side than your wagon assembly. Place a piece of plain paper on top of the block and tack in place with double sided tape or removable spray adhesive. Trim edges of paper to the block size. After harnessing is complete this paper will be used as a

template to place your wagon assembly so it must be easy to remove. Be sure to note and mark the position of each horse so you can properly pair and replace them after harness components are installed.

Position horses and wagon on the foam block as you want them to be in their final location. "T" pins can be used to hold the wagon in position. Horses will be located with their hoof pins. Trace around hoofs and mark locations where wagon wheels touch the paper. Cement wheels to axle pins and front axle pivot in final position to minimize movement during assembly of harness. Do not cement wagon to template!

Remove horses from the block. Harness will be added to each horse individually then horses are repositioned on the block for final assembly. Wagon can remain in position on the block.



### PREPARE HARNESS STRAP MATERIAL

Cut about five strips of paper 1/16 inch wide by 6 inches long. This is more than you will need but some pieces will get damaged in handling.

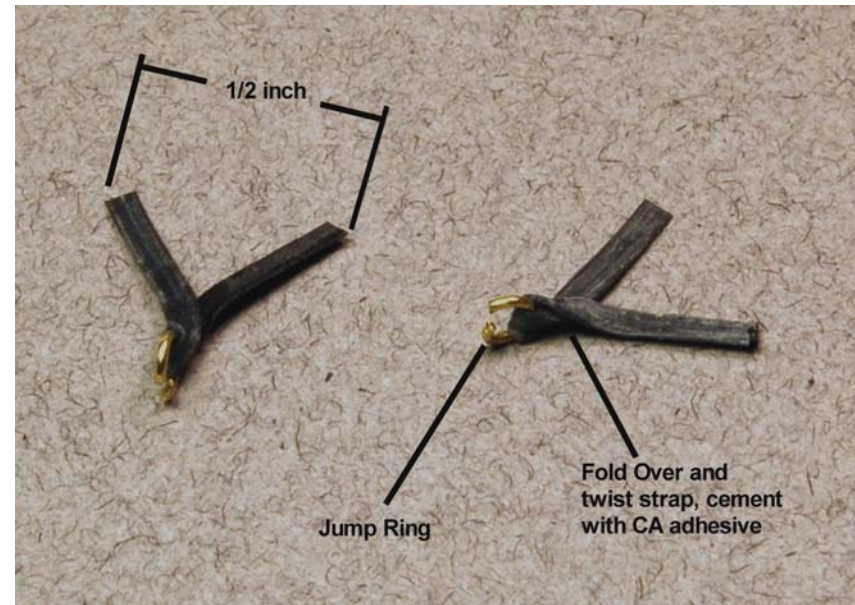
## Harnessing Instructions for Wagon Kits

Brush both sides of each strip with undiluted matte medium (available at art and craft stores) and place on a plastic sheet to dry. Heavy kitchen freezer bags work well. The matte medium will soak into the paper and make the strips more flexible and durable.

After medium has dried peel strips up. Fold a piece of fine sandpaper in half and carefully pull each strip thru the folded paper. This will smooth and dull the matte medium and remove any feathered edges.

### PREPARE NECK YOKE AND STRAPS

Locate the neck yoke casting from the wagon kit. Drill two additional #72 (.025) holes on the outside ends as shown on the wagon kit instructions for the doubletree. These holes are for the jump ring that will hold the Neck Yoke straps. Finish remainder of Neck Yoke as described in Wagon Kit instructions.



Cut 2 pieces of prepared paper strip 1 inch long. Fold strips in half and hook a jump ring over the fold. Make a  $\frac{1}{4}$  turn with the brass loop and spread the legs of the strap into a "V" shape. The top of the "V" is about  $\frac{1}{2}$  inch wide. Secure the fold and ring in place with AC adhesive. You will need two strap assemblies.

