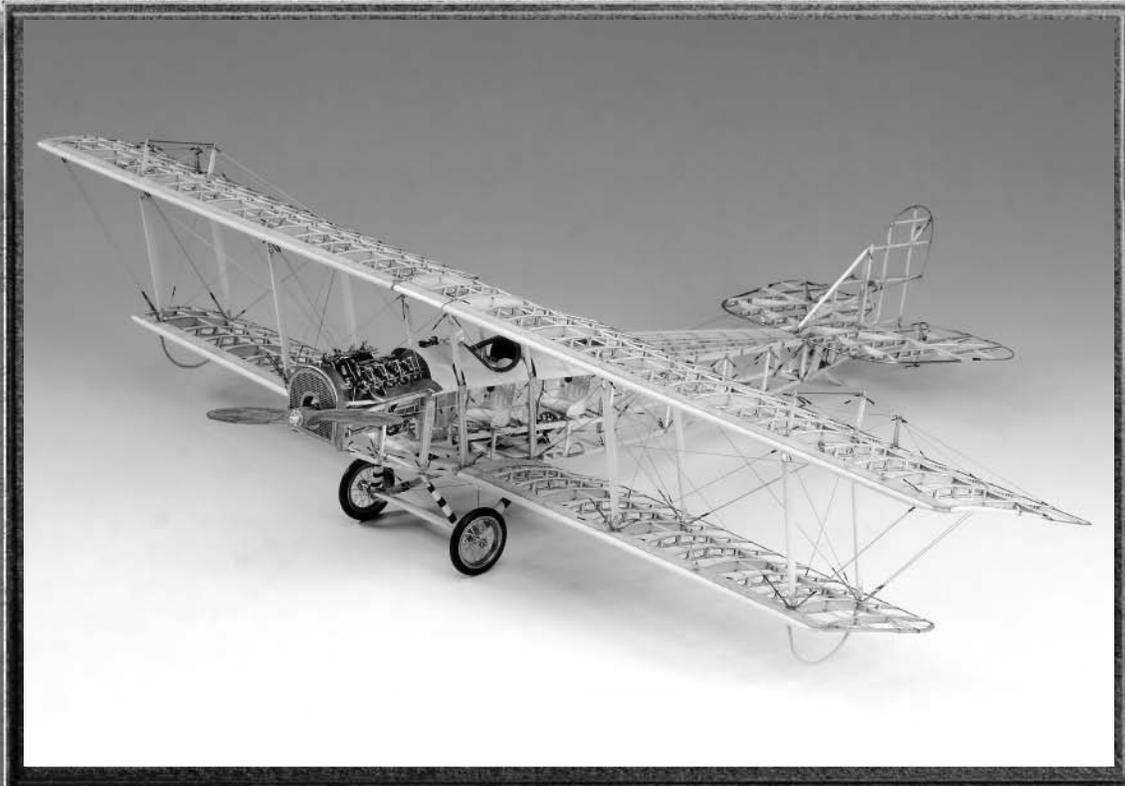


# MODELING THE CURTISS JN-4D JENNY ◆ 1917 ◆



**PREPARED BY BEN LANKFORD**

### Technical Characteristics

SCALE:  $3/4" = 1' 0"$  (1:16)

WINGSPAN:  $32-1/2"$  (826 mm)

FUSELAGE LENGTH:  $20-1/2"$  (521 mm)

**MODEL AIRWAYS**



Manufactured by Model Airways  
A Division of Model Expo, Inc., Hollywood, FL  
<http://www.modelexpo-online.com>

**Model Airways Kit No. MA1010**

# HISTORY

The *Jenny* biplane was introduced in 1916 and manufactured by the Curtiss Aeroplane and Motor Corporation in Hammondsport, New York. The *Jenny* name was coined from the JN series. Not a combat aircraft in World War I, but it became an important trainer for pilots of the United States Air Service. The aircraft became more famous after the war, being used as a barnstormer and mail carrier. More than 6000 aircraft were built. The most produced and most popular model was the JN-4D. More than 3000 were built. Some 1200 were produced in Canada and known as Canuck JN-4CAN. About 1000 aircraft, mostly JN-4D's, were built by other US firms such as Springfield Aircraft Corporation, St. Louis Aircraft Corporation, and Liberty Iron Works.

The *Jenny* has a wingspan of 43 feet 7 inches and weighs 1430 pounds. She flies at a speed of 75 mph, has an endurance of 2.5 hours, climbs to 2000 feet in ten minutes, and the service ceiling is 11,000 feet. The aircraft is manned by a crew of two and is powered by a Curtiss OX-5 in-line V8, water-cooled engine. Thousands of these 90 HP engines, first manufactured in 1910, were used in the *Jenny* and other aircraft.

Besides the JN-4D model, there were other minor variations in the models JN-1, 2, 3, 4, and models JN-4A, 4B, 4C, JN-4D2, and JN-6H. Some had engines mounted with no engine-prop down thrust, some had wings with less stagger (10" to 12" as opposed to 16" on JN-4D). Other variations included a different stabilizer shape, more dihedral in the wings (up to 4 degrees), and a longer lower wing length. All in all, however, all models looked pretty much the same.

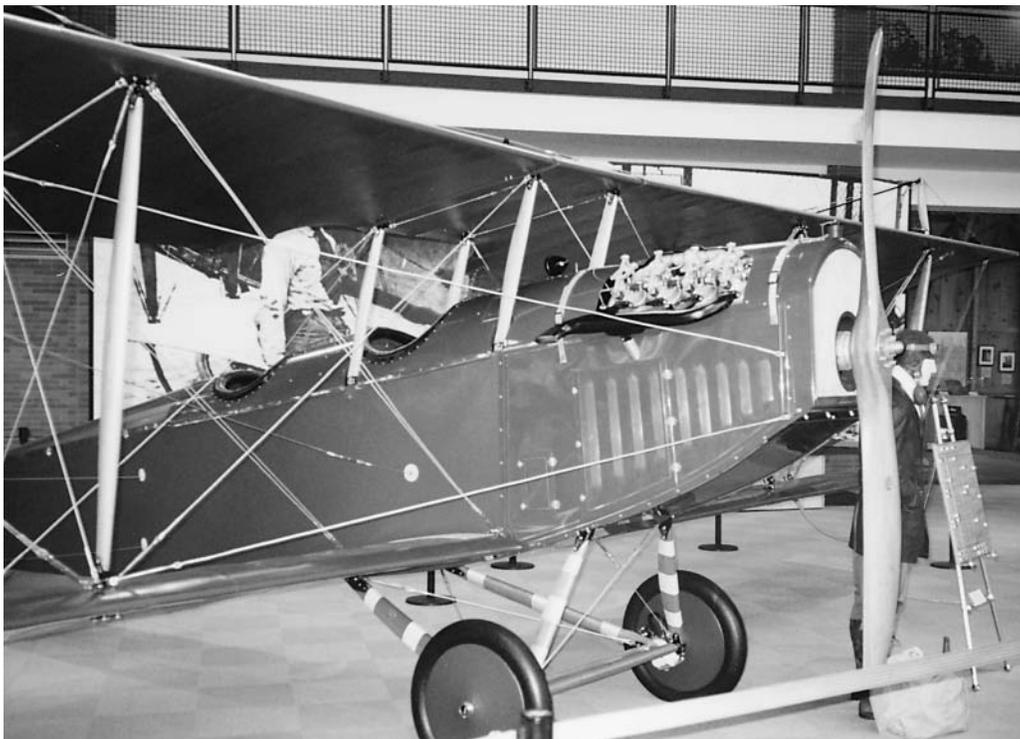
The prototype JN-4D had ailerons on both wings, but the production models eliminated the lower wing ailerons. Earlier

aircraft used a wheel for controlling the rudder, but the D model used sticks. Quite a few *Jenny*'s have been restored and are still flying today. Restored aircraft can be found in museums around the country, including the Smithsonian Institution's Garber Preservation Facility) in Suitland, Maryland outside Washington, DC; College Park Aviation Museum in College Park, Maryland; Curtiss Museum in Hammondsport, New York; and the History and Traditions Museum at Lackland Air Force Base in San Antonio, Texas, to name a few.

To see a *Jenny* in action, an outstanding video is *It's Gotta Be a Jenny*. This is a 1989 film by the EAA (Experimental Aircraft Association) Aviation Foundation's Paul Harvey Audio-Video Center, in Oshkosh, Wisconsin. It has a good history and vintage footage of the *Jenny* as a military trainer and a barnstormer. The video highlights Ken Hyde's restoration of a *Jenny* with scenes of its initial flights. The video has some wonderful color photography of several restored *Jenny*'s close up and in flight. These scenes are from a 1989 reunion of these historic aircraft held in Oshkosh. Lots of different color schemes and markings.

