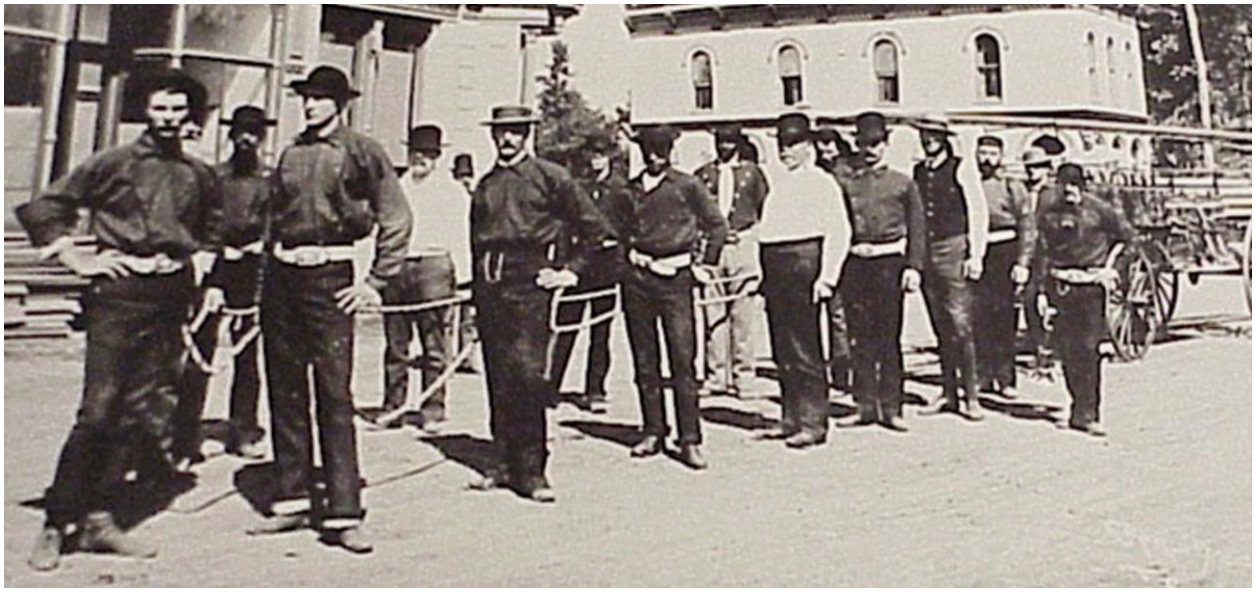
About the 1890 Hook and Ladder Wagon

This wagon was pulled by the willing hands of stout-hearted smoke-eaters to many a fire. For many a small community the Hook and Ladder Wagon was often the first purchase of fire fighting apparatus. Back then it was more a matter of rescue than extinguishing the fire. The rope reel was let out for the number of men pulling; then reel stops inserted into the pulley and the men would step into the loop and grab the rope with two hands and in single file ran off to the fire. This particular wagon was a transitional design and had two rings on the rope handle to engage a hitch for a horse. For the men, it must have been a challenge going up and down hills; and as soon as community funds allowed a horse drawn version was implemented.



Before You Begin to Build

At 1" = 1' 0” (1:12) scale, it is relatively easy to build this model and obtain precise detail. Laser-cut parts offer a simple building method. Britannia (white metal) parts eliminate creating parts from scratch.

Before starting the model, carefully examine the kit and study the plans and the assembly instruction manual. First, determine if all the listed parts are present using the Parts Layout sheet. Handling them will produce a better understanding of the kit’s building requirements. Try to visualize how every piece will look on the completed model. Also, try to follow the building sequence and what must be completed first, or ahead of time and what can be done simultaneously if you wish. For example, you may want to skip to the wheel construction as you are working on other parts or waiting for glued assemblies to set or paint to dry.

The Plans

Plan sheets are provided for reference and part identification and may not be true to scale due to reproduction. These drawings show elevation views, a parts layout with color guide, and a perspective view illustrating the parts and their placement or relationship to each other. Some parts are not drawn in the perspective view for better clarity of other parts. Review and study the plans and assembly instructions prior to starting the build to better understand how the parts will come together and the build sequence.

Make Allowances during the Build.

Try to be exact when following the instructions, but use common sense. Adjustments may be necessary to compensate for small differences in how your model is shaping up and how the parts are relating to each other. An old saying in the model building craft is that “if it looks right, it is right.”

Kit Lumber

Laser cut Basswood spokes and parts along with plywood rims are supplied in the kit. A word about laser cutting: a common misconception is that the parts should punch out of the carrier sheet. This is not so. Laser cut parts are retained in the carrier sheet by small bridges of uncut wood called tabs. Tabs can be oriented parallel to the grain or perpendicular to the grain. It is always better to cut through these tabs rather than try to punch out the parts by breaking the tabs. This is particularly true of laser cut plywood. Plywood tabs are much more difficult to laser cut than basswood. You may have to cut through not only the tabs but portions of the part outline that did not cut completely

through the sheet. Turn the carrier sheet over and cut from the backside to release the part without damage.

Britannia Metal Parts

There are many Britannia (white metal) parts in this kit. First, remove any mold joint flash with a #11 hobby blade using the back edge as a scraper, then file or sand with fine sanding stick or sandpaper. ***Important:*** **Always dry fit parts together first to determine if holes need to be drilled further or if mating surfaces are flat to each other.** Once parts have been dry fitted wash parts in dishwashing liquid and warm water to remove traces of mold release agent and the body oils your fingers may deposit. Allow the parts to dry thoroughly before applying primer and painting. Try to avoid painting, whenever possible, surfaces to be glued together, or locating pins that insert into holes. Due to the molding process used; some deformed parts may be received, or filed in holes that will have to be drilled. These can be straightened by **gently and slowly** reforming with your fingers. Check with the plans and photographs to verify the reforming of the part (s); every effort was made to reproduce the parts accurately but some deforming may occur during shipping due to the weight of the parts themselves.

Wheel Hubs and Axles

The wheel hubs in the kit are precision machined. The axles are cast Britannia metal. It is important to check the fit of the hubs on the axle shafts at the outset before beginning the kit. Being cast, the axle shafts will likely have a tiny bit of flash, or parting line mismatch preventing a smooth running fit on the hubs. Use a sanding stick to work the axle shafts until the hubs fit and run freely. The axle shafts can be easily bent, so work very carefully. If you should happen to bend an axle shaft, it can be straightened, also avoid painting the axle shafts where the hubs will ride.

Working with Gasket Material parts

The wheel tires, nuts and a few other parts are laser cut from Gasket Material. Use care when cutting the parts from the sheet. Sand perimeter tabs areas smooth after being cut from sheet.

Glues

Super glues, such as Jet, Flash, or Zap, produce quick adhesion. For most applications, the medium viscosity, gap-filling variety is best. The thin type is recommended for filling a narrow crack and wicking into laminate joints. These instructions will refer to super glues as CA (cyanoacrylite).

A word about gluing laser cut parts. Laser cutting burns through the wood and leaves a charred surface. This charred surface does not make good strong glue joints. It is recommended to lightly sand or scrape away the loose char before gluing. It is not necessary to remove all the char, unless a finished wood surface is required. In some cases simply scraping with the back edge of a # 11 blade is sufficient.

Building Tips and Suggestions before Starting to Build

- Locate and purchase one (1) spray can each of Krylon Gray Primer; Banner Red; Satin Black, Satin Clear.
- Read assembly instructions and review the plans to understand and familiarize yourself with various parts and components and how they relate to each other.
- Verify that you have all the tools and materials needed to start the build. See materials and suggested tool list.
- Try to follow the suggested build sequence outlined in the assembly instructions.
- Pay attention to steps that are **BOLD** face type. These are critical actions to avoid problems with assembly or when extra care is needed.
- Parts are **Capitalized** on purpose for emphasis when reading.
- Clean excess residue from edges of laser cut wood parts.
- Cast white metal parts in some cases are delicate due to replicating in 1/12th scale. Extra care and caution is required when cleaning, filing parting lines and adjusting to dry fit.
- Due to the molding process used; some deformed parts may be received. These can be straightened by **gently and slowly** reforming with your fingers.
- Prime, paint and dry fit all cast parts prior to assembling. Keep primer and paint to a minimum to keep fine details crisp. When dry fitting parts if excess paint is an issue scrap off paint as needed for a good fit. Fill any casting voids with putty if required and then sand and prime.
- **Spray Can Use:** A tip for using spray cans is to warm the spray cans under running warm water; then shake the can to feel for the temperature change and repeat heating steps until no difference in temperature can be felt. Dry the can completely of any water before spraying. The heating does two things; it better atomizes the paint than when cold and it slightly increases the pressure within the can for better paint application.
- Take your time and enjoy the build process as much as the finished model.

Building Strategy – Before starting to build think about which build strategy would be best for you to follow. One approach is to clean, file, dry fit and paint all parts before starting assembly; the other approach is to clean, file, dry fit and paint sub-assemblies as needed. The following instructions will work for either approach. Perhaps the deciding factor is really how much space you have to work in and being able to organize all the parts at once. Regardless of the approach the following instructions will address sub-assemblies of components to be worked on and then set aside for later assembly.

Hook and Ladder Wagon Materials List

Additional materials that will be needed:

- CA adhesive and glue dispenser
- Fine sand paper or sanding sticks.
- 1 Bottle MS4975 English Oak stain
- 1 Spray can of Gray Primer
- 1 Spray can Krylon Banner Red
- 1 Spray can Krylon Satin Black
- 1 Spray can of Satin Clear.
- 1 Bottle Satin Dark Tan

Suggested tool list:

- Xacto blade holder and #11 blades
- Small needle nose pliers
- Small end cutters
- Tweezers – straight and bent
- Medium size Mill bastard file
- Assorted needle files
- ScotchBrite pad
- Sanding stick 120/240
- Assorted small spring clamps
- Small square
- Several round toothpicks
- Masking tape- low tack
- Small touch-up paint brushes
- Q-tips for staining
- Pin vise for drill bits
- Drill Bits 1/32”; 1/16”
- Pencil

Hook and Ladder Wagon Building Instructions

Building the Frame:

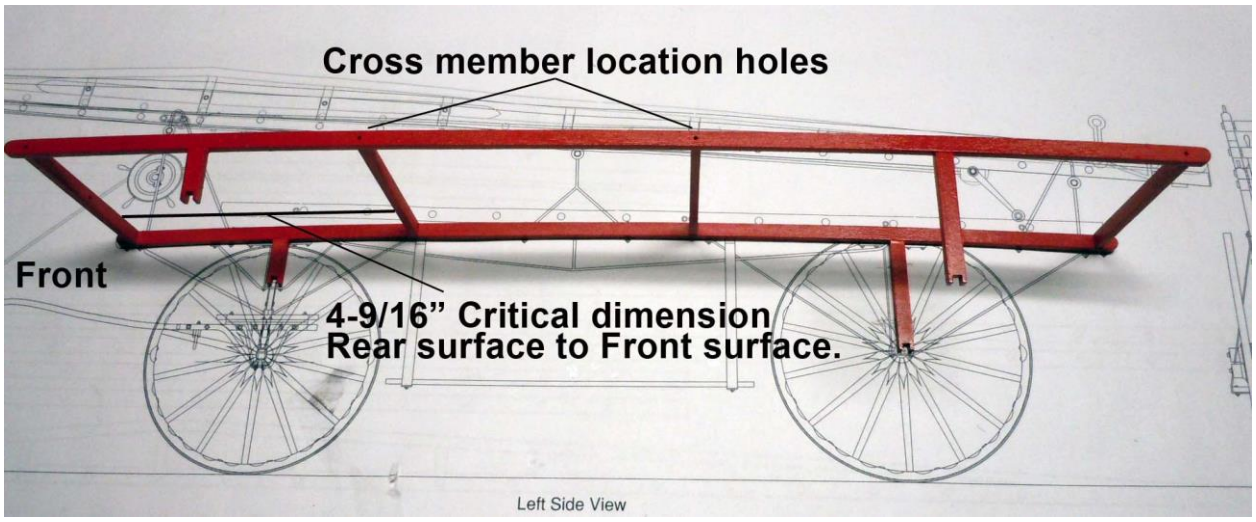
Remove from the Laser Cut Basswood sheet the 10 parts need for the wagon frame. The two (2) Long Side Frame pieces; four (4) Cross Members; two (2) Front Axle Supports; two (2) Rear Axle Supports. Lay the Side Frame pieces on the plan sheet to determine which end is the front. Once the front is determined, glue the Front Axle Support in place and then the Rear Axle Support. Repeat for the second Side Frame piece and make sure the Front and Rear axle supports are identical to the first Side Frame. Allow the glue to set completely.

Note on the four (4) Cross Members that one has a 1/16” hole located in the center, this is the Front Cross Member; the Cross Member with two 1/16” holes is the second Cross

Member; the remaining two have no holes. On the side of the frame are four (4) 1/32” holes; these are the location spots for the Cross Members; as well as Bolt locations, the ends of the Cross Members are centered on these holes.

With one of the Side Frames with Axle Supports glued in place lying flat; mark the centerline of the location holes on both the top and bottom of the Side Frame with a pencil. Now glue the end of the Front Cross Member with the center hole in place on the **topside** of the frame using the pencil marks as reference. Use a small square to assure the cross member is perpendicular. A small laser cut square is provided.

Now add the second Cross Member with the two holes centered on the small locating hole on the side frame. **This cross member location is critical and the distance between the first and second cross member should be 4-9/16”.** See picture below for reference. Later the cast Front Axle Braces will be added to these two Cross Members in the three 1/16” holes. Again, use a small square to assure the Cross Member is perpendicular.



Now add the third and fourth Cross Members using the location holes and use a small square to assure the cross member is perpendicular.

Once the glue has completely set on the Cross Members now add the second Side Frame using the location holes making sure the first and second Cross Member maintain the critical distance of 4-9/16”. See picture above.

Prime and paint the Frame once the glue joints have completely set. Krylon Banner Red was used on the prototype; however one can use any color of choice. Once painted set aside for later use.