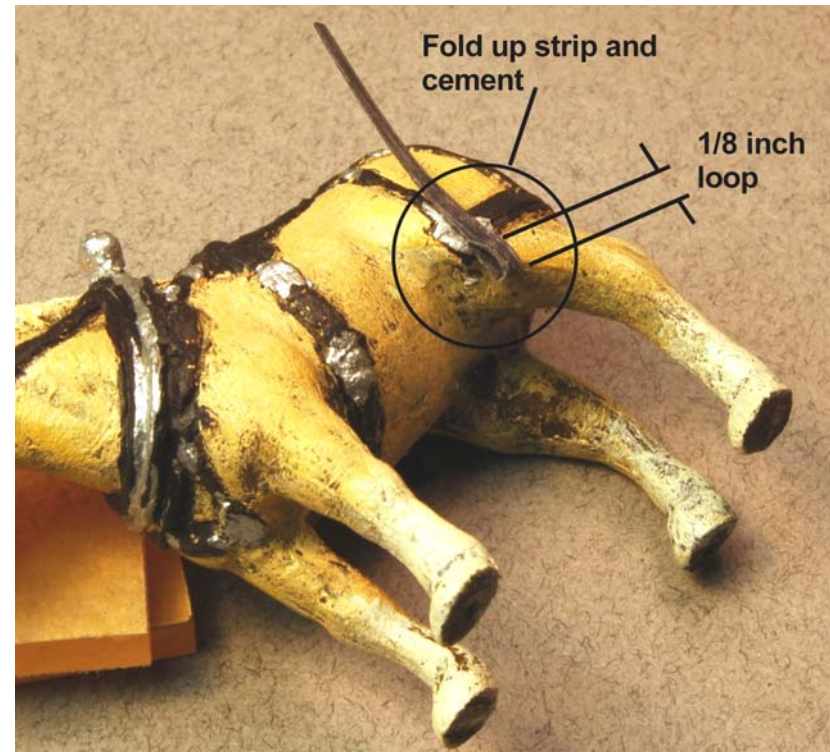
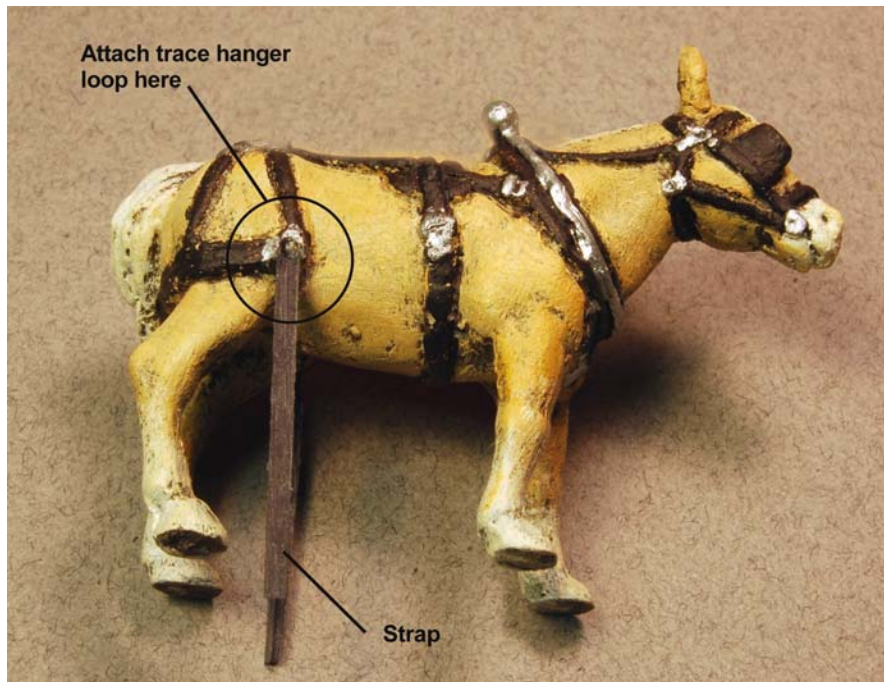


### PREPARE TRACE HANGER LOOP

Cut four pieces of paper strip 1 inch long.