Several photos of a *Jenny* restored by Ken Hyde are shown throughout these instructions. Refer to the credits below for more information about Ken Hyde himself.

For more flight scenes and close-ups, look for the 1975 movie of *The Great Waldo Pepper* with Robert Redford. There is also an outstanding video available entitled *World War I: America Takes To The Air, Volume III*. This video has early film shots of pilots training in *Jenny*'s. The film was shot at various locations, including Minneola Field, NY, and Kelly Field in Texas. The video was copyrighted in 1993 by Aerofilm.



*Ken Hyde's restored Jenny at the Maryland Museum*

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## INTRODUCTION

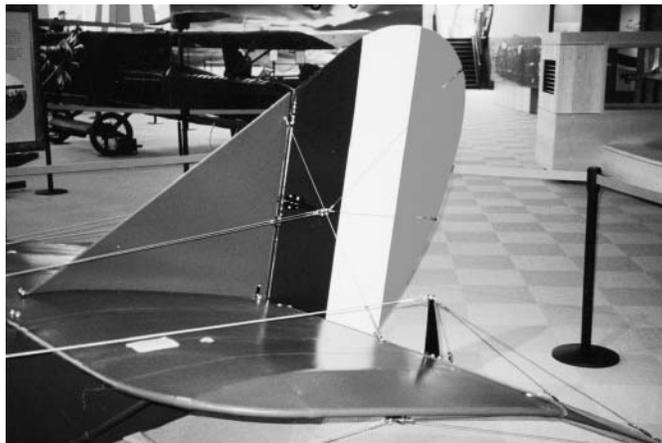
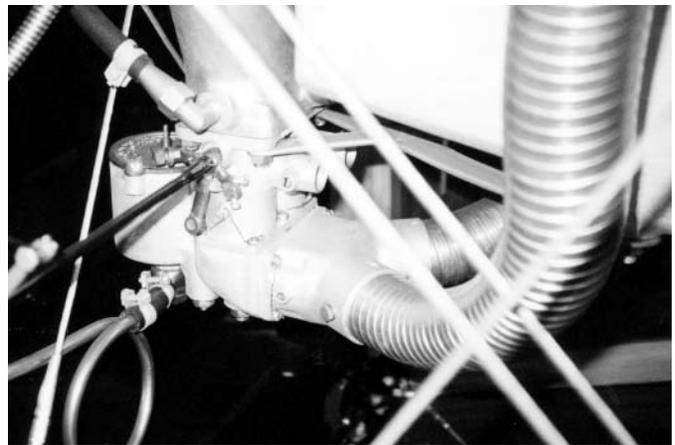
# MODELING THE CURTISS JN-4D JENNY ◆ 1917 ◆

PLANS AND INSTRUCTIONS BY BEN LANKFORD, VIENNA, VA  
PROTOTYPE MODEL BY BOB WERNER, HOLLYWOOD, FL

Model Airways developed its *Jenny* kit between 1999 and 2001. The design is based on factory drawings of *Jenny* aircraft, along with historical photographs, and photographs of restored *Jenny*'s in museums and private owned aircraft that are still flying today. Because of varying dates on many of the references, and knowing that changes were made over a period of time, the design depicted by Model Airways may not represent any one particular aircraft. Most modifications found in the various references were minor detail changes, so the overall design is representative of a typical *Jenny*. Many thanks to the subscribers of the *World War I Model E-mail List* for their assistance with various details of the aircraft. The Internet home page address for the list is <http://www.pease1.sr.unh.edu/1/index.html>, and the site is

maintained by Allan Wright. You will find some great information and a gallery of some fine WWI models on these pages. The home page provides instructions for joining the mailing list if you are interested.

Thanks also to Ken Hyde from Warrenton, VA, an expert builder and restorer of full-size antique aircraft, including the *Jenny*. Ken answered many questions that had me puzzled while developing the kit design. Ken, who is 61 years of age at this writing, is a former American Airlines captain and Boeing 727 pilot. Ken's interest in antique planes obviously came from his father, John "Captain Johnny" Hyde, a barnstormer in the early 1900s. Ken's latest project is a replica of the Wright 1903 Flyer, which he intends to fly at Kitty Hawk at 10:35 a.m., December 17, 2003, as the Wright brothers did 100 years earlier.



*Clockwise from upper left: Interplane Wing Strut Fitting, Carburetor, and Tail Surface and Rigging, as they appear on restored examples of the Jenny airplane*

## Before You Begin

The *Curtiss JN-4D Jenny* is an interesting aircraft and makes a splendid model. The kit is intended as a structural model without any fabric covering. Most every detail of the real aircraft has been included as model scale permits. While your model structure will be glued together, the original real aircraft had little glue if any. Most of the wooden structure was joined with many small wood screws and metal clips. However, some of the restored *Jenny's* now use glue in addition to the screws, since better glue is now available.

Britannia, photo-etched metal, and wooden fittings eliminate creating many parts from scratch. However, some require final finishing before they are suitable for the model. This is especially true for the britannia castings and will be discussed later.

Always complete one construction stage before moving to the next. When things go awry, consider doing them over.

## Necessary Construction Tools

The following tools and supplies are recommended for the construction process. Modelers who have built before may have their own favorites.

### A. Knives and Saws

1. Hobby knife with No. 11 blades
2. Razor saw or jeweler's saw

### B. Files

Set of needle files

### C. Clamps and Pins

1. Alligator clips (some with and some without teeth)
2. Wooden clothespins (craft shops have small versions of the design)
3. Rubber bands
4. Package of straight pins or florist pins with plastic heads

### D. Boring Tools

1. Set of miniature drills
2. Pin vise

### E. Miscellaneous

1. Tack hammer
2. Tweezers (a few)
3. Small fine-pointed scissors
4. Miniature pliers
  - a. small round
  - b. flat nose
5. Wire cutters (for cutting steel and brass or copper wire, rod, and strip metal)

### F. Sandpaper

Fine and medium grit garnet or aluminum oxide sandpaper (#100 to #220), and #400 wet-or-dry paper for fittings and final wood sanding

### G. Glue

White glue, Carpenter's wood glue (yellow in color), and Cyanoacrylate glue (super glue) can be used for most of the

model. Five-minute epoxy provides extra strength for gluing fittings. The best super glue for most applications is a medium viscosity gap-filling type. The watery thin type is recommended to fill a narrow crack by capillary action.

### H. Power Tools

While not really necessary, one power tool would be advantageous for this kit. The kit contains several sizes of steel music wire that is extremely hard. A Dremel or other rotary tool fitted with a small fiberglass-reinforced cut-off wheel is ideal for cutting off and flattening the ends of steel music wire.

### I. Building Board

A soft but stiff board, such as acoustic ceiling tile or insulation wallboard, to easily take straight pins for holding parts during assembly. This soft board should be nailed or glued to a hard board so it will be flat. You can use a table, but a portable board is good for turning it around to make the work easier.

## Working with the Plans & Parts

Before starting the model, carefully examine the kit and study the plans. First, determine if all the listed parts are present. Handling them will produce a better understanding of the kit's requirements. Try to visualize how every piece will look on the completed model. Also, determine the building sequence – what must be done first – ahead of time. The instructions will help, but a thorough knowledge of the plans at the outset is essential. Be especially aware of when to rig the many brace wires in the fuselage. There are a lot of parts that must be added inside the fuselage. The brace wires would get in the way if rigged too soon.

To avoid losing small fittings and hardware, sort them into labeled boxes or compartments. These should have lids to keep out dirt.

### 1. The Plans

Six plan sheets are provided:

1. Laser-Cut Wood Patterns and Fitting Sketches
2. Upper and Lower Wing Assembly and Details
3. Basic Fuselage Assembly and Details
4. Tail Surfaces and Landing Gear Assembly and Details
5. OX-5 Engine and Cockpit Controls Assembly and Details
6. Component Assembly and Rigging Details

Model Airways' *Jenny* kit is manufactured to a scale of  $3/4" = 1' 0"$  (1:16). Each sheet is drawn to that scale except areas enlarged to show detail. Most of the enlarged details are double scale, and designated 2X ( $1-1/2" = 1'0"$ ). Most dimensions can be lifted directly off the plans by using draftsman dividers or a "tick" strip (piece of paper such as an adding machine roll). Lay the paper strip

over the plan, carefully mark the item's length with a sharp pencil, then transfer the marks to the wood.