Front Axle and lower Fifth Wheel assembly:

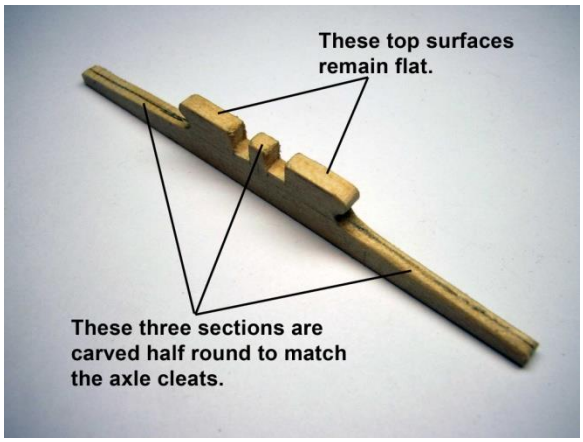
Clean, file, paint and dry fit all the following parts for the front axle assembly. Front Axle (1); Basswood Front Axle Brace (1); Axle Braces, left and right (2); Rope Handle (1); Lower Fifth Wheel Half (1); Center Pivot Cleat (1); Pivot Bracket Brace (1); Axle Cleats two (2) short and two (2) long; Gasket Nuts (18); Gasket Cleat Brackets (4).

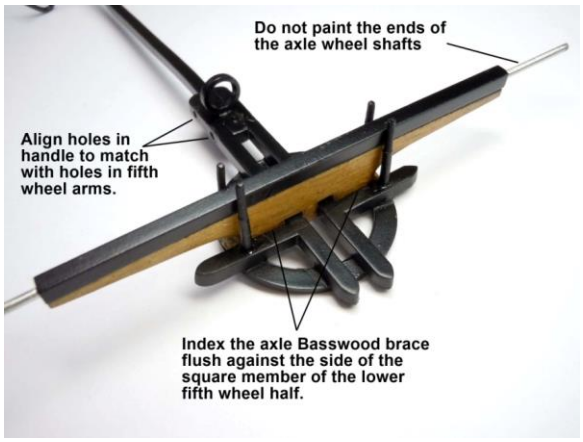
After cleaning and dry fitting and adjusting parts paint the cast parts Satin Black.

Carefully carve the Basswood Axle Brace to the required half round shape to receive the Axle Cleats. See picture below. Once the Axle Brace is carved and sanded; stain with water based Oak Stain and then coat with a Satin Clear.

Glue the Axle Brace to the Square Axle section making sure it matches each end of the Axle square section.

Index and glue the Basswood Axle Brace into the Lower Fifth Wheel part making sure the Basswood is flush to the square section of the Fifth Wheel section. See picture below.





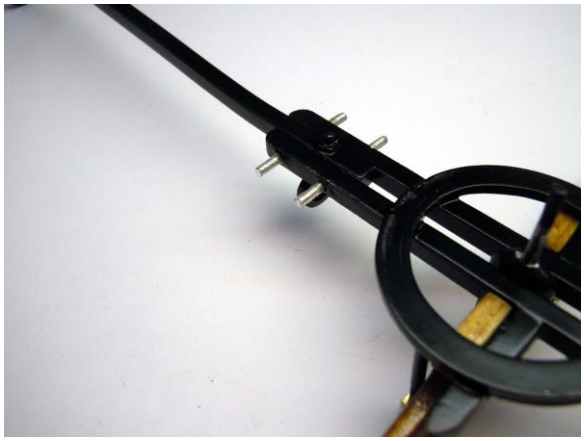
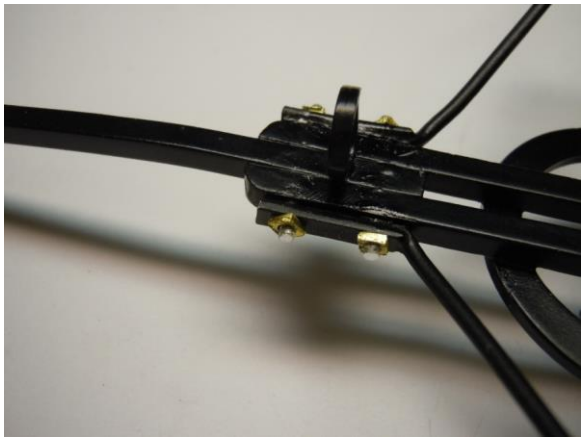
Once the glue has set; index the Center Pivot Cleat down the center of the Fifth Wheel making sure it is fully indexed onto the Basswood Axle Brace and glue in place. See picture below.

When the glue sets on the Center Pivot Cleat turn assembly upside down and fit in place on the two studs the Center Pivot Cleat Brace aligning the four (4) arms to the Fifth Wheel arms and glue to Fifth Wheel. Add the Gasket Cleat Brackets and Gasket Nuts to the end of the studs as shown in picture below.

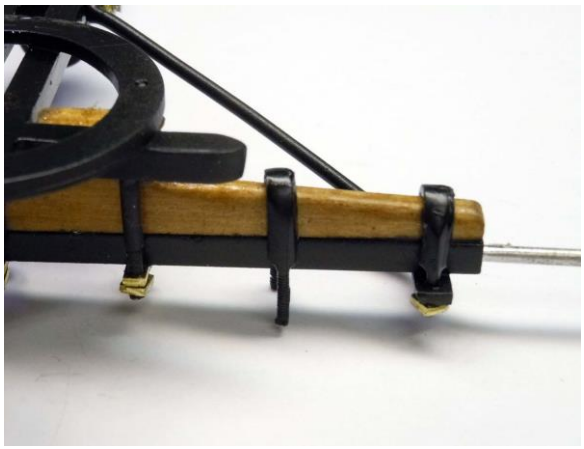
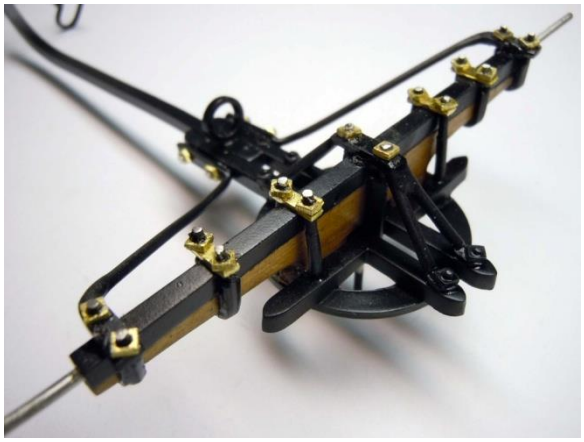
Next add the two (2) 3/4” long Threaded Rods into the aligned Fifth Wheel Arms and Rope Handle holes and spacing them equally on both sides as shown in the picture below.

Index in place the two (2) one left and one right Axle Braces onto the Threaded Rod while at the same time index in place the two (2)Short Axle Cleats onto the Basswood Axle Brace indexing into the holes onto the Axle Brace’s other end. Once each Axle

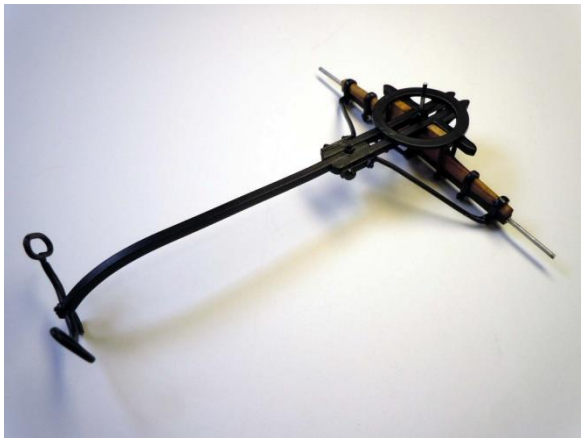
Brace is adjusted and in place; add two Cleat Brackets onto the ends of the Short Axle Cleats and then glue the eight (8) Gasket Nuts in place. See photo below

Now add the two (2) Axle Cleats centering them between the end Axle Brace and the third Cleat. Make sure they fit snug and then glue to axle. Next add the two Cleat Brackets and Nuts and glue in place. See photos below. Trim and file all stud ends to proper length; then brush paint Satin Black all the Gasket Nuts and Brackets.

Here is the finished Lower Fifth Wheel assembly; top and bottom views..



Top View

Bottom View

Set the assembly aside for use later.

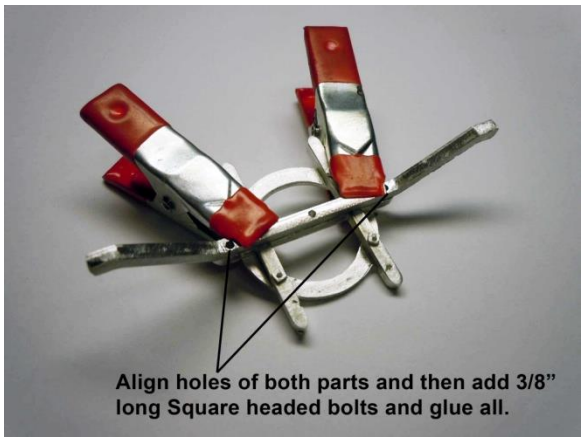
Wagon Frame Assembly

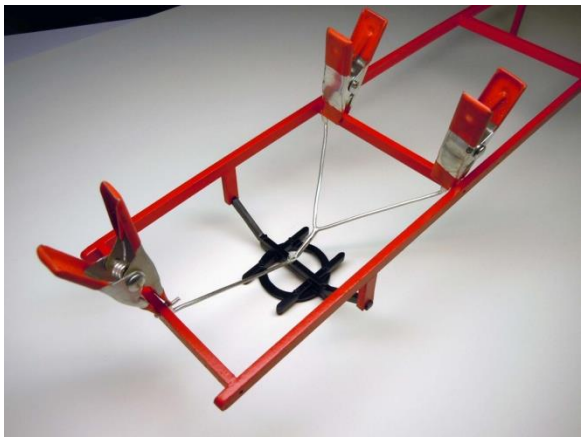
Clean, file, dry fit, adjust and then paint **Satin Black** all the following parts for the frame assembly. Upper Fifth Wheel Half (1); Fifth Wheel Support Arm (1); Fifth Wheel “Y” Brace (1)Rear Axle (1); Rear Axle Support Brackets (4) Forward two (2) with round heads and rearward two (2) with nuts; Frame Reinforcement Brackets (4); Rear Axle Long Braces (2); Rear Axle Cross Braces (2); Center Frame Braces (2); Front Axle Support Brackets (4) Forward two (2) with round heads and rearward two (2) with Nuts; Front Axle Support Braces (2); Rope Reel Shaft (1); Front Ladder Roller Bracket (2); Middle Ladder Roller Bracket (2); Rear Ladder Roller Bracket; Running Board Support Brackets (4); Running Boards (2); 3/8” long Round Head Bolts (22); Gasket Square Nuts (20).

Paint the following parts **Red**; Rope Reel Handles (2); Reel Stops (2); Ladder Rollers (3).

Stain the Basswood Running Boards (2) with a water based Oak stain. Then spray with Clear Satin.

Once the parts clean and ready for assembly; align the holes in the Fifth Wheel Support Arm with those on the Upper Half Fifth Wheel and insert two (2) 3/8” Square Head Bolts into the holes and glue all together. Once glue is dry add the two (2) Square Nuts to the end of the bolts.

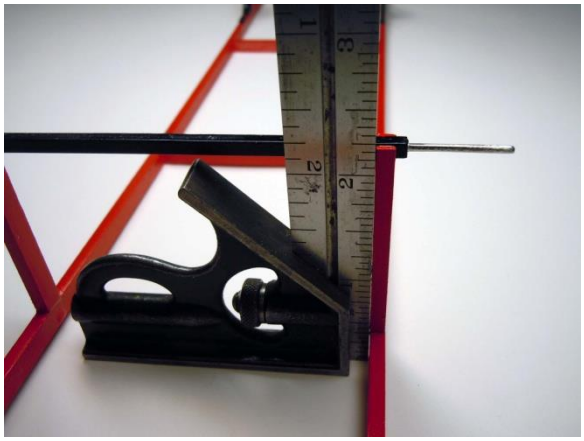


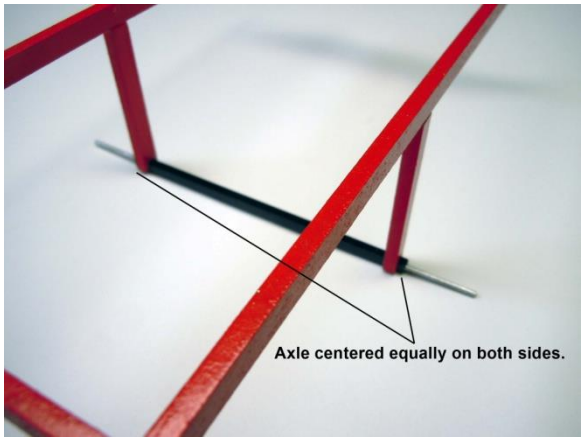


Next index the Fifth Wheel Support Arm into the square openings on the Front Axle Support with 1/32" projecting beyond each Front Axle Support. When fitted in place as shown in the picture above glue the Fifth Wheel Support Arm in place.

The Fifth Wheel "Y" Brace will need to be adjusted locating the holes in the Y Brace to those in the Frame Cross Members and Fifth Wheel. This is why the 4-9/16" dimension was critical when locating the front two Frame Cross Members. The aligning of the four (4) holes; 3 in Basswood Cross Members, 1 in the Fifth Wheel, will require some patience and three spring clamps to hold in place. See the picture above. When the glue is set; ream the holes with 1/16" drill bit and add three (3) painted Satin Black 3/8" long Square Headed Bolts and Nuts into the holes.