Cut a notch in the bottom of each cast in trace loop ring on the horse figures. Notch is same width as paper strip and will be as deep as the center of the cast ring.

Cement one end of a paper strip into the notch with the length of the strip extending toward hooves. Repeat for other horse. After CA has set fold each strip up to form 1/8 inch loop. Secure top of strip with CA. Repeat for remaining animal. After CA has set trim excess strip to top of cast in trace loop ring.



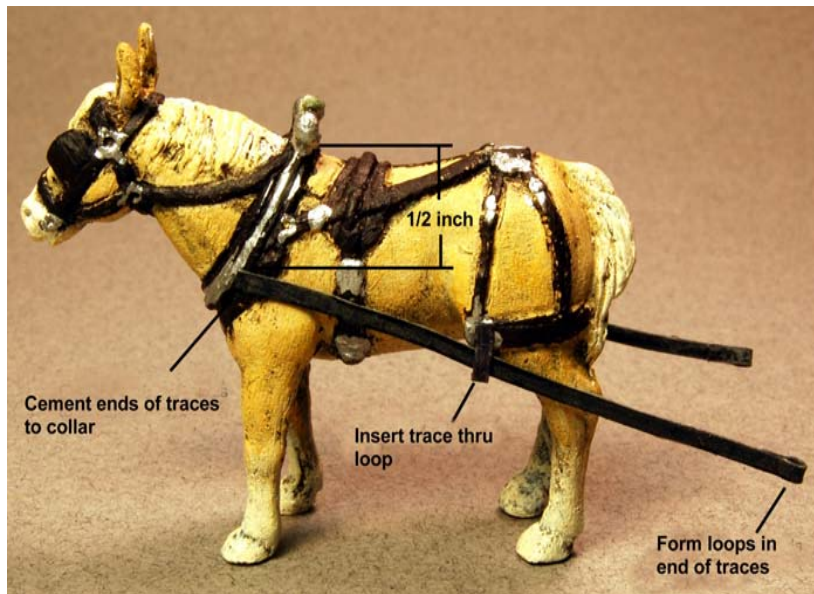
## Harnessing Instructions for Wagon Kits

### PREPARE AND INSTALL TRACES

Cut four pieces of paper strip 2-1/2 inches long.

Form a loop at one end of each strip. Wrap strip around a 1/16 diameter rod and overlap the strip about 1/8 inch. Secure loop with CA adhesive applied to 1/8 inch overlap. Loop must fit over ends of singletree rods. Trim strip to 2-1/8 inches long from center of loop to end of strip. Repeat for remaining traces.

Thread a trace through the trace loop. Loop on trace strip is toward the rear of the horse. The trace loop overlap should face into the horse figure. Secure the non-loop end of the trace to the inner collar about 1/2 inch from the top of the collar. Trace should angle downward from collar and through trace loop. Angle is about 12 degrees from horizontal. Repeat for remaining trace.



### INSTALL NECK YOKE STRAPS

Trim ends of Neck Yoke Straps on a 45 degree angle. Flush cutters work well. Secure each end of the strap to the collar as shown in the photo with CA adhesive. Strap loop is centered between horse's forelegs. The cast in strap detail on the figure can be used as a guide. When adhesive has set, bend straps upward about 5 degrees. Repeat for remaining animal.