Because these are model building plans, actual measurements were converted to model inches. For comparison,  $1/16"$  on the model is equal to  $1"$  on the real aircraft,  $1/8"$  is  $2"$ , and so on. The table below compares full-size dimensions with scale model inches and millimeters:

## SCALE CONVERSION TABLE

Full Size Inches	Model Scale Inches	Model Scale Millimeters
1/4"	1/64"	0.40mm
1/2"	1/32"	0.79mm
3/4"	3/64"	1.19mm
1"	1/16"	1.59mm
1-1/4"	5/64"	1.98mm
1-1/2"	3/32"	2.38mm
1-3/4"	7/64"	2.78mm
2"	1/8"	3.17mm
2-1/4"	9/64"	3.57mm
2-1/2"	5/32"	3.97mm
2-3/4"	11/64"	4.37mm
3"	3/16"	4.76mm
6"	3/8"	9.53mm
9"	9/16"	14.29mm
12"	3/4"	19.05mm

### 2. Parts

Laser-cut wood parts, photo-etched parts, and britannia castings are designated by a letter-number (such as *W1*, *F4*, *R2*) on plans and sketches. A part noted such as *L2R* or *L2L* would indicate a right or left hand part. You may also see some similar parts labeled, for example, *R3A* and *R3B*. Parts are classified generally in the following letter categories:

**C** – CONTROLS: AILERONS, RUDDER, ELEVATOR

**E** – ENGINE, ENGINE PIPING, ENGINE CONTROLS, RADIATOR, FUEL TANK, PROPELLER

**F** – FUSELAGE

**L** – LANDING GEAR, TAIL SKID

**R** – RIGGING FITTINGS COMMON TO VARIOUS LOCATIONS

**S** – STABILIZERS, RUDDER, ELEVATOR

**W** – WINGS

Wood strips and sheets, rod, wire, tubing, rigging cord, and similar parts which must be cut from longer pieces have no letter designation. Rather, only the dimension of these items is shown on the plans.

A parts list is included in each of the construction stages, noting the parts required for that particular stage. A **Master Packaging Parts List** (separate from these instructions) is provided that lists the quantities included in the kit. For wood strips, sheets, rod, wire, tubing, and rigging, one or several pieces are provided in the kit as noted on the master packaging parts list. Each of these have been assigned a Model Expo (Model Airways) WP stock part number. These parts must be cut to length or shape according to the dimensions shown on the plan.

### 3. Kit Lumber

Strips and sheets of solid basswood or birch plywood are supplied in the kit. Sort the wood in the kit by thickness to save time. After selecting and cutting what you need, return the remaining stock to the proper thickness and wood-type pile. Don't worry about using a piece for one item intended for another. Model Airways supplies enough extra wood to complete the model before running out.

### 4. Britannia Metal Parts

These parts will require final finishing before mounting on the model. First, remove mold joint flash with a #11 hobby blade, then file or sand with fine sandpaper. Clean out any holes using a drill bit or reamer. Some of the smaller holes may not be completely formed. Also, if another part must fit in the hole, ream the hole if necessary for the parts to fit. Wash fittings in dishwashing liquid and warm water to remove traces of mold release agent and the body oils your fingers deposit. Allow to dry thoroughly.

### 5. Photo-Etched Parts

Cut the sprues off the parts with a sharp hobby blade on a hardwood backing, or use a sprue cutter. File any remaining sprue to smooth out the part. Some photo-etched parts must be bent to conform to the shape shown on the plans, and lengths or configuration may be modified for the same part to fit different locations. Bend parts using flat nose or needle nose pliers. Don't try bending with your fingers.

### 6. Rigging Cord

On the real aircraft, the flying and landing wire rigging and cross brace wires are 1/8"- or 5/32"-diameter stranded steel wire. For the kit, however, gray nylon cord is provided to make it easier to rig. All of the cord should be beeswaxed to protect it and cut down fuzz.

### 7. Setting Up the Plans

Build the wings, vertical and horizontal stabilizers, elevator, and fuselage sides directly on the plan. Place the plan on your building board and cover the plan with waxed paper or plastic wrap. Be careful applying glue, especially super glue. Although the waxed paper or plastic wrap protects the plan somewhat, you could accidentally glue the protective sheet to the model parts, or even to the plan itself. Plastic wrap is really a bear to remove if it is accidentally glued to the model with super glue. Use small applicators such as a commercial Microbrush or toothpick for applying the glue. You don't need a lot of glue for the aircraft's fragile parts.

### 8. Part Identification and Readiness

All the laser-cut wood, britannia castings, and photo-etched copper and aluminum parts can be identified by the patterns and sketches shown on Plan Sheet 1.

Before starting each stage, have all the parts required for the stage, such as laser-cut parts, britannia castings, photo-etched parts, stripwood, rod, and rigging, identified and ready to use. Sand wood parts as required to get rid of any fuzziness and prepare the castings and photo-etched parts as noted in Paragraph 4 and 5 above.

### 9. Bending Wood Strips

During the process of building the model, you will be advised to heat-bend some wood, such as fuselage longerons, wing tips, and wing skids, to conform to a specific curve. A good way to do this is to use an aluminum tip with a flat end filed to a 45-degree angle. Fit the tip in a 20- to 30-watt soldering iron. First, soak the wood in cold water for 5 or 10 minutes. Remove the wood and let it sit and dry out a bit for another 5 minutes. It won't completely dry out. Then take the soldering iron and press on the wood, moving along bending the wood to shape as you go. If necessary, press over a form shaped to the

curve. The heat applied will easily bend the wood, and the formed shape will remain after the wood is dry.

## Painting & Staining the Model

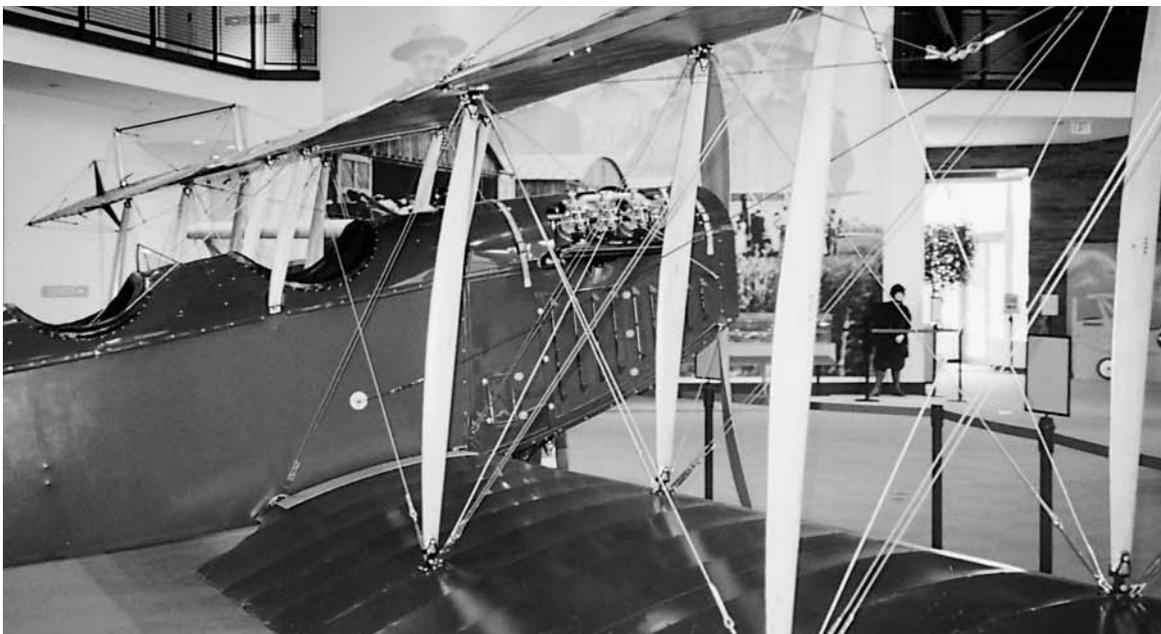
The *Jenny* model need not be painted or finished at all. However, it is recommended that you stain the wood parts and seal the britannia castings for protection. A light tan stain on all wooden parts will help to make the entire structure uniform in color.

Some parts could be painted, such as the radiator and the fuselage cockpit cowl. This would add a nice contrast to the otherwise unpainted model. Since many color schemes were used on various models, you will need to do a little research on your own for proper colors. You could also paint fittings such as wing strut fittings and fuselage clips copper color or black for contrast. If black is your choice, consider using Blacken-It, a chemical rather than paint. Steel rod represents steel tubing on the real aircraft. These can be left as is or painted a light gray color. Cast cockpit fittings can also be painted gray or just varnished.