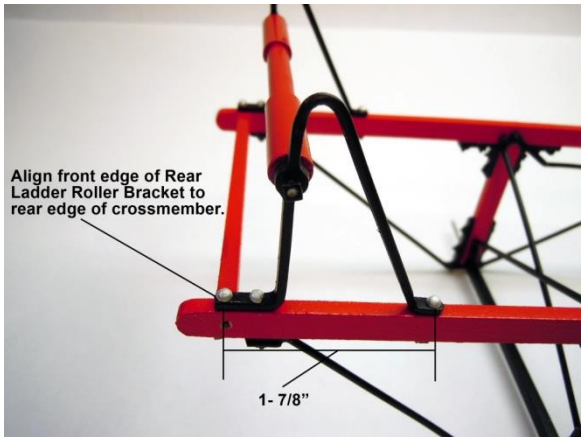
Locate the Rear Axle Supports and use a small square to assure the Support Arms are square. Now add the Rear Axle and position equally spaced on the Rear Axle Supports.



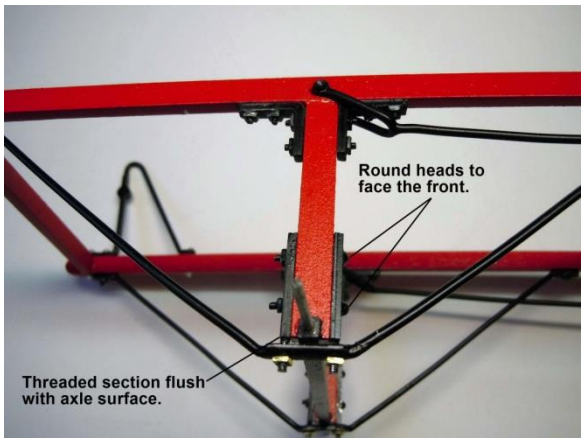


Parts will be added to the Wagon Frame starting at the rear and move to the front. This will keep the overall weight down for handling while adding parts during the build process.

Now adjust and dry fit the two (2) Rear Ladder Roller Brackets so the distance from front hole to the arm hole is 1- 7/8". See Picture below. Set each Bracket in place align rear edge of flange to the rear edge of the Cross Member and mark the three (3) hole locations in frame. Then drill the three (3) holes on each side of the frame. Position the **right side** bracket onto the frame holes and glue three (3) 3/8" Long Square Headed Bolts; then glue three (3) Gasket Nuts in place on the Bolts.

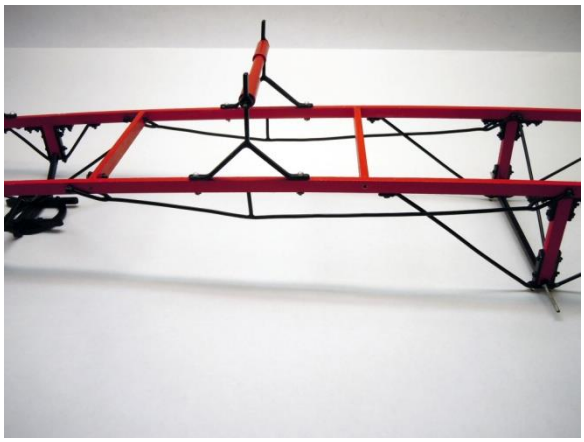


Position the left Rear Ladder Roller Bracket onto the three holes and insert the three (3) Square Headed Bolts into the holes, **do not glue** but hold. Then index the Red Ladder Roller into the Right Bracket hole then into the Left Bracket hole. Now glue the Bolts with the Left Bracket vertical and add the three Gasket Nuts.

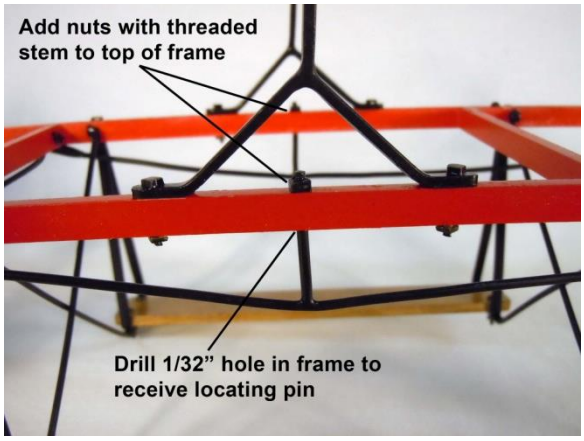


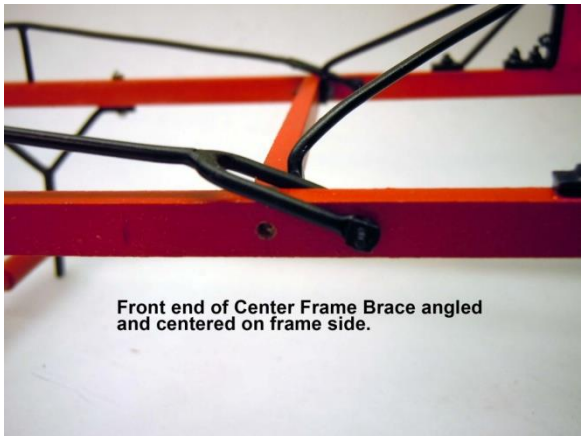
Glue in place the four (4) Frame Reinforcement Brackets as shown above. Next add the Rear Axle Support Brackets (4) **forward two (2) with round heads** and **rearward two (2) with nuts**. Make sure the two with round heads are towards the front of the wagon and the threaded section ends flush with the Axle. See picture above. Now add the two (2) Rear Axle Long Braces indexing on the studs with the arms sitting flush on the Frame. Once satisfied with the fit glue the two Arms in place on the Frame; then add and glue the four Gasket Nuts in place. See picture above.

Now add the two (2) Center Frame Braces which will need to be adjusted slightly to fit properly. Start at the Rear Axle and center the cast in Bolt Heads on the wood frame as seen below and glue both inside and outside of the Frame.

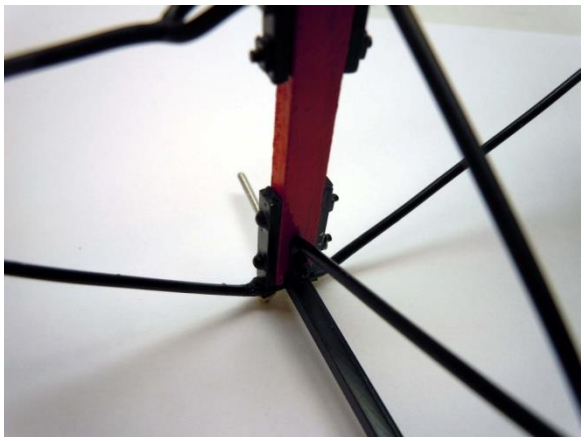


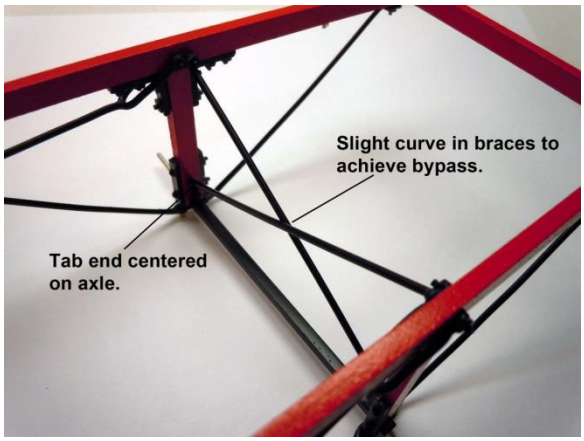
Once the glue has set locate and drill a 1/32” hole in the bottom of the Frame to receive the locating pin on the center post. Glue center post in place and then fit the front end of Brace with Bolt Heads centered on Frame side. Now add two (2) painted Square Nuts on the top surface of the frame opposite the center post. Cut a 1/16” length of threaded bolt shaft and glue it into the Nut and touch up with paint. See picture below.

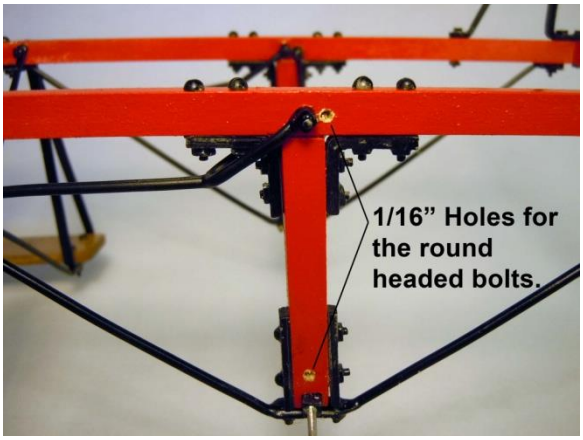


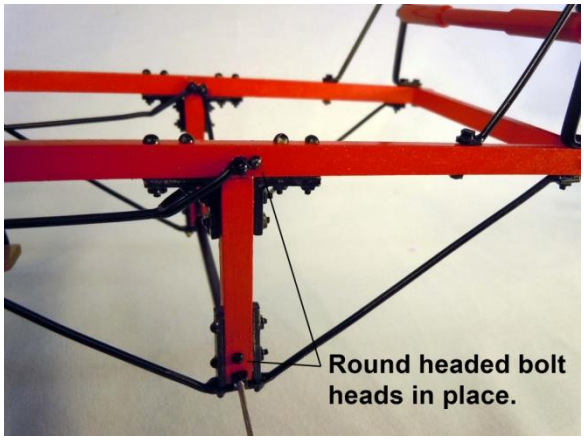


Next add the Rear Axle Cross Braces. The large tab end is centered on the Rear Axle while the other end is adjacent to the bolt of the Center Frame Brace. First a very slight curve is formed in each to achieve the bypass of each other. Once satisfied with the dry fit glue ends in place. See pictures below. Now drill four (4) 1/16” holes to receive the Round Headed Bolts opposite the inside Nuts of the Cross Braces both top and bottom.

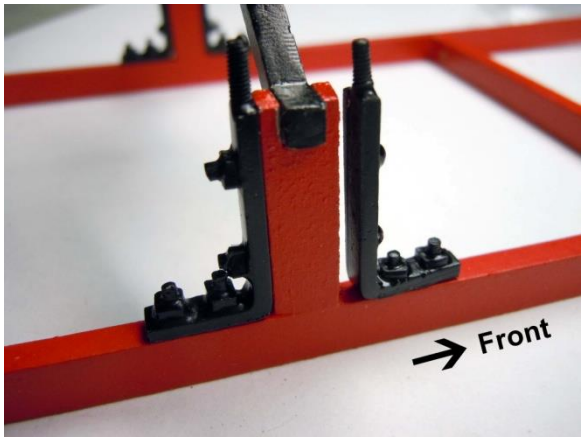


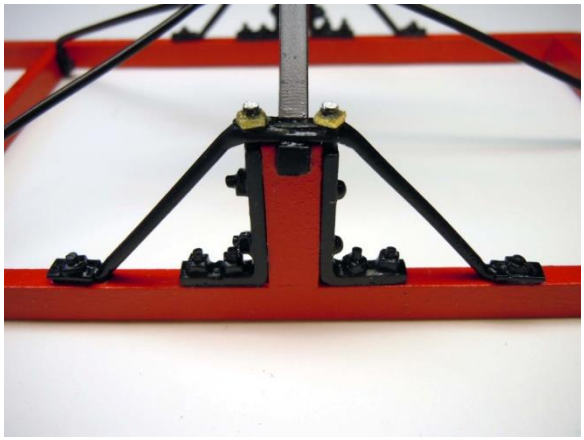






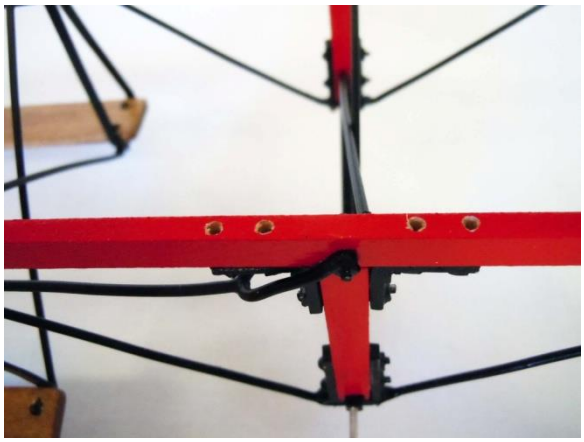
Add the Front Axle Support Brackets (4); forward two (2) with round heads and rearward two (2) with nuts. Make sure to check the angles, and that they match the Axle Support and the **Round Heads are to the front.** See picture below.

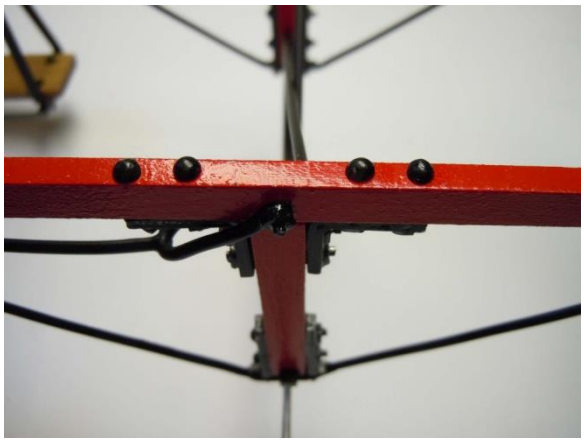




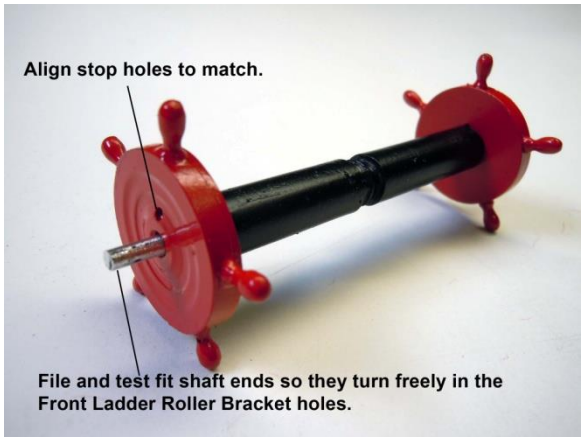
Add the Front Axle Support Braces by indexing them on the studs and the arm ends meeting flush on the frame. Then add the four (4) Gasket Nuts on the studs. File the ends of the studs as needed to the proper size. Touch up with Satin Black paint.