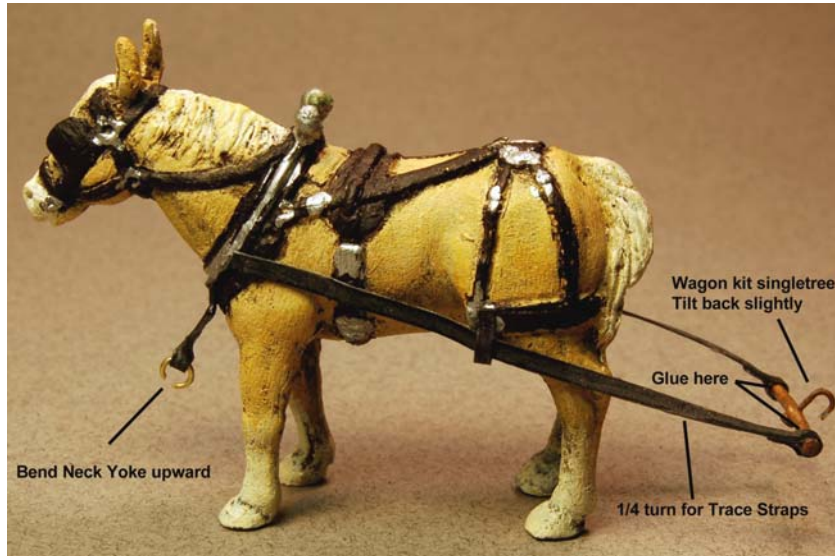


## Harnessing Instructions for Wagon Kits

### ASSEMBLE TRACES TO SINGLETREES

Insert assembled single tree from wagon kit into one of the trace loops. Singletree hook faces up and away from the horse so it can hook into the doubletree attached to the wagon. Rotate singletree so trace has a ¼ turn and insert end of singletree into trace on other side. This trace will need a ¼ turn as well.

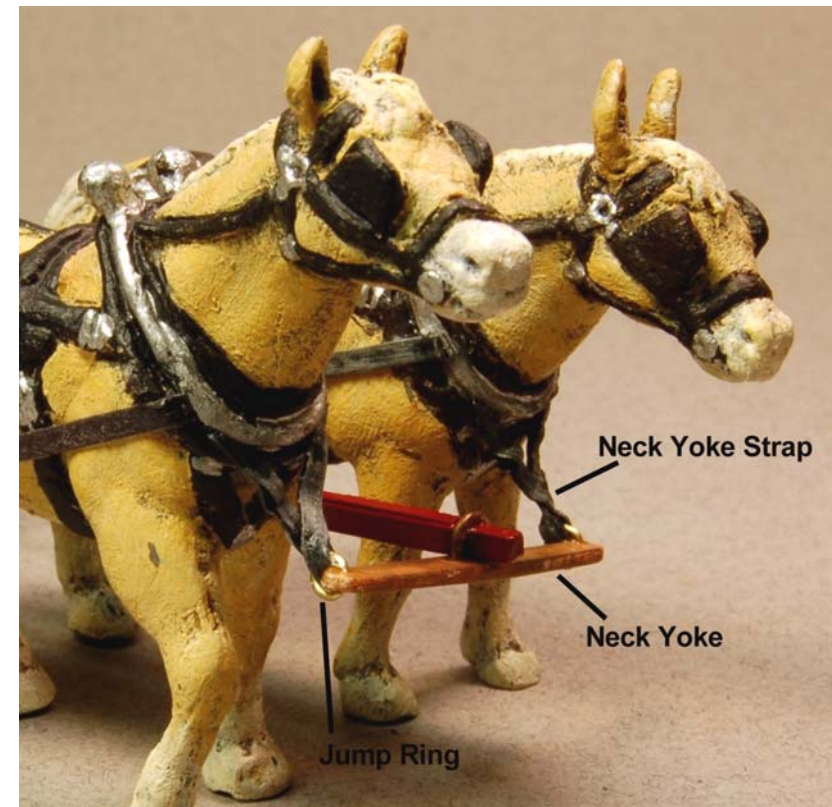
Tilt singletree hook away from horse slightly and secure strap loops to singletree with CA adhesive. Trace loops should be at the ends of the single trees. Repeat for remaining horse.