**Sanding and cleaning:** Sand all wood surfaces with 220-grit dry sandpaper, followed by 400-grit, and wipe off all dust thoroughly. A tack rag would be helpful.

**Brushing and stains:** A soft artist quality brush can be used to apply stain to the parts. Model Shipways or Minwax brand stains are excellent for staining. For the castings, a clear flat finish is suggested. This finish could also be applied over the stained wood parts as added protection.

**Painting:** If parts are to be painted, use a primer first, then paint. Any of the model paints are satisfactory. For this model, flat paints will probably look better than gloss paints.



View of wing struts on Ken Hyde's restored Jenny

## STAGE 1: BUILDING THE WINGS

Plan Sheet 2 shows all the details for constructing the wings, wing struts, and rigging drag wires within the wings. In addition, refer to Sheet 6 and Stage 7 for rigging the kingposts on top of the upper wing that can be done during this stage if desired. The following parts are required for this stage:

### Laser-Cut Wood Parts

Upper wing ribs – 2 of W1  
Upper and lower wing ribs – 4 of W2  
Upper and lower wing ribs – 22 of W3  
Upper and lower wing ribs – 12 of W4  
Upper wing ribs – 10 of W5  
Upper wing ribs – 6 of W6  
Upper and lower wing ribs – 4 of W7  
Lower wing ribs – 2 of W8  
Lower wing ribs – 2 of W9  
Upper wing ribs – 2 of W10  
Lower wing ribs – 2 of W11  
Upper wing ribs – 2 of W12  
Aileron ribs – 4 of W13  
Aileron ribs – 16 of W14  
Center section ribs – 1 of W15  
Center section ribs – 2 of W16  
Center section wing struts – 4 of W17  
Interplane wing struts – 8 of W18  
Kingposts on upper wing – 4 of W19  
Lower wing handhold blocks – 2 of W23  
Wing building jig shims – 20 of W24

### Britannia Castings

Aileron control horns – 4 of C1  
Aileron control cable sheaves – 4 of C3  
Aileron control cable sheave bodies – 4 of C4  
Wing strut end fittings – 20 of W20  
Wing skid end fittings – 4 of W21

### Photo-Etched Copper Parts

Single eye rig fittings for drag wires and kingpost wires – 128 of R1  
Double eye rig fittings for aileron control horn brace wires – 6 of R2  
Drag wire and kingpost wire tumblers – 54 of R3A(short)  
Wing wire rigging plates at struts – 20 of W22

### Wood Strips (cut to length as required)

Rib vertical web stiffeners and cap strips – 0.020" x 1/16"  
Wing strut and kingpost support pads – 0.020" x 1/8"  
Stringers and miscellaneous wing stiffeners – 1/32" x 1/32" and 3/64" x 3/64"  
Front beam flanges, and shims for wing building jig setup – 1/32" x 3/32"  
Rear beam flanges – 1/32" x 1/8"  
Front beam webs, and web blocks at compression ribs – 1/32" x 5/32"  
Support stringers for lower wing walk and wing tip stiffener – 3/64" x 3/64"  
Rear beam webs, and web blocks at compression ribs – 3/64" x 1/8"  
Wing tips – 1/16" x 3/32"  
Aileron leading edges – 1/16" x 5/32"  
Upper wing rear web in way of ailerons – 5/64" x 1/8"  
Wing skids – 3/32" x 3/32" flexible beech wood

Front beam web between first two ribs inboard and center section – 3/32" x 5/32"  
Leading edge – 3/32" x 3/16"  
Rear beam webs between first two ribs inboard and center section – 1/8" x 1/8"  
Blocks (to be carved) at leading edge wing tips and handholds – 3/16" x 5/16"

**Wood Sheet (cut to length as required)**  
Leading edge cover sheet and lower wing walk – 1/64" plywood

**Steel Rod (cut to length as required)**  
Wing trailing edge and struts between kingposts – 1/32"-diameter  
Fake wing hinges at center wing section and fuselage – 1/16"-diameter

**Brass Rod (cut to length as required)**  
Pins for kingposts – 1/32"-diameter

**Brass Strip (cut to length as required)**  
Aileron fake hinges – 1/64" x 1/16"

**Self-Adhesive Copper Tape (cut to shape as required)**  
Bands securing trailing edge to ribs and stiffeners

**Rigging Cord (cut to length as required)**  
Drag wires in wings and kingpost wires – 0.010"-diameter gray nylon cord  
Wrapping cord for splices – 0.008" diameter black nylon cord

## 1. Preparing the Wing Ribs

All wing ribs are laser-cut. For your information, the airfoil is an Eiffel 36. There are several different types of ribs, such as solid compression ribs, where the drag wire fittings are located, basic ribs with lightening holes, shorter ribs in the upper wing center section in way of the upper wing ailerons, and the aileron ribs. The outboard rib near the wing tip is a solid rib, more narrow than the others since the wing tapers at the tip. The inner most rib on each wing panel is thicker than the others.

**Rib stiffeners:** As the first order of business, glue the vertical rib stiffeners on each side of ribs where lightening holes are located, as

shown on the plan. These stiffeners prevent rib cracking on the real aircraft. The thickness of the rib plus the vertical rib stiffeners on each side should equal the width of the cap strips that are 1/16" wide. However, the vertical stiffener wood supplied is 0.020" thick (1/64" not available). Before gluing the vertical stiffeners, block sand the strips down to 1/64" thick if necessary. Test fit a cap strip to make sure it is flush with the stiffeners. Hard to do after the wing is assembled. Cut the stiffeners flush with the top and bottom of the ribs, except cut the one at the center flush with the underside of the stringer notches (*Figure 1-1*).

## 2. Setting Up the Wing Spars

In addition to the ribs, the wings basic construction consists of a heavy main front and rear beam, two small stringers (upper and lower) in between the main beams, a trailing edge, and a leading edge. On the real aircraft the main beams are a solid "eye" beam continuous through the ribs. However, for the model these beams are composed of an upper and lower continuous wooden flange with a separate web fitted in between each wing rib.

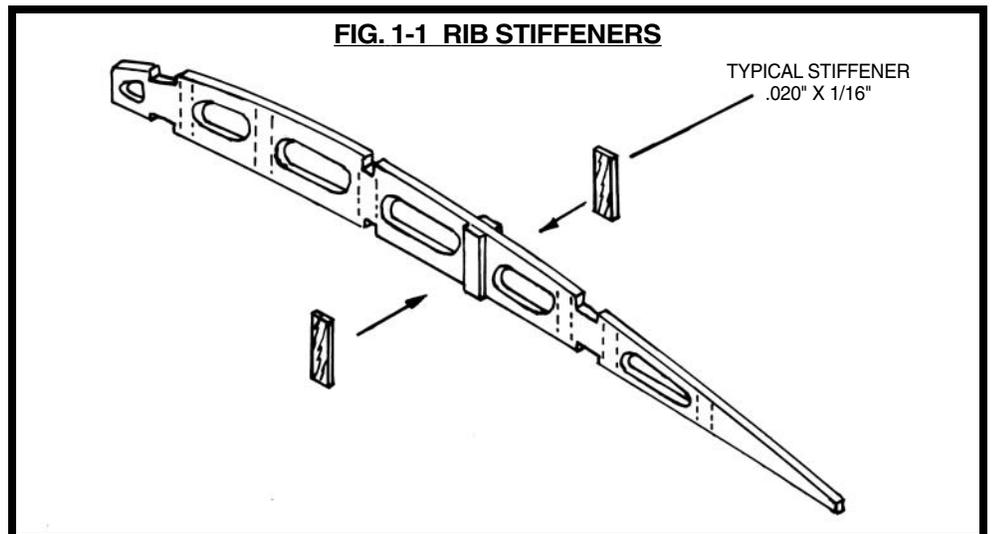
The leading edge is a solid continuous wooden spar, with the addition of a strengthening cover sheet back to the center of the front beam on the top side of each wing panel.

Small stringers fit into the notches at the top and bottom of the ribs. These stringers are to prevent rib twist on the real aircraft.

The trailing edge is a steel rod on the model (tubing on the real aircraft). The rod splices into a wooden wing tip on the lower wings. For the upper wings, the rod is continuous around the ailerons and is wood on the main part of the wing.

Both the upper wing and lower wing panels are similar in construction, so the instructions to follow are applicable to both except for specific details which will be noted.