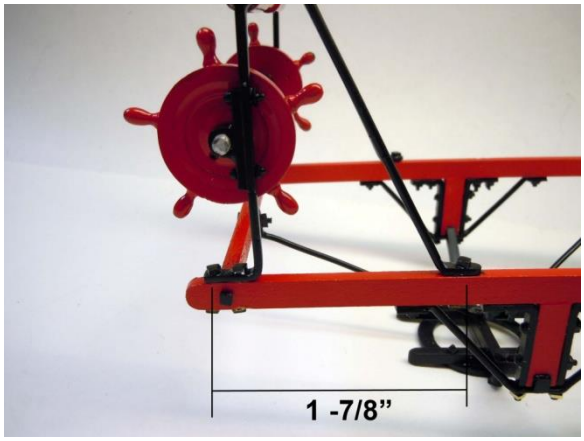
Turn the Frame upright and drill the 22 holes on both sides of the Frame for the Round Headed Bolts are over their nuts on the Axle Support Braces. First drill a **1/32" guide hole** in the 22 locations and then drill 1/16" to receive the painted Satin Black cut short 3/8" long Round headed Bolts. See the pictures below.





Assemble the Rope Reel by aligning the two (2) Rope Reel Handles with the Stop holes in line with each other. Set on a flat surface with the Grab Handles aligning the holes as seen in the picture below then glue the Handles to the Shaft. Set aside to use later.

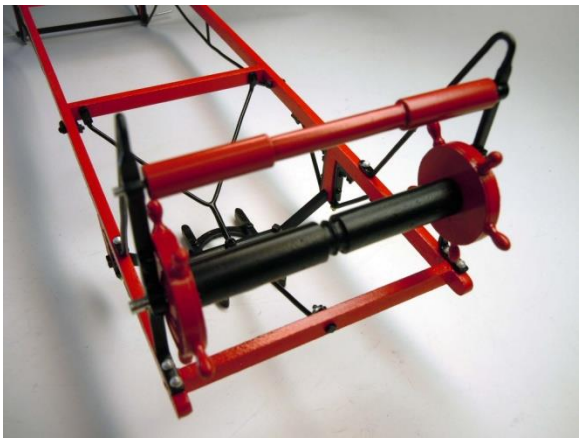




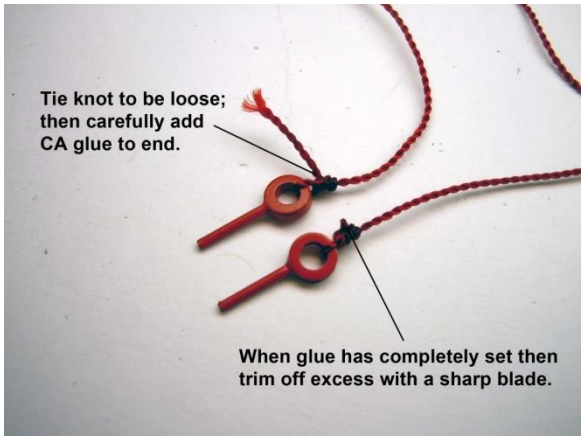
Next adjust the Front Ladder Roller Brackets such that the front holes and the holes in the arms are 1-7/8" on center. Now position the Bracket holes to straddle the location hole in the Frame and mark the holes to drill. Drill the front holes and insert a 3/8" Long Square Headed Bolt in place and mark the Arm hole and drill it. With the three (3) holes drilled on both sides position the **left** Ladder Roller Bracket in place with Square Headed Bolts in hole and glue; make sure the Bracket is vertical. Add the three (3) Gasket Square Nuts and allow the glue to completely dry.

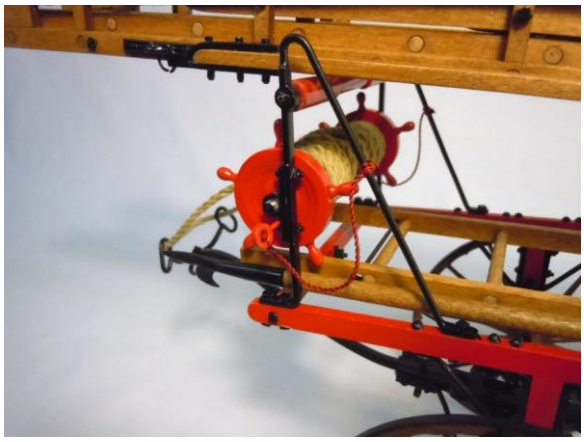
Position the Right Front Roller Bracket in place with bolts **not glued**. Carefully insert the Shafts of the Rope Reel and Ladder Roller in their respective hole on the Left Bracket.

Then close the Right Bracket onto the Shafts until in position. Glue the Right Bracket with Bolts in place making sure the Bracket is vertical. Both the Rope Reel and the Ladder Roller should turn freely.



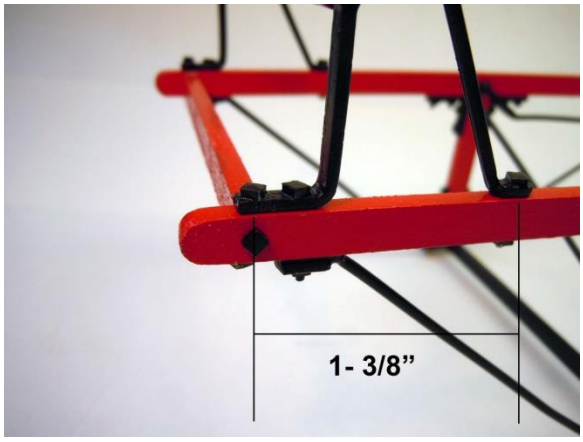
With a length of Red Cord tie a loose knot on the loop of the Rope Reel Stop. Carefully add CA glue to the short end of the Cord and when dry trim excess with a Xacto knife. Now tie the long length of Cord onto the angled arm of the Roller Bracket glue in place, carefully trim the excess Cord. Insert straight end into the hole on the Reel Handle. Repeat for the opposite side. See pictures below.

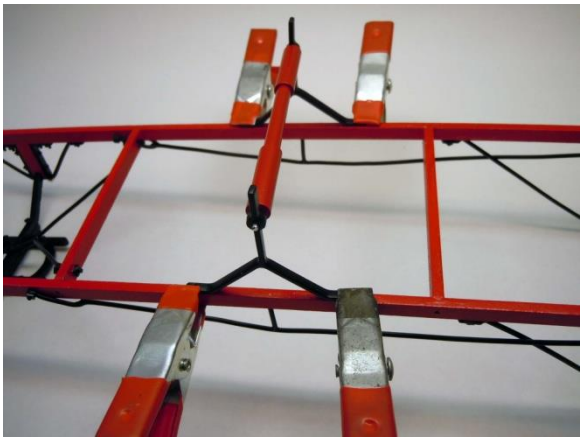




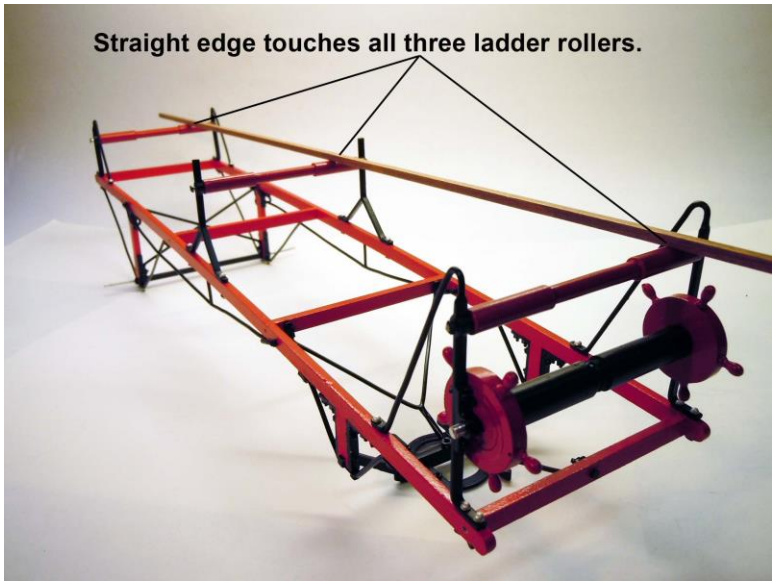
Adjust the Rear Ladder Roller Brackets such that the front holes and the holes in the arms are 1-3/8” on center. See Picture below. Position the Right Bracket so the edge is in line with the rear edge of the Cross Member; mark and drill the front holes and insert a 3/8” Long Square Headed Bolt in place and mark the arm hole and drill it. With the holes drilled on both sides position the right Ladder Roller Bracket in place with Square Headed Bolts in hole and glue; make sure the Bracket is vertical. Add the three (3) Gasket Square Nuts and allow the glue to completely dry.

Position the left Rear Ladder Roller Bracket in place with bolts not glued. Carefully insert the shaft of the rear Ladder Roller in the hole on the right Bracket. Then close the left Bracket onto the Shaft until in position. Glue the Left Bracket with Bolts in place making sure the Bracket is vertical. Add the three (3) Gasket Square Nuts and allow the glue to completely dry. The Ladder Roller should turn freely.



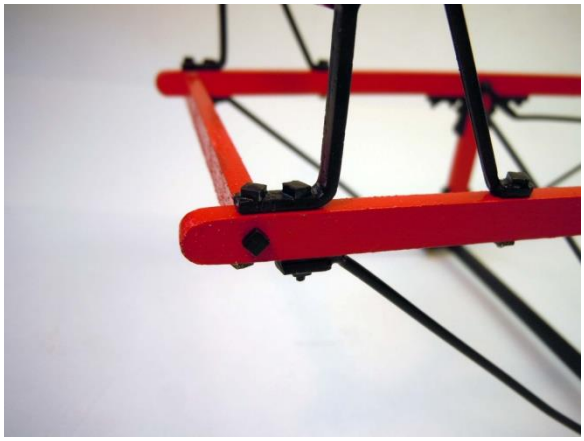


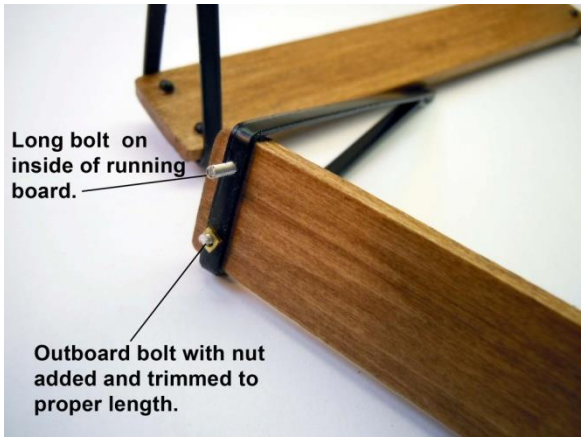
Position the two Middle Roller Brackets on center over the center post of the Frame Braces using spring clamps to temporarily hold them in place. Now using a straight edge check and carefully adjust the Bracket and clamps until the three Ladder Rollers touch the straight edge. Once achieved, glue the Middle Roller Brackets in place before removing the clamps. Then drill the bolt locations and add Bolts and Nuts. Add Square Nuts to the shaft ends of the three Ladder Rollers; be careful not to glue the Shafts to the Brackets. The Ladder Roller should turn freely.



Now using a 1/16” drill bit drill the eight 1/32” holes in the side of the Frame that were used to locate the Cross Members. Drill just enough to penetrate the end of the Cross

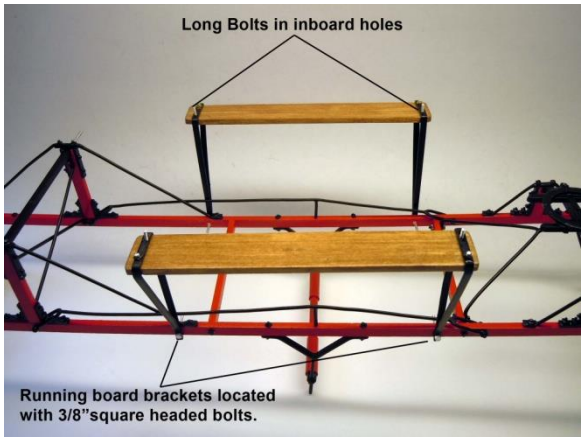
Member. Once drilled add Square Headed Bolts cut to the necessary length in each hole. See photo below.

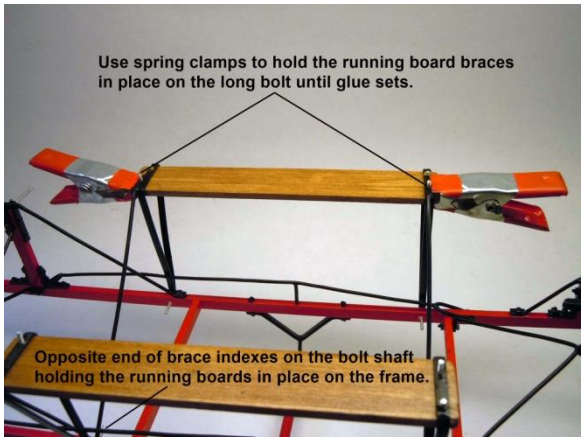




Now stain the two Basswood Running Boards with water based English Oak stain. Then spray them with a Clear Satin Finish. Align the holes in the Running Boards with those in the four (4) Support Brackets and insert eight 3/8” Long Round Headed Bolts. Then add four (4) Square Nuts to the **outboard Bolts only** and trim to length.

Add the two (2) Running Board assemblies to the laser cut 1/16” holes in the Frame with four (4) 3/8” Long Square Headed Bolts and glue in place to the Frame. Once the glue has set, turn the Frame upside down to add the Running Board Braces.





Index two of the Running Board Braces on the Running Board Bolt shafts on the same side and the other end of the Braces onto the bolt shafts holding the Running Board Support Brackets to the Frame. Glue **the brace end on the frame bolt first** and add two (2) Square Nuts and let the glue set. When the glue has set use spring clamps to hold the Running Board end of the Braces in place; add two (2) Square Nuts and glue. Repeat the same steps to the other side of Running Board Braces. When the glue has

set on all the Bolts trim the bolt shaft to proper length and file smooth then paint all the Nuts Satin Black. See picture below.