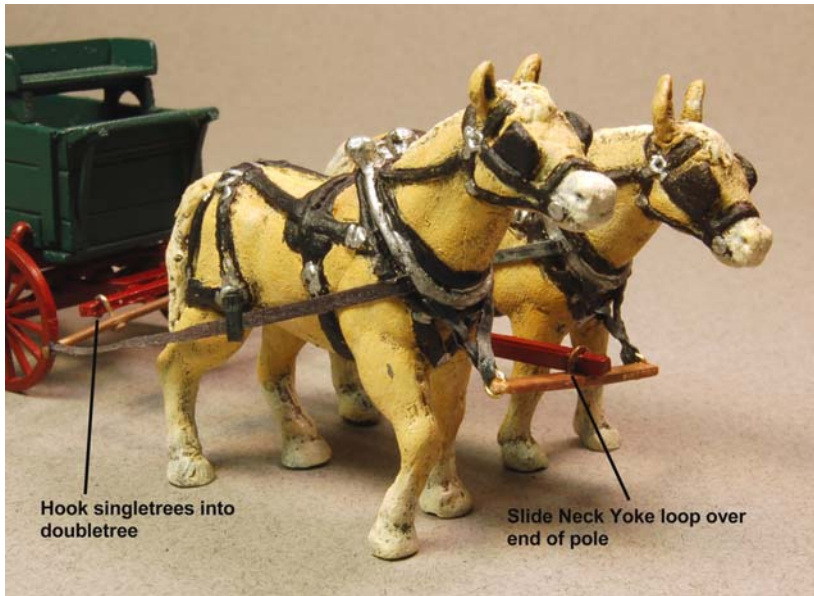
### ASSEMBLE NECK YOKE STRAPS TO NECK YOKE

At this time you will be attaching the neck yoke strap to the neck yoke. This will join two horses together and require more careful handling to avoid tearing the neck yoke straps.

Carefully feed the open jump ring on one of the horses neck yokes into one of the holes in the neck yoke. After the loop is in place carefully close the loop with needle nose pliers. Be sure the horses are positioned in the same way as in the preliminary setup. Left horse on the left etc. The wire loop in the center of the neck yoke faces up and the holes in the ends of the neck yoke are toward the horses. Once the first horse is in position repeat for the other horse.



## Harnessing Instructions for Wagon Kits

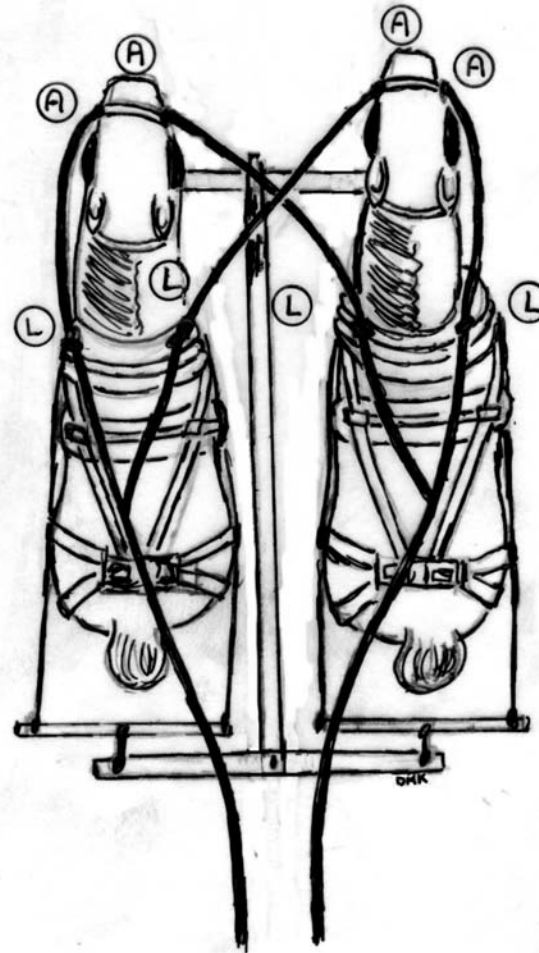


Place horses back in proper position on the foam block. Be sure that neck yoke loop slips over end of pole. Singletree hooks should align with doubletree holes. Some minor adjustment may be required. Insert hooks into doubletree and cement in position. Level neck yoke and cement in position on pole.