**Setting up the spars:** Lay out the basic wings without the upper wing ailerons. Build these separately (*see Paragraph 11*).



Since the wing ribs have undercamber, jig shims are required to correctly locate the beam flanges at their proper angles. The shims are laser-cut parts.

The leading edge is a rectangular spar and is deeper than necessary so it can sit directly on the plan without any shim strips. Pin the leading edge to the plan first. Later, when the wings are removed from the building board, the leading edge will be rounded to its correct shape.

Next, lay a 1/32"-thick shim just behind the leading edge in way of each rib. This will hold the ribs off the work surface to allow for the thickness of the cap strips. Also, lay a 1/32"-thick shim under the trailing edge. Both of the 1/32" shims can be short pieces in way of each rib or a long strip.

Laser-cut jig shims, W24, are used to hold the beam flanges at the correct height and angle. It is suggested that these shims be laid just to one side of each wing rib rather than under it, so you can still see the rib locations on the plan. Pin the shims to the plan. Note that there are only enough of the laser-cut parts to build one wing panel at a time. If you want to build more, you must make your own additional shims.

Lay down the lower beam flanges and pin them on top of the jig shims. *Figure 1-2* illustrates the setup. Out near the wing tips, both of the beam flanges must be tapered as shown on the plans. Also, the flanges are angled toward the wing tips outboard of the last full-size rib. Consequently, you can take the flanges during this step only out to the full-size rib and then add the remaining portion of the flanges when you do the wing tips (to be discussed later).

**Option:** The small lower stringer at the middle of the wing ribs could also be installed along with the beam flanges. Refer to Paragraph 6 for a discussion on the stringers.

**Note:** When pinning the flanges (and the stringer if the option is chosen) to the shims, use one of the full-length lightened ribs to check the fit as you go. The front end of the rib will butt against the leading edge, and the bottom slots in the rib must fit the lower beam flanges (and stringer).

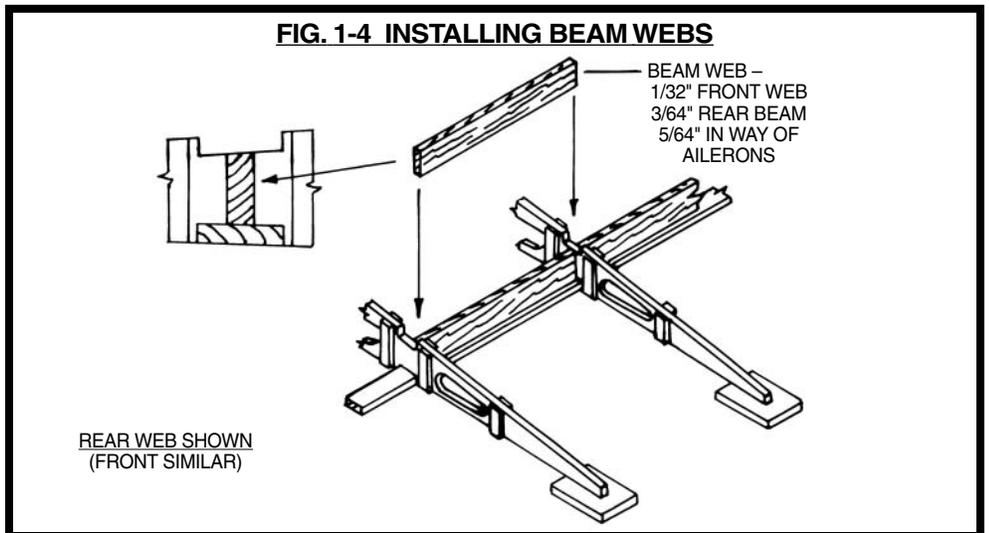
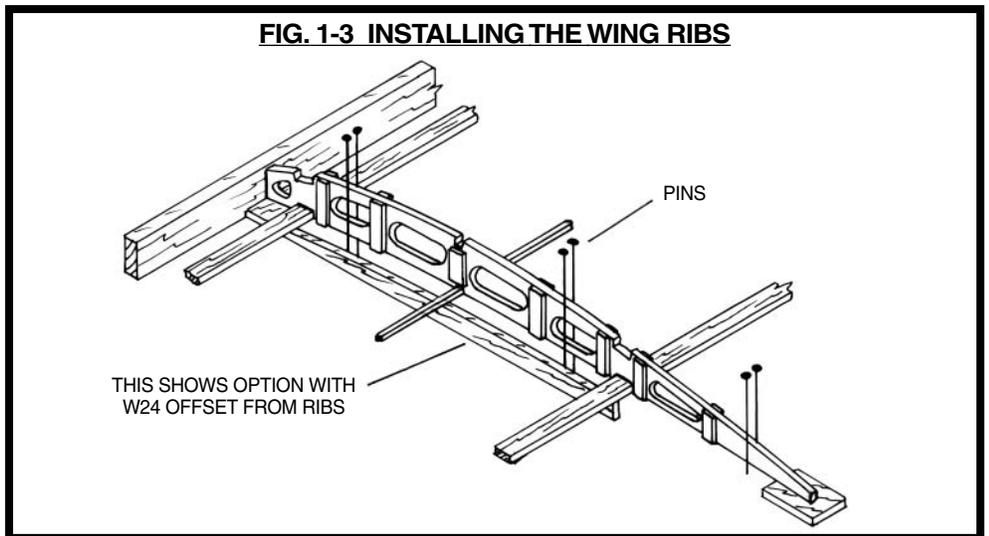
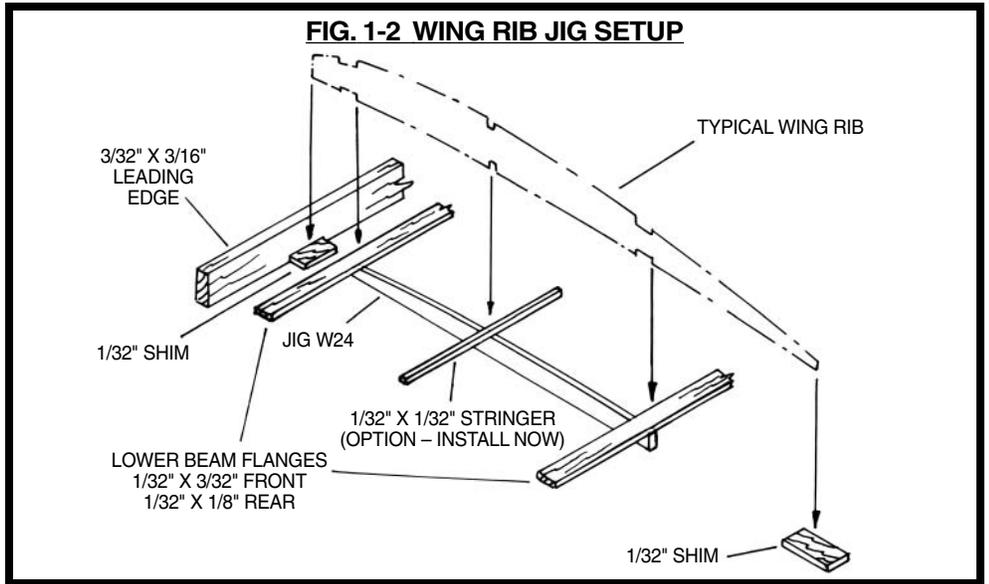
### 3. Installing the Wing Ribs

Position and glue each wing rib to the leading edge, and to the front and rear beam lower flanges (and the center stringer if this option is used). Use pins if necessary to hold the ribs vertically at each location (*Figure 1-3*).

The short ribs at the trailing edge, W7, can be installed now, or wait until the trailing edge is in place.

### 4. Installing the Beam Webs and Web Blocks

With the ribs in place add the webs at the front and rear beams. The top of the webs must be shaped so they are flush with the bottom of the slots for the upper flanges. Glue the webs to the lower flanges and to each rib. *Figure 1-4* illustrates the basic



webs between ribs. Variances are as follows:

- A. The webs between the inboard two ribs are the same thickness as the flanges. This thick web supports the fake hinge pins that connect the lower wings to the fuselage and upper wings to the center section. For the model, drill a hole in the ends of each web for inserting a fake hinge made of steel rod. The inboard ribs

already have a laser-cut guide hole (more on this later).

- B. The rear web outboard where the ailerons are located is a continuous piece and is set flush with the aft side of the flange. Like the flanges, the beam webs outboard of the last full depth rib are not installed at this time. They will be done with the wing tip construction per Paragraph 5.