At this point the Ladder Wagon Frame assembly is finished. Look over the Frame for any paint touch ups then set the Frame aside for later use.

Wheel Assembly

Building the wheels is **very critical** and **tedious**; so they have identified numbered steps to follow for authenticity and use of a building fixture.

Build Wheel Fixture

1. Remove large square with hole in center from the 3/32” plywood sheet.
2. Locate 1/8” x 1/8” x 12” Basswood strip and cut eight (8) 1 inch pieces.
3. Glue the 1” strips diagonally across each corner of on both sides square fixture (See Photo 1).

Building the wheels:

1. Remove the four (4) plywood Wheel Rims from the 3/32” plywood sheet by cutting the tabs with a #11 Xacto knife. The larger diameter Rims are for the Rear Wheels; the smaller diameter the Front Wheels.

2. Sand and clean both the inside and outside surfaces of all the Rims to remove the burnt char residue from the laser cutting. The char has an adverse effect with most adhesives resulting in weak glue joints. **Tip:** *Use a small course needle file after the initial sanding while filing the Wheel Rim on a scrap wood surface to file the inside*

surface where the Spokes will be glued. Once clean of char then stain **only** and allow the Rims to dry.

3. Cut the large Rear Wheel paper template from the provided Elevation Plan sheet. Carefully cut out the Center Hub hole and place on the previously built wheel assembly jig with the 1/8" x 1/8" x 1 inch strips glued diagonally in the four corners. Insert and test fit the metal wheel hub into the paper template hole while also placing the wheel hub into the jig hole and check for the Wheel Hub to be concentric with the circular reference line.

4. Using double sided tape, spray glue, or glue stick the paper template with the spoke locations visible to the plywood wheel assembly jig.

5. Locate the large plywood rim onto the paper template and align the rim with the drawing of the rim perimeter and use four (4) spring clamps to hold the rim firmly in place. (See Photo 1). Insert painted (Satin Dark Tan) wheel hub with flat axle bearing surface facing up in the wheel assembly jig center hole.

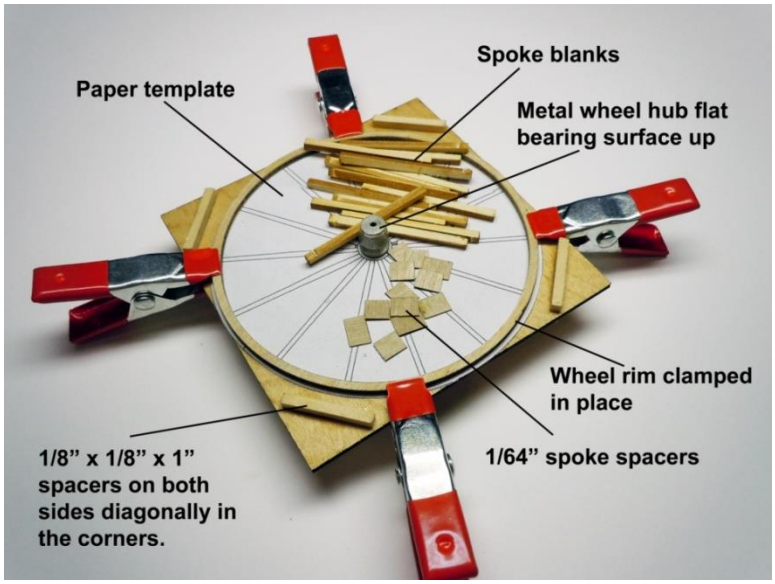


Photo 1

6. Remove fourteen (14) of the Long Spokes from the 3/32" Basswood sheet by cutting the retaining tabs on the edges of the Spokes.

7. Identify the wider end of the Spokes and mark lightly with a pencil a reference line 1/4" down from the end on all 14 spokes. With the laser cut surface up and a sharp #11 Xacto blade trim each end using the 1/4" reference mark leaving about 1/32" wood surface in the center and trim excess (1/32") off each side; then sand smooth and then stain with English Oak all the Spokes and allow to dry. (See Photo 2)

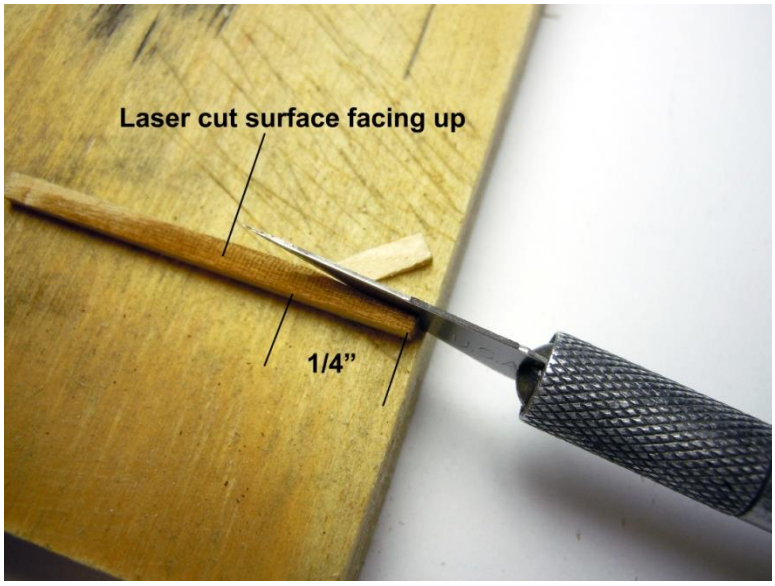


Photo 2

8. Using a pencil lightly mark on the plywood Wheel Rim the center of each Spoke location for reference.

9. Remove the spoke spacer shims from the 1/64” plywood sheet and place one under the Spoke at the Wheel Rim end of the Spoke about 1/16” from the Rim to avoid being glued to the Spoke during assembly.

10. Using Weldwood glue on the end of a round toothpick dab a drop of glue on each end of the Spoke and then insert the Spoke at a slight angle into the hub first and the other end aligned to the Spoke center reference mark and press the Spoke end against the inside of the Rim making sure the Hub end is aligned with the Hub center axle hole. Adjust as needed with tweezers and remove any excess glue at either end of the Spoke. Since this is the first Spoke **allow the glue to set** before adding the rest of the Spokes to avoid shifting.

11. Once the first Spoke glue has set a little; quickly and carefully glue the remaining Spokes in place using the Rim Spoke center location marks and justify the equal spacing around the Hub before the glue completely sets.

12. Put the assembly jig aside to allow the glue to set with the Rim clamps in place and all the Spokes in their proper position. To further assure a good strong joint add drops of CA glue carefully around the joint where the cast Wheel Hub and Spokes meet. **CAUTION:** Be careful not to glue the Wheel Hub to the assembly jig by adding too much CA glue. Allow the CA glue to set completely before removing the clamps holding the Rim to the assembly jig. (See Photo 3)

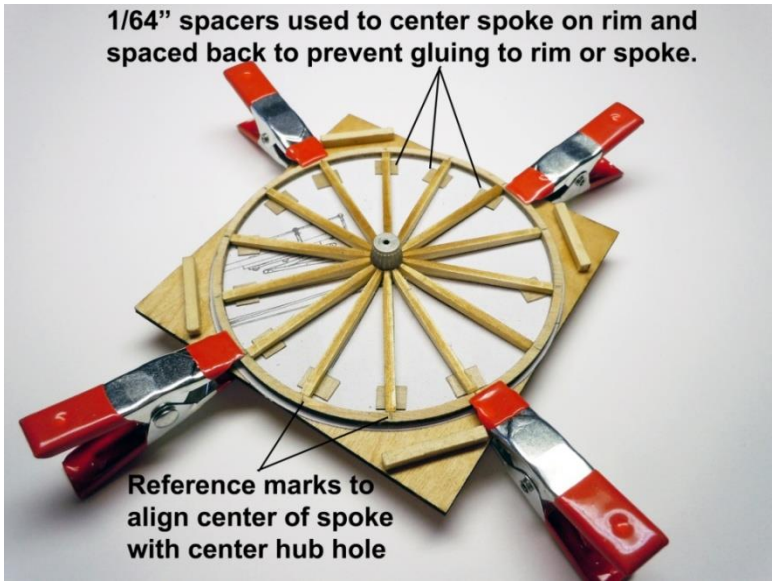


Photo 3

13. While waiting for the gluing operations (Step 12) to set; sand and clean the remaining Rims and Spokes for each remaining Wheel.

14. Once the CA glue has completely set, remove the clamps from the Wheel Rim and set the Wheel aside. Clamp the second Wheel Rim in place and repeat Steps 6 -12 for the second Large Wheel.

15. Repeat Steps 3-5 using the Front Wheel Rim sizes. Justify (equalize) the smaller Rim size with the lines on the paper template to make sure it is centered relative to the Hub.

16. Repeat Steps 6-12 using the shorter Spokes.

17. Once all the Wheels are assembled and all glue joints firmly set it is time to carefully hand carve the Spokes to their final shape using a new sharp #11 Xacto blade. This next carving step should be done **slowly, carefully and cautiously** being sensitive to the direction and hardness of the wood grain in each Spoke. When completed all the Spokes should have the same light airy feeling and be as close as possible to identical.

18. With the new sharp #11 Xacto blade proceed to carefully trim starting at the 1/4" mark on the Spoke a tapered cut down the Spoke to the Rim using the stain color as reference for the trim cut (See Photo 4). I found it easier to hold the rim with my left hand using my fingers gripping equally around the Wheel Rim and holding the wheel in my hand against my chest. I trimmed all the left side of the Spoke first; then cut the right side with the blade protruding up through the Spokes. At the Rim the trimmed angle cuts should be about 1/6 the width, or about 1/64" of the top surface of the Spoke.

When both sides of the Spoke are cut the result at the Rim should be a small half extended octagon shape. (See Photo 4) The eventual desired shape is to be a tapering oval from the Hub to the Rim.

Once one side of the Wheel has all the Spokes trim cut then do the other side. Once all the cuts are completed then carefully using a small needle file round off and smooth the Spoke to its final oval shape. All edges of the Spokes from the oval cross section at the Rim to the rectangular cross section at the Hub should be slightly rounded; no sharp edges only varying radii.

Photo 4

19. Stain the filed and sanded smoothed Wheel and Spokes making sure the upper part of the Spoke adjacent to the Wheel Hub gets stained as well as the painted Hub. The Dark Tan paint works as a base coat color for the stain to match the spokes. You may have to use a small brush to get into the tight areas. Wipe off excess stain and allow to completely dry. Repeat Steps 18 & 19 for all Wheels.

20. Using the 1/32" (#67) drill bit in a pin vise, drill holes through the Rim centered between the Spokes and down from the outside centered on the flat surface of the Wheel Rim where the tire will be located. **Note:** Do not drill two locations directly opposite each other; these will have the cast Rim joining plates added in the center. (See Photo 5).

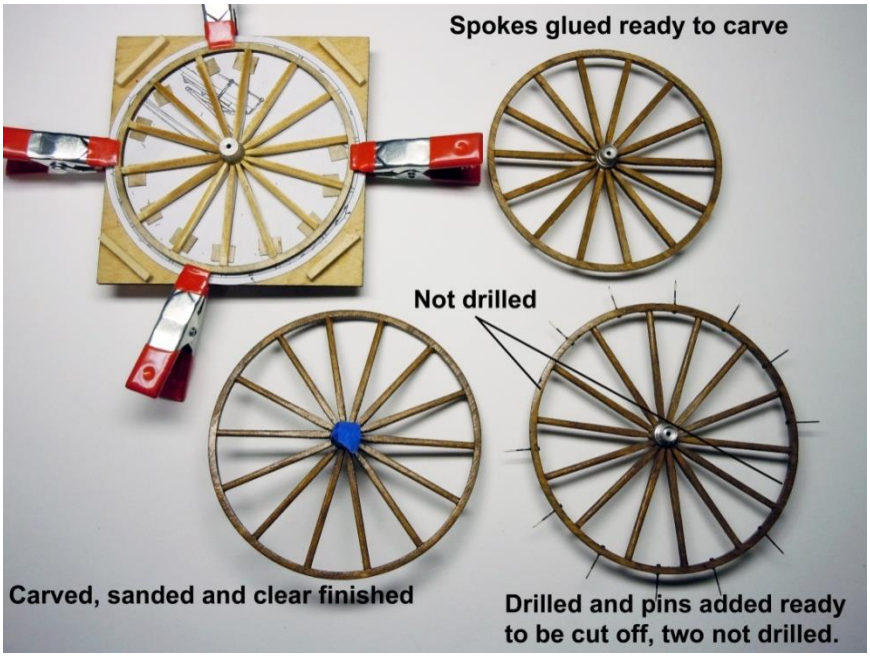


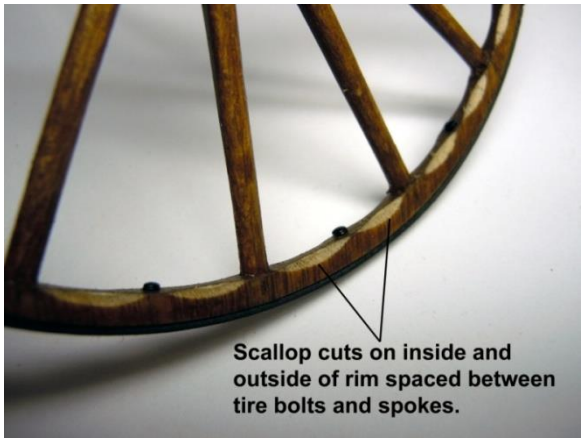
Photo 5

21. Insert painted black #8 pins (tire bolts) in the Rim holes from the inside of the Wheel; twelve (12) in total and CA glue pins in place; cut and file the pin shafts flush with the outside Wheel Rim surface and file smooth. Repeat Steps 20 & 21 for all Wheels. Should a pin loosen during cutting or filing operation just re-glue and allow glue to set.