You are now ready to move on to adding the reins. Refer to drawing for rein layout

### **INSTALLING REINS**

Reins are made from heavy black thread. Model ship building suppliers are a good source as are craft stores. You will want a flexible thread about .020 inch (0.5 mm) diameter.



On the prototype, reins are flat leather straps run through metal loops and attached with various types of clips. In a small scale like 1:48 using thread and attaching it to the proper places with a drop of CA adhesive provides a convincing model. Feel free to add any level of detail you may want.

Before adding reins you will want to identify and prepare the driver figure you will use. If you want to model a wagon without a driver reins for a parked wagon were coiled up just after the collar and tucked behind the belly strap on the drivers side animal. (typically the right side when seated on the wagon) The reins were ready to pick up as the driver mounted the wagon.

The driver figure used should of course be seated and proportioned to fit in the seat with feet resting on the footboards. A number of figures are available from manufacturers including Xeodon Design. The figure should also have hands that are positioned to hold reins. Reins should extend past the figure's hands by about 5/8-3/4 inch. Cement driver into position on right hand side of seat. After adhesive dries you can begin installing reins.

Refer to following sketch for rein positions. Cut two lengths of thread 4 1/2" long for the outside reins. Excess will be trimmed after installation. Cement a rein into the drivers hand with 5/8-3/4 inch hanging down behind the hand. Run the rein across the back strap and attached to the collar with a drop of CA at the point marked "L" on the sketch ("L" denotes a point where the rein passes through a loop on the prototype) Putting a slight notch in the collar with an X-acto knife can provide a place for the rein to hook.

The rein should drape naturally and can also be fixed to the horse at the point where it passes over the back strap if desired. Fix the rein to the horse bit at the side of the mouth. This is the point marked "A" on the sketch. ("A" denotes a place where the rein was fixed with a hook or clip) Be sure rein drapes naturally and after CA adhesive cures the excess can be trimmed at the bit ring. Repeat for rein on outside of other horse.

Cut two lengths of thread 2 1/2" inches long for the inside reins. These reins were clipped to the outside reins at about the mid back of the horse, run through loops on the inside of the collar and crossed to the opposite horses bit.

Fix one end of the inside rein thread to the outside rein thread as shown on the sketch. Squeezing the inside rein thread flat and slightly hooking the end will make it a bit easier to fix to the outside rein. After the CA sets run the inside rein to the collar and fix. (a notch will help here as well). Continue the rein across to the other horse and fix to the bit loop at the horses' mouth. Be sure the rein drapes naturally. After CA is cured the excess thread can be cut flush to the bit loop. Repeat for other inner rein. A drop of silver paint at each point where the reins attach or pass through a loop will disguise the CA adhesive.

### **HORSE AND WAGON INSTALLATION**

Your wagon and horses can now be transferred to their intended location. Carefully remove the assembly from the foam block. Set in a safe location.

Remove the template paper from the foam block and place in wagon's final position. Mark locations of hoof pins and wheel locations. Clear any scenery or ground cover where wagon assembly will touch. Drill holes for hoof pins and mark wheel locations.

If you want your assembly fixed in place apply a drop of adhesive to hoof and wheel locations. A water based cement that dries clear or a clear epoxy would be appropriate. Other adhesives can be chosen based on personal preference.

Carefully move the wagon assembly into place. Place horses first then wagon. Gently move wagon away from horses to tighten Traces and Reins. After setting wagon, excess adhesive can be removed before it sets. After adhesive sets appropriate scenery materials can be applied to blend the wagon in.

Add other figures, freight and detail parts as desired.



### **FABRICATING JUMP RINGS**

Cut a piece of 0.020 diameter brass wire about 6 inches long and wrap about 10 coils around a 1/16 inch diameter rod. Clamping the 1/16 inch diameter rod in a vise or drill chuck with about 1 inch protruding will make the wrapping easier.

Use flush cut pliers to clip single loops from the coil. Use needle nose pliers to align the cut ends of the rings then open loops about 1/16. You will only need two but make extra loops. They will get lost!