**Option:** The web blocks to be described in the next paragraph can be glued to the beam webs before the beam webs are glued between the ribs.

**Installing web blocks:** At each compression rib, add the web blocks on each side of the ribs. Fit these blocks on the forward side of the rear beam and aft side of the front beam. These blocks hold the drag wire single eye rig fittings (R1). The fittings should be installed in the blocks before installing the block; easier now than later. *Figure 1-5* illustrates.

At the compression ribs where the wing struts are located, add additional blocks on the other side of the beam webs. The blocks, now on all four corners of the rib juncture provide support for the pads in way of the wing struts (*Figure 1-6*).

### 5. Installing the Wing Tips, Trailing Edge, and Upper Beam Flanges

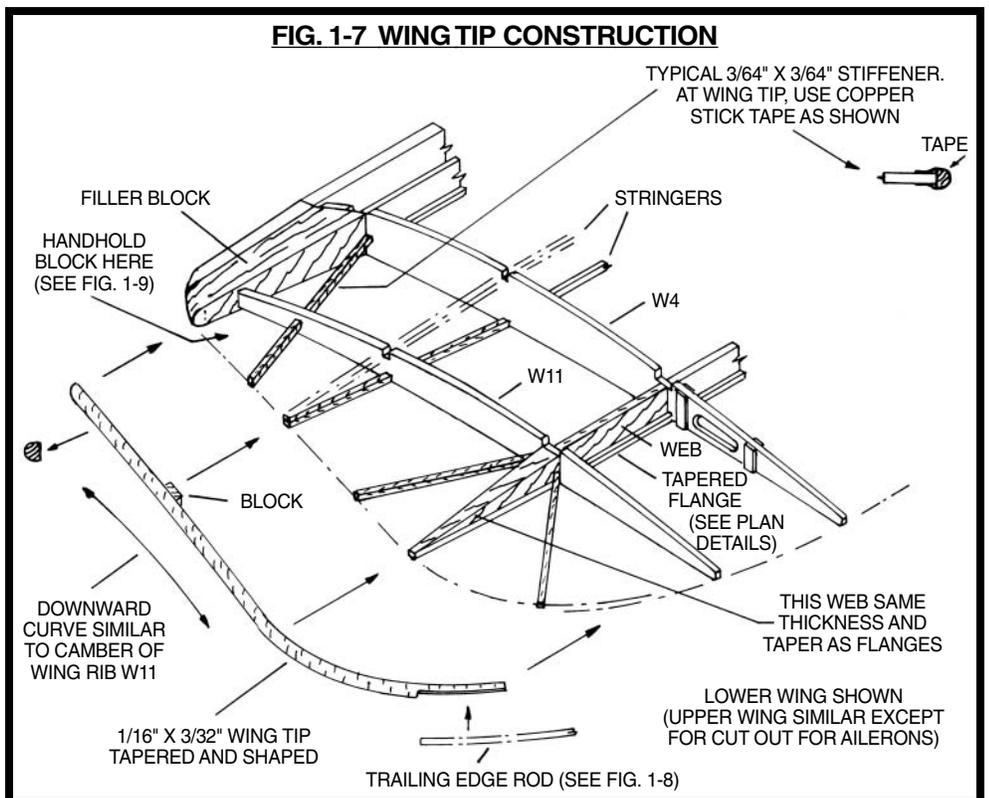
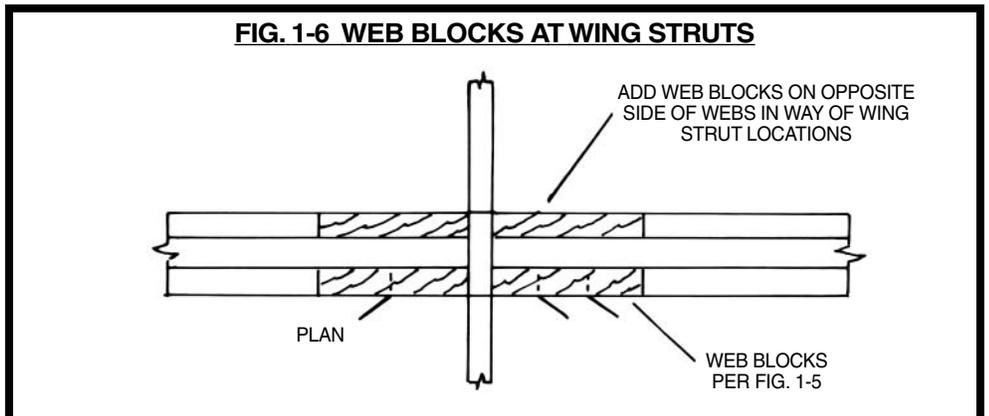
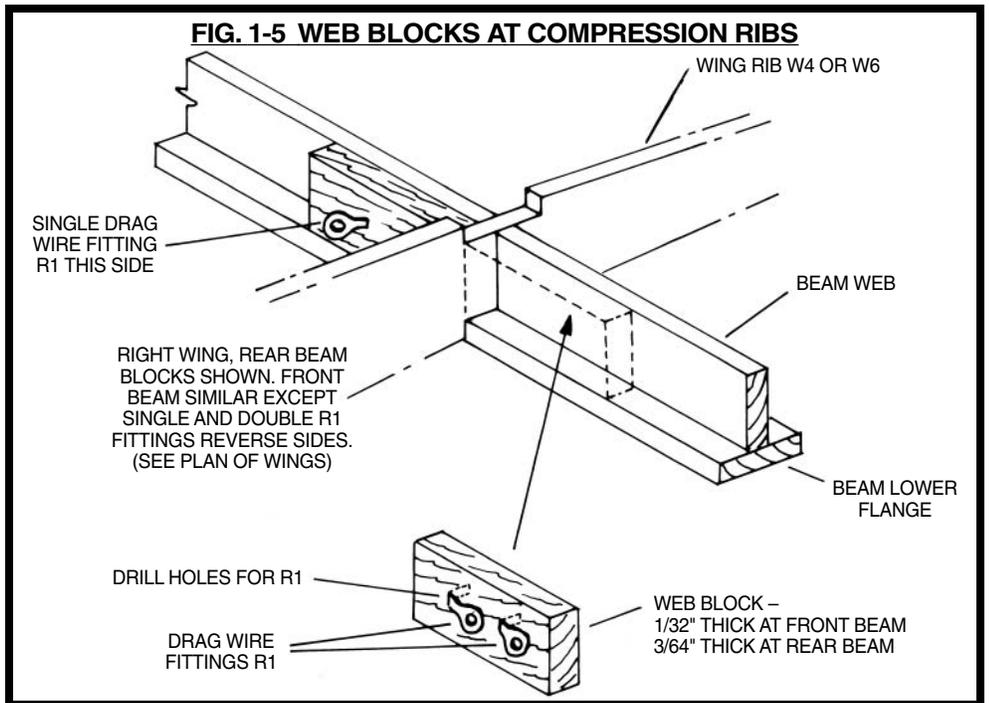
The wing tips are made of wood. The rear beam flange tapers aft, and its web tapers top and bottom to the tip. The front beam flange tapers forward, and its web tapers top and bottom. See Detail 2-F and 2-G on the plan for the correct tapers. There is a filler block at the leading edge. It tapers like the front beam. Outboard of the last full-size rib there is a narrow wing rib. Taper and fit the wing tips. On the lower wing, the tip curves into the trailing edge. Heat bend this curve. Note that the wing tip follows the curvature of the undercambered wing ribs, so it is not a straight piece. *Figure 1-7* illustrates the wing tip construction, with the exception that the upper beam flanges and stringer have not yet been added.

The trailing edge is a steel rod. It is tied into the wooden wing tips of the lower wings. Bend the trailing edge to shape. Splice the steel trailing edge into the wooden lower wing tip and wrap with thread. For the upper wing, the ailerons have the rod. Position and glue the trailing edge to the ends of the ribs with just a touch of super glue (*Figure 1-8*). After the wings are removed from the building board, and the cap strips have been added, the copper self stick bands will be added at each rib over the trailing edge rod. The lower wings have a handhold block (W23). Install the laser-cut blocks and sand to the taper of the wing tips and round the hole edges. See *Figure 1-9* and Detail 2-H on the plan.

**Installing the upper flanges:** After all webs and web blocks and the wing tips are in place, add the beam upper flanges. Flanges are tapered at the wing tips. See Detail 2-F and 2-G on the plan.