22. Cut/score a line in the surface to the Wheel Rim sidewall centered between the Spokes with no pin holes using the Xacto blade and stain. This represents the butt joint of the two Rim halves. Now add two (2) painted Rim Joining Cleats (cast parts) to all four Wheels centered on the scored joint line. (See Photo 7)

22. Remove from 1/32" Gasket Material sheet the four (4) Tires and carefully glue in place on all four Wheels and mate the ends flush with a butt joint. Care **must** be taken to **not cut too short** with a resulting gap in the Tire.

23. Once all Wheel Tires have set; a final detail must be hand carved using care and judgment to both the inside and outside edges of the plywood Wheel Rims. Again with a sharp #11 Xacto blade remove a slight arcing (scallop) cut between the painted black Wheel Bolt (pin) heads and the Spokes. There are no cuts in the section with the Rim Cleats. (See Photos 6 & 7) This Rim detail was typical for wheels of the period to help reduce the buildup of mud on the rim surface. When cutting with a sharp #11 blade start at a spoke or bolt head and slowly cut using a slicing action with the blade and remove just a little at a time and be sensitive to the grain hardness of the plywood and use the stain as a reference gauge.



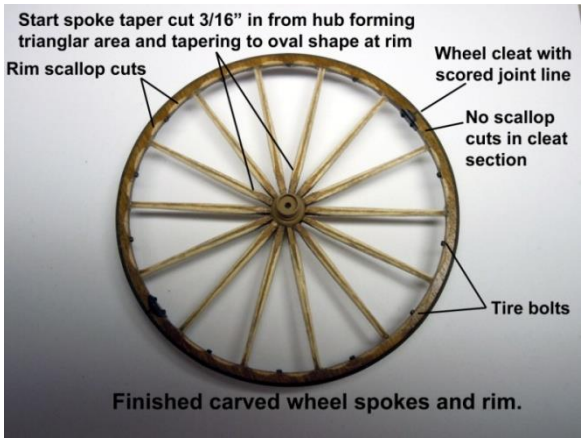
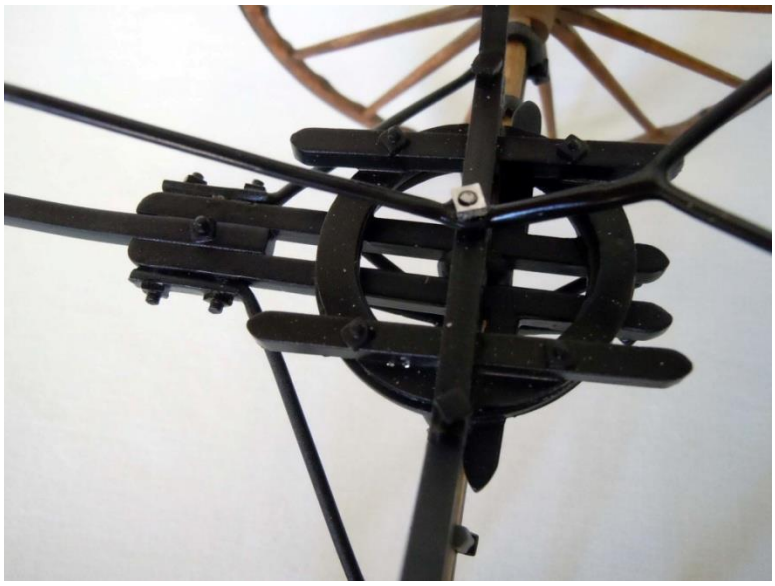


Photo 6 **Photo 7**

24. Once all Wheel Rims have been cut and stained; spray both sides of Wheels with Clear Satin Finish and allow to thoroughly dry.

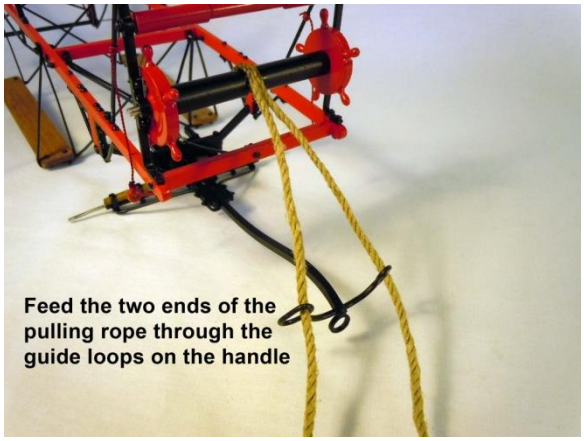
Fifth Wheel Assembly:

Take the Lower Fifth Wheel assembly and index the Bolt into the hole of the Upper Fifth Wheel Support Bracket. Now add a Square Nut to the top of the Bolt and **very carefully** glue the **Nut only** in place. The Fifth Wheel assembly should be able to turn freely. See the picture below. The Nut is not painted for clarity.



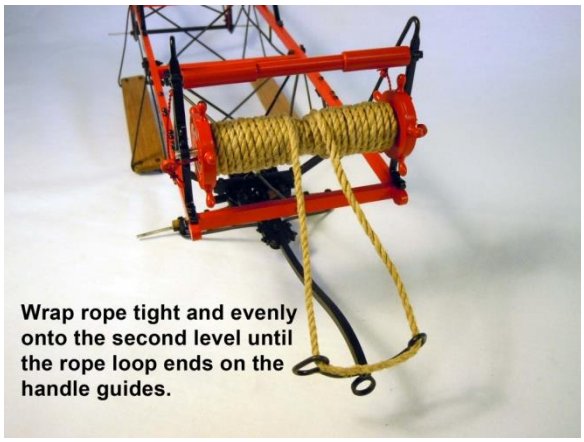
Adding the Pulling Rope:

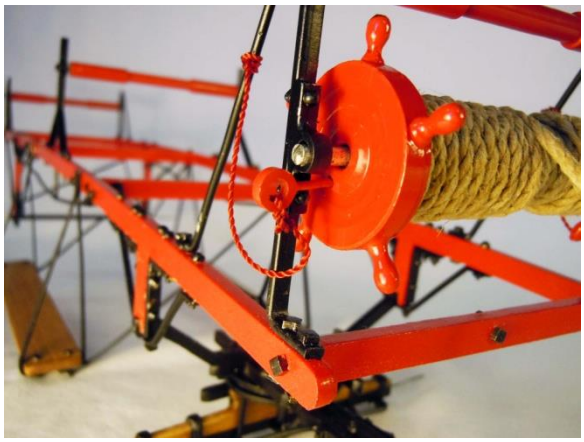
Take the 7 foot Man Pulling Rope and locate both ends; then and add CA glue to the ends just enough to form a curve to the ends that matches the center recess area of the Rope Reel. Once the ends are formed feed each end through one of the rope loop guides on the Handle see the pictures below.



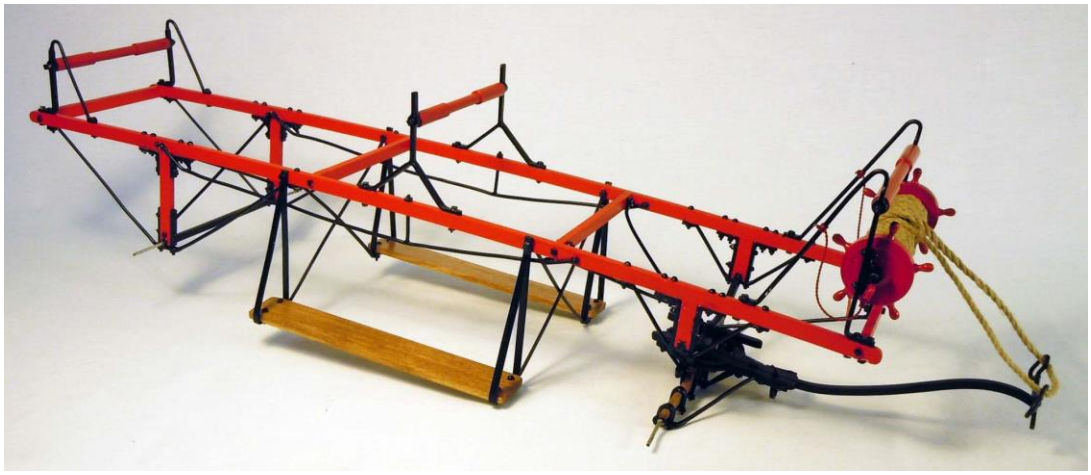
Now glue the curved rope ends into the center Rope Reel recessed area and let set. Next carefully start to wrap the rope onto the Rope Reel by turning the Rope Reel Handles with one hand and using the other hand's fingers as follower guides to keep the Man Pulling Rope tight and even which is critical. See pictures below.

Once reaching the sides of the Reel Handle carefully start the second level of wrapped Rope keeping it tight and even as seen in the pictures below. Once the Rope closes on the guide loops insert the Reel Stops into the holes in the Reel Handles on each side. Now carefully pinch the Rope at the two guide loops to square off the rope.





This should be the last step in the building of the Wagon Frame, and below is what you should have built so far.



Adding the Wheels:

Slip all four Wheels on their respective Axle locations and the Wheels should turn freely. Locate and remove from Gasket Material sheet eight (8) Large Square Nuts and index/glue two together to represent the original Wheel Nut thickness. Index four of the thick Square Nuts and slip onto ends of Axle shafts to hold Wheel in place and carefully glue. **CAUTION:** DO NOT glue the Hub to the Axle shaft. Wheels should turn freely on the Axle shaft when the glue is set on the Large Square Nuts.

Building the Hook:

Clean, file and paint the cast Hook Satin Black.

Drill on center one end of the Wood Pole 3/16" in diameter and 18" long a 1/16" hole deep enough to receive the Hook locating pin.

Stain with water based English Oak Stain the Pole (3/16" x 18") and once stained spray with a Clear Satin finish.

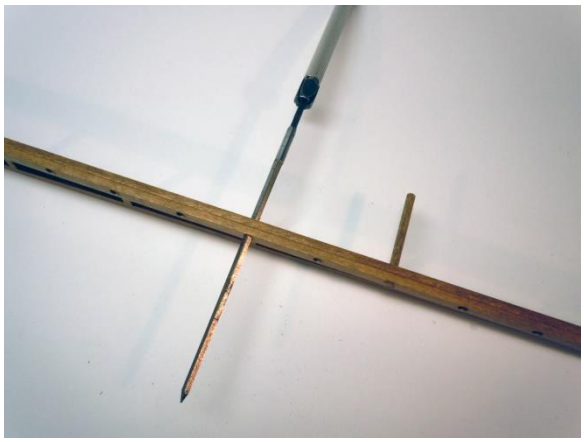
Glue the Hook onto the Wood Pole by inserting the shaft on the Hook into the 1/16" hole.

Building the One Story Scaling Ladder:

Clean, sand and stain with English Oak water based stain the two (2) Side Rails for the One Story Scaling Ladder; these are the 1/8" thick 14- 1/2" long pieces with 12 rung holes.

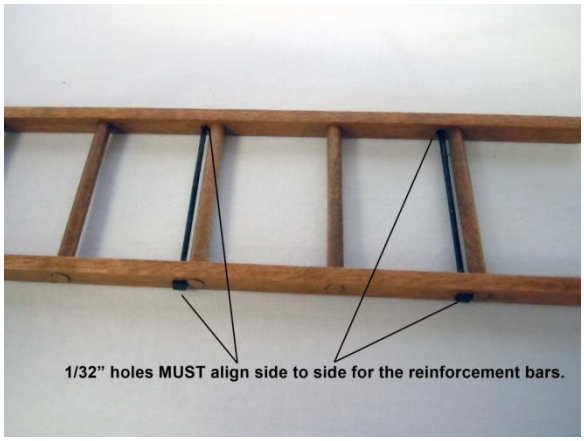
Stain with English Oak water based stain the four (4) lengths of the 1/8" wood dowels. These dowels will be used for rungs on all ladders.

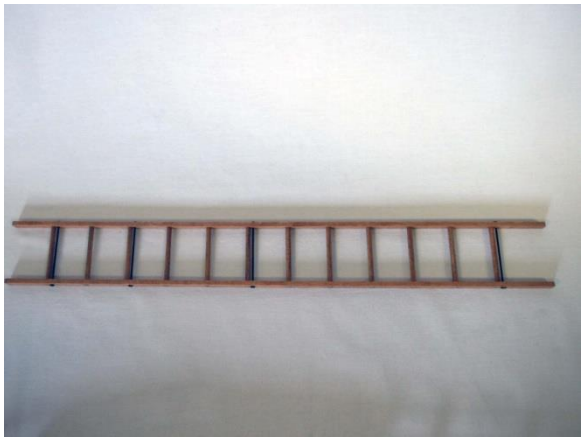
Cut 12 pieces of 1/8” dowel 1-3/4” long for the Rungs of the One Story Ladder. Due to the variations in the dowel some of the Ladder Rail holes may need to be reamed for a snug fit.



On a flat surface a small hammer can be used if necessary to seat the Rungs flush with the outside surface of the Rail. Select 12 Rungs and index them into one Side Rail only making sure all are flush to the outside surface of the Side Rail.

Now align the second side with the first; note that 1/32” Reinforcement Bars holes **must be the same on each side**. See photo below.





Start pressing the Side Rail engaging the holes carefully one at a time until all are engaged. Then hammer if necessary to have the ends flush with the outside surface. Next cut four (4) pieces of the painted Satin Black 1/32” Brass Rod to 1-7/8”. Insert the Rods into the 1/32” holes and they need to protrude enough to add a Square Nut on each end. Once Nuts are in place glue and file the end square. Once all the Rods and Nuts are in place then paint them Satin Black. Set the completed One Story Scaling Ladder aside for later use.