### 6. Installing the Small Wing Stringers

The stringers on the real aircraft are very small dowels (about 5/16" full-size). However, 1/32" square strips are provided in the kit, as a dowel this small is not available commercially. You can sand the edges of the square to form a dowel or use a draw plate. Or, leave the square strips as is for more strength (rec-



ommended). Fit the stringers in the precut notches in the ribs. Fix with glue. The stringers are rather delicate, so be careful handling the strips. Out at the wing tips the stringers angle toward the wing tip strip as seen in *Figure 1-7*.

You should be able to slide the lower strip through the notches, or you could lay them down before installing the ribs (an option noted in Paragraph 3).

### 7. Adding Miscellaneous Stiffeners and Lower Wing Walk

Install the 1/32" square stiffeners between the ribs adjacent to the inboard edge of the ailerons.

On the lower wings, fit the supports and wood sheet over the two inboard ribs, which provides a wing walk (*Figure 1-10*).

### 8. Installing the Leading Edge Cover Sheet

Install the plywood cover sheet (also plywood veneer on the real aircraft) on top of the wings only. It fits from the leading edge strip back to the middle of the front beam (*Figure 1-11*). Use some small clamps to hold the cover sheet in position while the glue dries, or glue the front first, then glue the sheet to the front beam with super glue plus accelerator for a quick fix. The wood is not as long as the upper wing, so you must have one butt joint. Place the butt joint at one of the ribs.

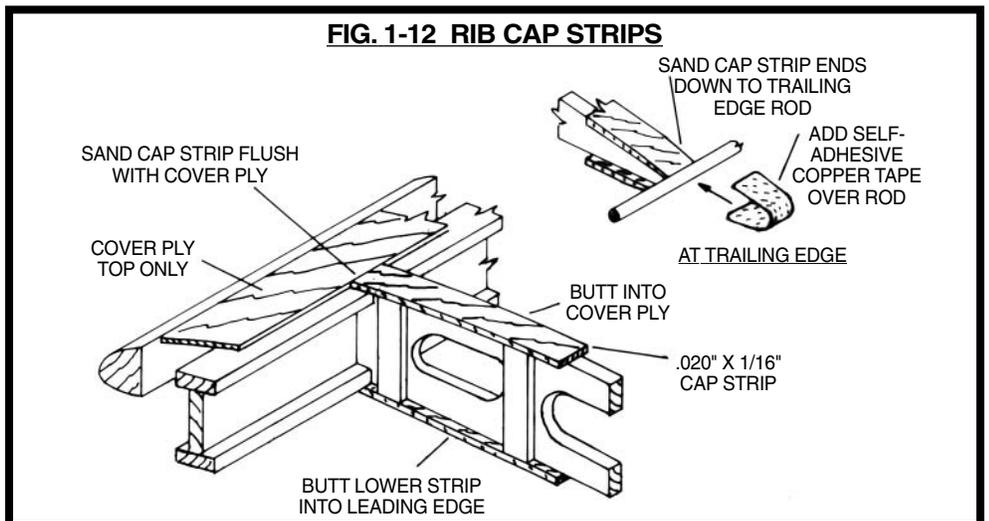
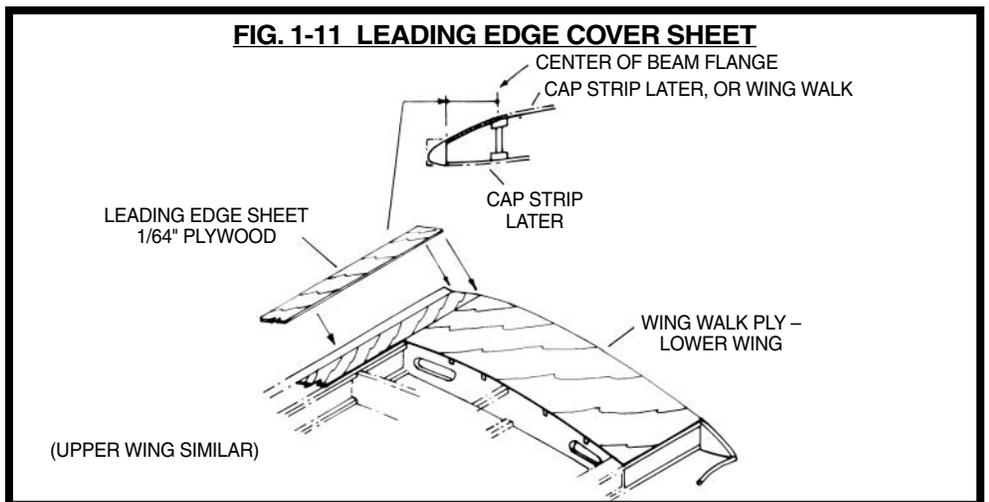
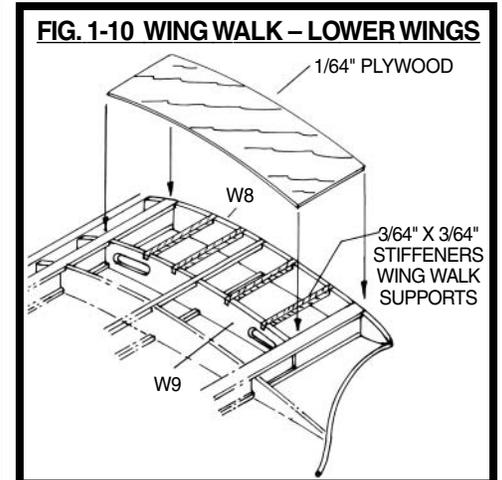
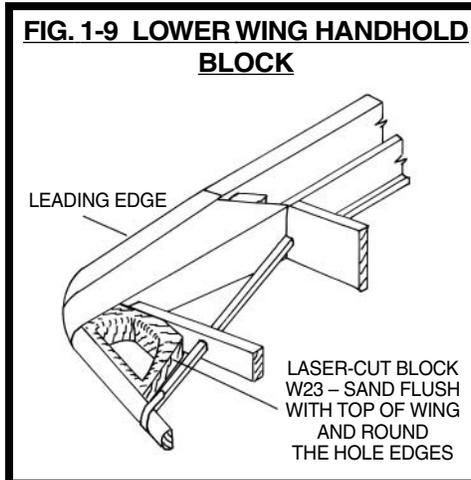
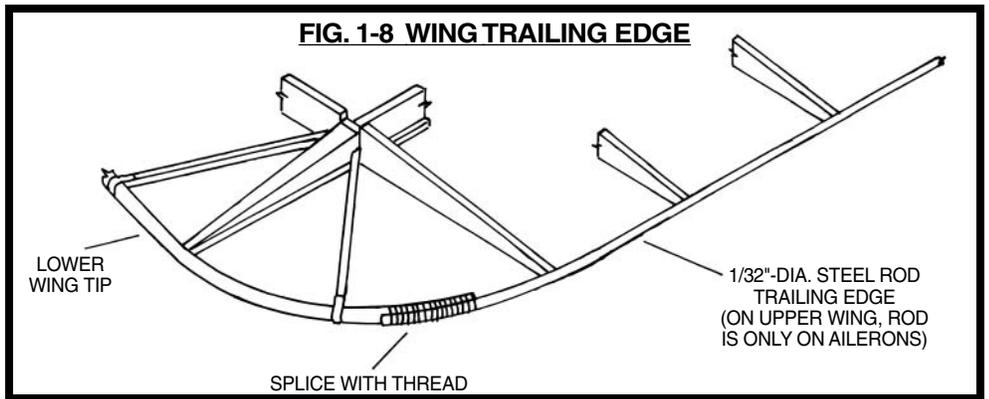
### 9. Installing the Cap Strips

The upper cap strips can be installed while the wings are still pinned to the building board. The wings must be removed from the board to install the lower strips. To hold the cap strips in position for gluing, use a bent pin, or super glue the cap strip at the leading edge and use super glue plus accelerator at the trailing edge. Then add glue to the remaining areas. The cap strips butt into the ply sheet on top of the wing and to the leading edge on the bottom.

After the wings are removed from the building board, add self-adhesive copper tape over the trailing edge at each rib. *Figure 1-12* shows the cap strips and also the copper tape. Remember this figure so you don't forget to add the tape later.

Another method for gluing cap strips is to coat the rib and cap strip with white glue, let dry, then use an iron to heat-bond the cap strips on. Though I have no personal experience with this method, I am told this works fine.

*Note:* The basswood cap strips at 0.020" thick are a little thicker than the 1/64"-thick ply sheet (1/64" basswood not available). Sand the front of the cap strips flush with the top of the ply sheet. Also, sand the cap strips at the trailing edge down to the steel rod before applying the self-adhesive copper tape. The ribs are a little deeper at the trailing edge than is found on the real aircraft.