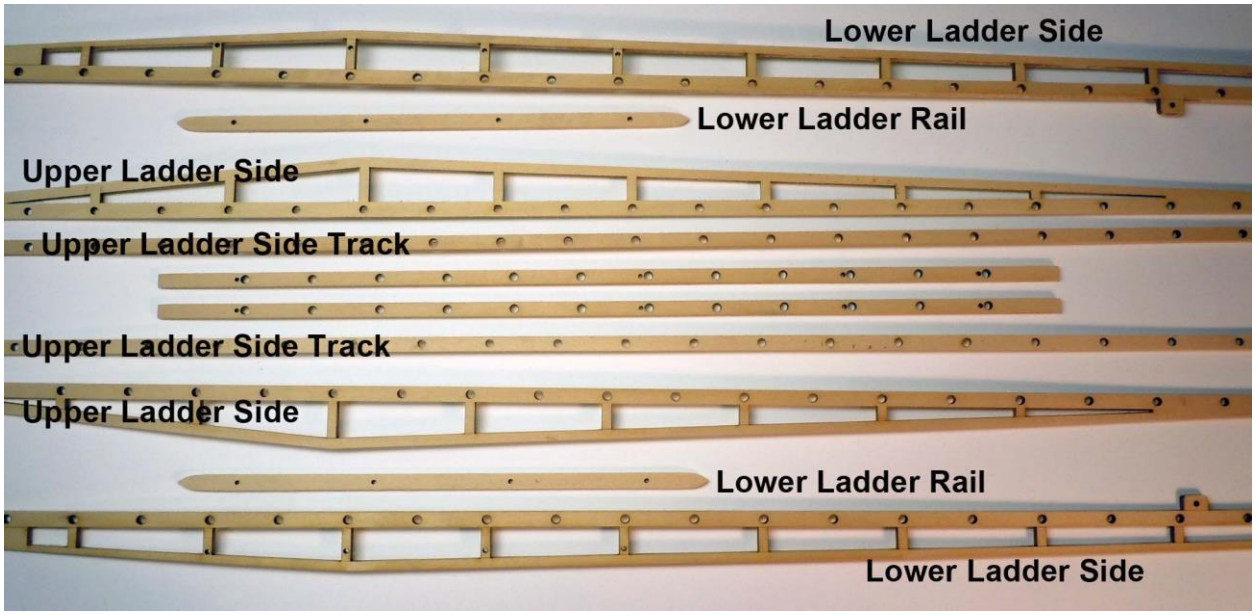
Building the Main Ladder:

Clean, sand and stain with English Oak water based stain the two (2) Side Rails for the Lower Ladder (2); two Side Rails for the Upper Ladder; dowels for Ladder Rungs; Lower Ladder Pulley Brace (1); Upper Ladder Rope Anchor Brace (1); Ladder Lifting Arms (2).

Paint the following parts **Satin Black:** Pulley Wheel (1); Pulley Wheel Bracket (1); Pulley Wheel Bracket Wing Nut; 1/2" Long Round Headed Bolt (1); Square Nut (1); Rope Cleats (2); Ladder Rung Stops (2) Rung Stops Square Pivot Rod, Rung Stop Limiting Arm (1); Ladder Cleats (4) Lifting Arm Storage Brackets (2); Rope Reel (1); Rope Reel Handle (1); Lifting Arm Top Cleats (2); Jump Rings (2); Ladder Lifting Cleats (2); 3/8" Long Square Head Bolts (8); 1/32" Brass Rods (2).

The Main Ladder is made up of two (2) Ladders; the **Lower Ladder** into which the **Upper Ladder** engages the retaining Rails mounted on the Lower Ladder. These rails also function as guides for the Upper Ladder. The Ladder Rungs are added in the same way as the One Story Ladder built earlier; with the exception of also adding cast parts while the Side Rails are added.

<u>IMPORTANT:</u> the Ladder Side Rails are Left and Right due to laser cut joint lines.



Lower Ladder Assembly:

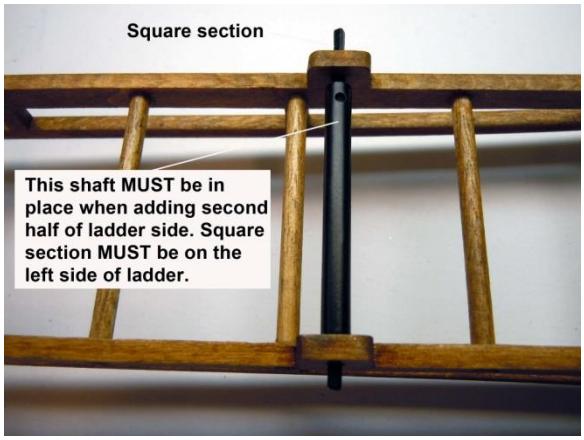
Take a Lower Ladder Side and examine it carefully to determine which side the **laser cut joints are on**. The laser cut joints face outboard on the finished Ladder.

Soak the bottom end of the **Right side** up to the fourth Rung of the Lower Ladder in very hot water and slowly form the slight curve out ward by carefully bending the end of

the side with your fingers. Use the drawings for reference of the curve. Repeat the forming of the curve on the **Left side.**

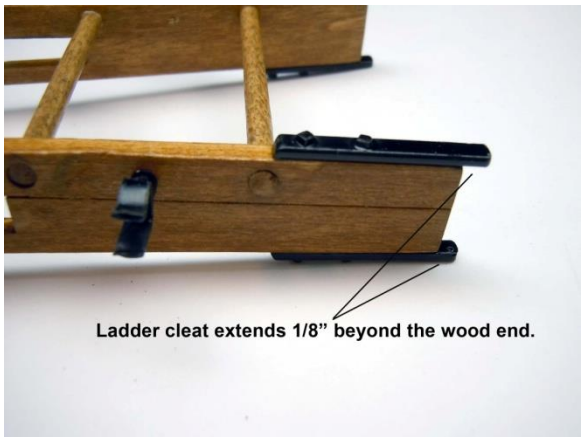
Cut 19 Rungs 1- 29/32” and add the Rungs to **Right side** starting at the top of the Ladder Side. Cut the second to last Rung 1-15/16”; and the bottom Rung 2-1/8”. **Note: due to the curve the last two Rung holes may need to be reamed to compensate for the curve.**

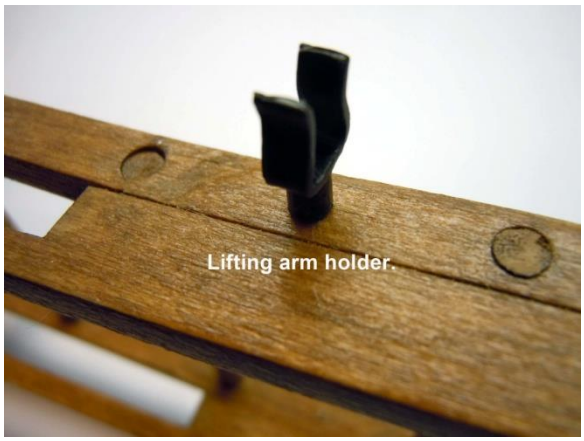
Once all the Rungs are in place on the Right Side add the Left Side starting at the top of the Ladder and work down the Ladder engaging the Rungs, **Index the Rope Reel** with the round end into the hole of the square part of the Ladder side while indexing the square end into the hole as you are adding the left side. See picture below. Check the ends of all the Rungs for flushness to each side and the bottom two may need to be sanded flush. The Rope Reel should turn freely with the square end of the shaft for the Crank Handle on the left side.



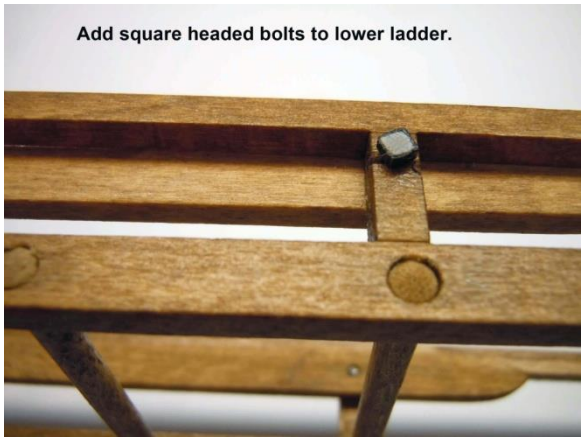
Once the Lower Ladder sides are assembled with Rungs and Rope Reel glue all joints by adding CA to the inside joints of the Rungs and Sides.

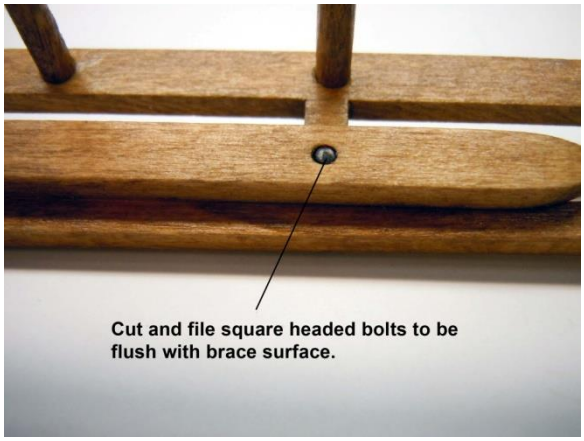
Next add the Ladder Cleats to the bottom of the Ladder side; then add the Ladder Lifting Arm Holders. See pictures below.



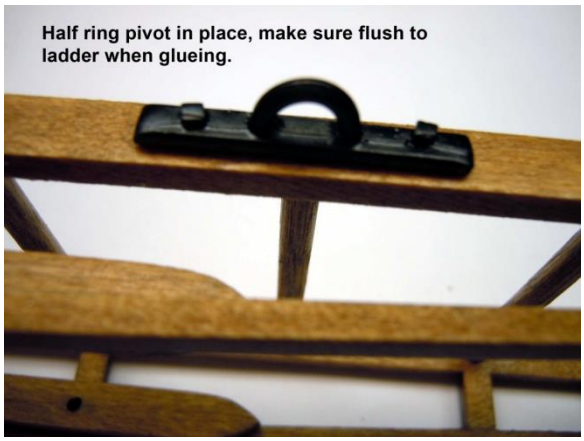


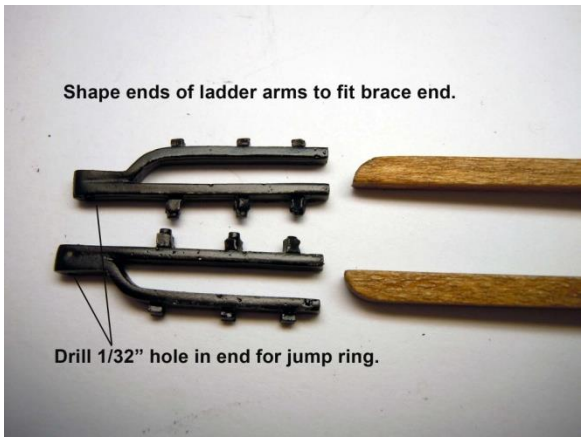
Next align the eight holes of the two Lower Ladder Rails and dry fit the eight Square Head Bolts into the holes. Then cut and file each Bolt to be flush with the surface of the Rails. Once trimmed paint the end of the Bolt first and then insert the Bolt in the hole and glue in place. Once all the Bolts are in place and the ends painted; now glue the Rails in place. See pictures below.



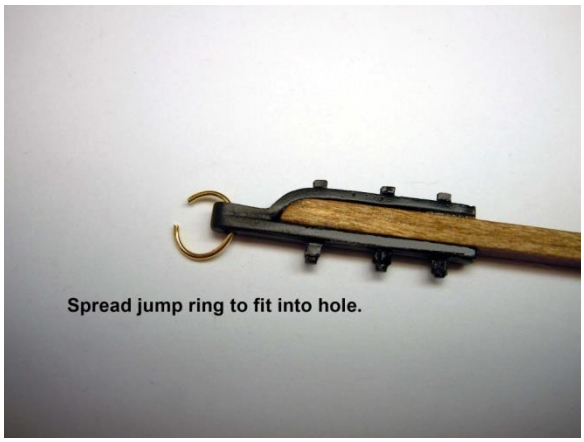


Now add the Half Ring Pivot in place into the 1/32” holes which may have to be reamed with a 1/32” drill bit. These are at the third Rung down from the top of the Ladder. See the picture below.



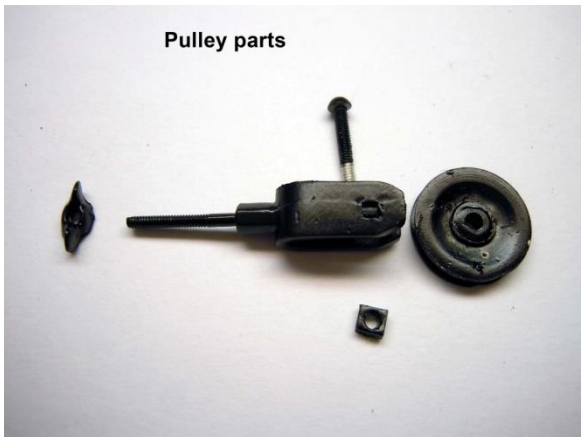


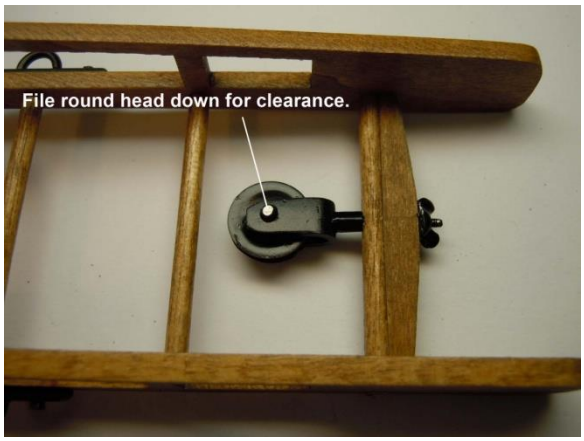
Next shape the ends of the stained Lifting Arms to conform to the Braces using a Xacto knife and files. Drill a 1/32" hole into the rounded ends of the cast Braces. See picture above.



Use a spring clamp to assure a tight fit and glue the Lifting Arm Braces in place and add a painted black, spread apart, Split Rings. See pictures above. Set the Lifting Arms aside for later use.

File a slight half round on the straight edge of the Pulley Brace to better seat against the Rung. Then stain and glue the Pulley Brace to the top Rung as seen below. Once the glue has set carefully drill a 1/16" hole on center through the Brace and top Rung. Now insert the Pulley Yoke into the hole from between the first and second Rung and then screw on the threaded shaft the Wing Nut and glue in place. As seen below. Insert the Pulley Wheel in the Yoke aligning the holes and insert a 3/8" long Round Headed Bolt and then the Square Nut to the Bolt; and **carefully** glue the Nut in place. The Pulley Wheel **MUST** turn freely. Once the glue has set; file down slightly the round head for the Upper Ladder clearance.



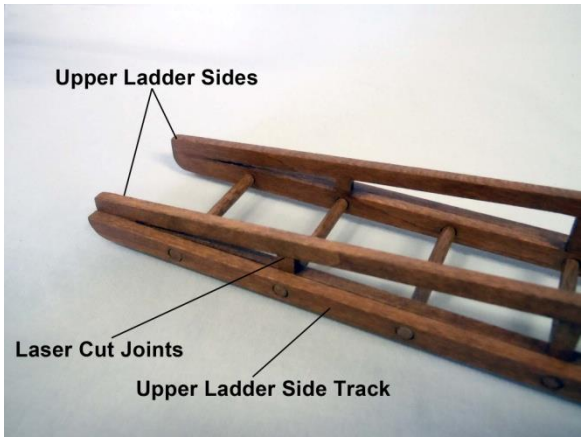


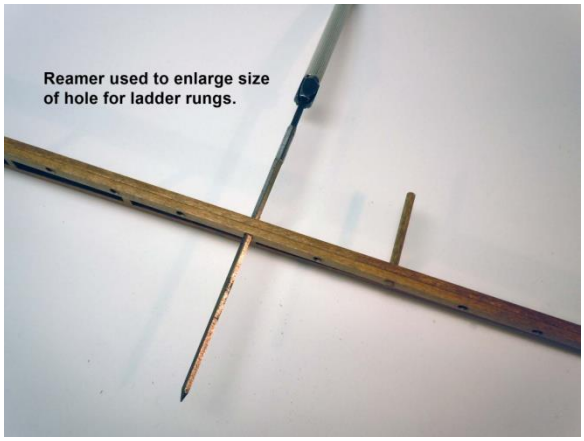
Now set the Lower Ladder aside for now.

Upper Ladder Assembly:

Select the Sides of the Upper Ladder and determine which sides have the laser cut joint lines. Then align the Rung holes of the Upper Ladder Sides to align witth the Rung holes of the Upper Ladder Side Track to the outward (laser cut) side of the Upper Side.

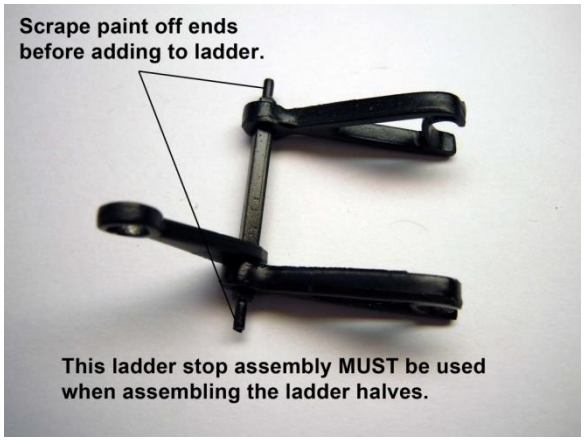
Keep in mind there is a **Left** and **Right** sides and glue the Tracks to the outboard sides. See picture below.





Cut 21 Ladder Rungs 1-5/8” long from the 1/8” dowels. Add the Rungs to **Right Side** starting at the top of the Ladder side; the Rungs need to go through both layers; the Upper Side and the Track and be flush with the outside Track surface. It also may be necessary to open the holes with a reamer. See above pictures. Set assembly aside.

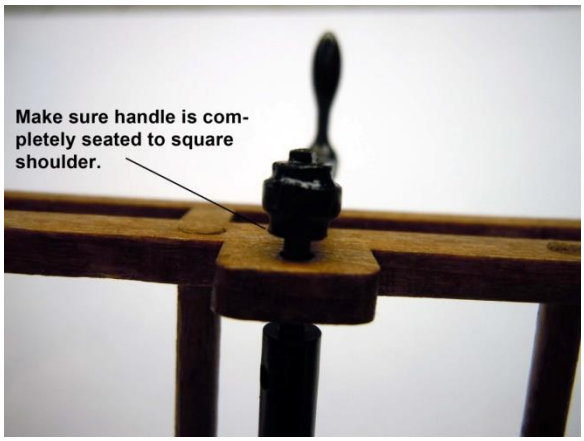
Now slide one (1) Rung Stop onto the Square Pivot Shaft; then slip on Stop Lever 110 degrees to the Stop. Now add the second Stop at the same orientation as the first one. Note in the picture below that this is the finished orientation. Glue the Stops 1/16” from the square shoulder ends where the round pivot starts. Then glue the Stop lever 1/16” from the left Ladder Stop. If the Square Pivot Shaft painted; scrape the paint from the round shaft that will engage in the wood.



With the Right Side that has the 21Rungs in place; start at the top Rungs and add the Left Side carefully working your way down the Ladder and **add the Rung Stop Assembly** round pins into the holes just above the third Rung from the bottom. Once all the Rungs are engaged check the Rung assembly to make sure it moves freely. Now glue all the ends of the Rungs to the Ladder Side.

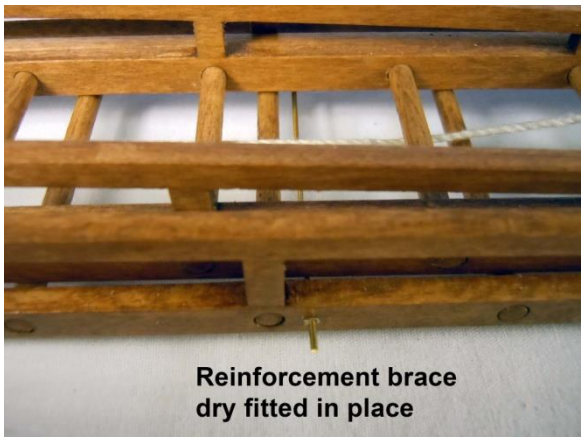
Ream and dry fit the 1/32” holes for the four (4) painted Satin Black Reinforcement Bars cut to a length of 1/32”x 1.625” (1-5/8”). Index the four (4) rods into the holes and file flush to the surface of the Side Track.

Add the stained Basswood Rope Cleat Mounting Plate. First, carefully file the mating ends to the Rung half round to fit between the Ladder Rungs five and six from the bottom. As seen in the picture below. Now glue the Rope Cleats in place on the Mounting Plate as shown below. Set Upper Ladder aside.



Hold the **Lower Ladder** in one hand and carefully index the Ladder Crank Handle onto the square section of the Rope Reel and make sure it is completely seated to the square shoulder and glue in place. See picture above.

Add the four (4) painted Satin Black 1/32” Brass Rods cut to 2-1/8” length into the laser cut holes just behind the rungs counting from the top of the Lower Ladder rung #2; #4; #10; #14 and #21. The fifth 1/32” bar is cut longer to 2-1/4”. Once each Reinforcement Brace is cut to size; add the 10 square nuts to the ends of the rods and glue in place. When the glue has set trim and file the ends and touch-up with paint.

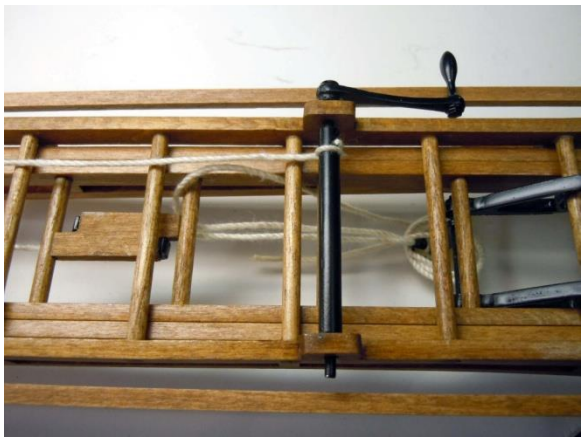


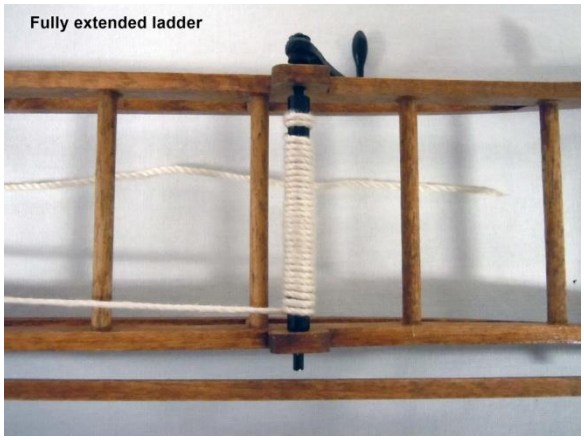
Now index the Upper Ladder into the Lower Ladder and the Upper Ladder should slide freely up and down with the Ladder Stops held out of the way. This assembly will now be referred to as the **Main Ladder**.

With the Main Ladder laying flat with the bottom to the right; using a 24” length of White Cord tie a knot on the left Rope Cleat then tie a knot through the Stop Lever loop as shown below, the Stop Lever should be perpendicular to the ground when the knot is finished.

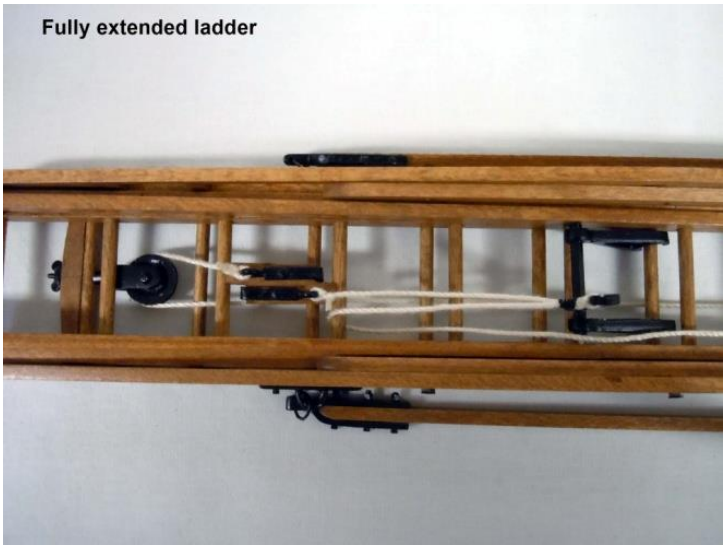
Once the knot is completed with a length of Black Cord whip the two ropes together as shown below; this will keep the longer length oriented in the correct direction. Now take the long length and index it around the second Rung to which the Rope Cleat Mounting Plate is glued to. See the picture below. This length of rope is used to pull the Rung Stops clear and allow the Upper Ladder to return down the Lower Ladder. When not in use this length of rope is formed into a loop and rested upon the Stop Lever.

Turn the Main Ladder assembly so that the underside is up with access to the Crank Handle. Insert the end of the White Cord through the hole in the Rope Reel and tie a knot. Lay the rope up the ladder and then feed the rope below the two (2) rungs below the Pulley. Turn the Main Ladder over and feed the end of the White Cord through the Pulley and then back down between the Ladders and back up before the Rung with the Rope Cleats and tie off with a knot on the Rope Cleat. See pictures below.



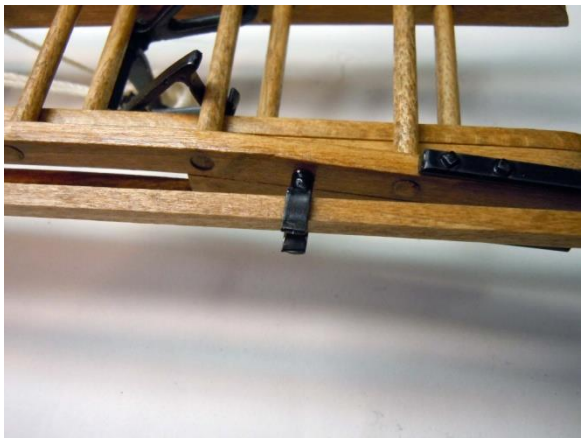


Time to test the Main Ladder; hold it up at a 45 degree angle, with knots tied turn the Crank Handle and the Upper Ladder should start to extend and when fully extended the Rope Reel should be covered like the picture above. While the Pulley end of the ladder ropes looks like the picture below. The Ladder Stops are pulled clear of the rungs with the loose end of the White Cord.

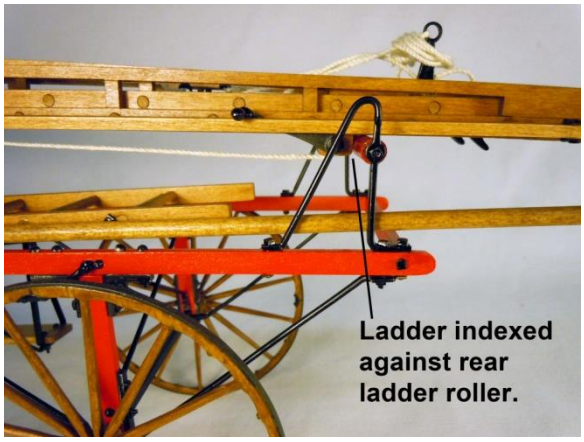


Lifting Arms:

Take the Lifting Arms that were set aside earlier and with the spread apart Split Rings engage the Half Ring Pivot on the sides of the Main Ladder. Once engaged carefully with small needle nose pliers close the Split Ring so the ends match. Once both Lifting Arms are completed; touch up the Split Rings with Satin Black paint if necessary. Now engage both Lifting Arms into the Lifting Arm Holders on the lower sides of the Main Ladder. See picture below.



The major components of the model are complete. Place the Hook and One Story Scaling Ladder in place on the Cross Members. Then rest the Main Ladder in place with the square section resting against the rear Ladder Roller. See pictures below.



Following are a random selection of reference photographs of the finished model.