## 10. Installing Wing Strut, Kingpost, and Wing Skid Support Pads and Fittings

The support pads are fitted on each side of the cap strips in way of the struts. For the lower wing, the inboard pads are on top of the wing. The outboard pads are on both the top and bottom of the wing. The bottom pads are supports for the wing skid fittings. On the upper wing center section, the pads are located only on the bottom side. On the main upper wing panels, install the pads on both sides at the outer wing strut location. The underside is support for the wing struts, and the top side provides support for the kingposts. At the inner strut location, locate the pads only on the underside. The plan, Detail 2-1 shows each pad required.

Glue the photo-etched copper wing strut rigging plates (W22) to the pads, aligning the center hole on the axis of the rib and beam. A common photo-etched copper fitting is provided in the kit. However, all the rigging eyes are not needed at every location. Cut off the eyes not required. The plan, Detail 2-J, illustrates what each should look like. Bend the remaining eyes to the angle of the wing wires.

On the real aircraft, U bolts going under the beams are used to hold the plates down. On the model, glue the fitting to the wings. It will also be held down when you insert the struts in the holes.

After the fittings have been installed, or before, drill a hole into the wing through the center hole of the fitting for receiving the wing strut, kingpost, and skid end fittings. *Figure 1-13* illustrates the installation of pads and fitting.

## 11. Building and Installing the Upper Wing Ailerons

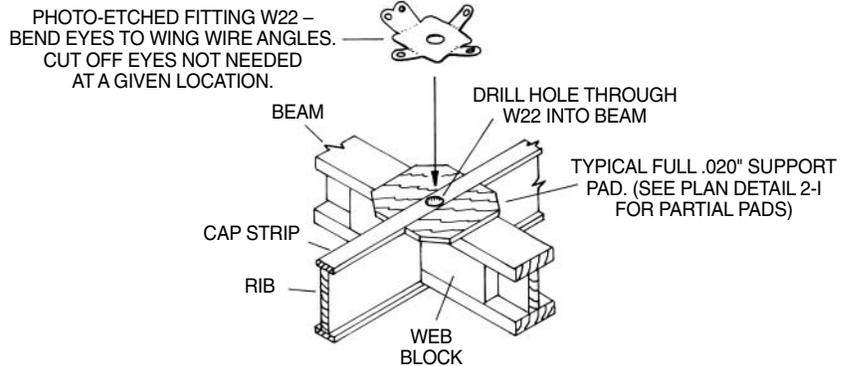
Build the ailerons flat on the plan. First, lay down the leading edge and rod trailing edge, then pin and glue the ribs to the leading and trailing edge. Install the stiffening between ribs. Add the cap strips as you did the wing panels, then add the copper bands at each rib. Cut slots in the aileron leading edge and the rear wing beam web for fake hinges. Use a strip of brass for the fake hinges. The location of the hinges is from factory plans. However, you could omit all but the two outer hinges as an option on the model. See *Figure 1-14* for the basic aileron construction.

In way of the control horns, add the pads and filler blocks on each side of the rib and drill a hole for the fittings. Install the britannia casting control horns (C1) and the three back brace wire fittings (R2). See *Figure 1-15* and plan Details 2-A and 2-D.

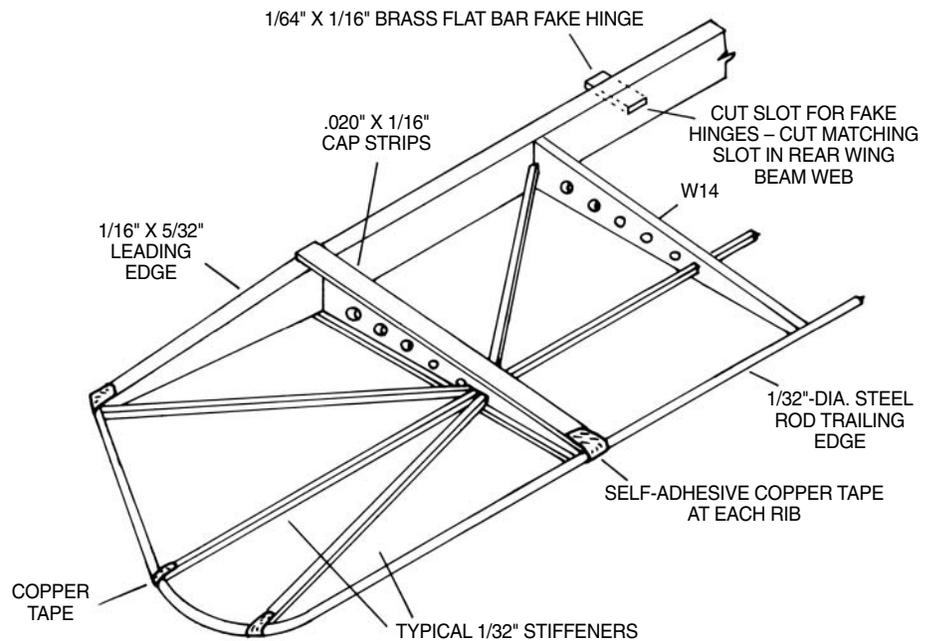
## 12. Installing the Aileron Control Sheaves

Pin or glue the sheaves (C3) into the sheave body (C4) to assemble the sheaves. The sheaves are located on the front beam. Insert a U pin made from brass rod into the beam to attach the sheaves to the top and bottom

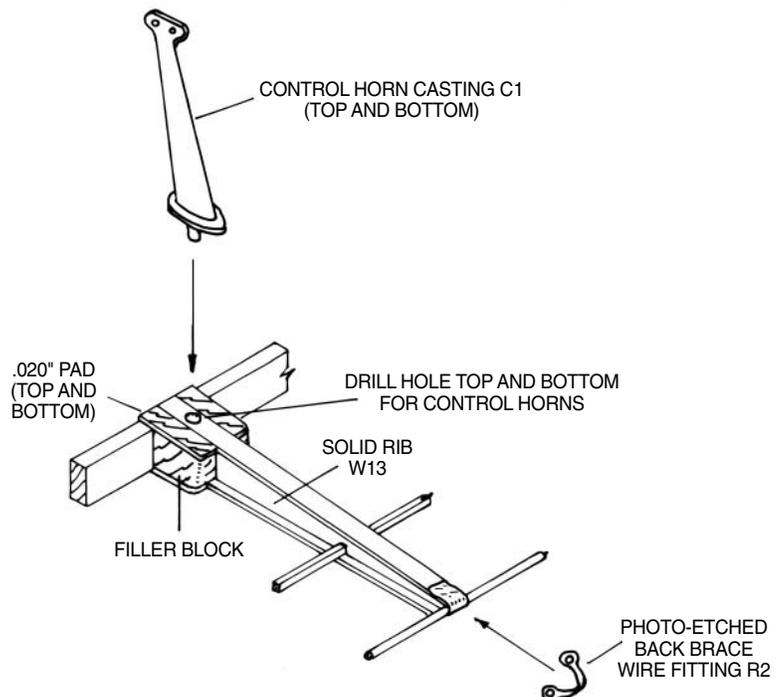
**FIG. 1-13 STRUT SUPPORT PADS & WING WIRE FITTING**



**FIG. 1-14 BASIC AILERON CONSTRUCTION**



**FIG. 1-15 AILERON CONTROL HORNS & BRACE WIRE FITTINGS**



of the wings (*Figure 1-16 and plan Detail 2-C*). Actual rigging of the aileron control wires will be discussed in a later stage.

On the right side of the upper wing center section add a similar U pin that will serve as a fairlead for the aileron control wire (*See Figure 1-22*).

### 13. Installing the Drag Wires

The turnbuckles have an eye on each end. One end can be tied with thread to the rig eye fittings (R1), or if you file out one side of the eye they can be hooked into the fitting. On the real aircraft the end is U-shaped for bolting to the fitting.

Add the short turnbuckles (R3A) and rig the drag wires (nylon cord on the model). These go between the compression ribs on the main wing panels and also on the upper wing center section (*Figure 1-17*).

Try to be neat with the cord. Don't get knots too big. Touch all knots with super or white glue so they won't come adrift.

### 14. Installing the Fake Hinge Rods in the Upper and Lower Wings

On the real aircraft, the lower wing was attached to the fuselage and the upper wing was attached to the center section by a pair of heavy hinges bolted to the beam webs. Until such time as the rigging wires were installed, the wings were not supported and would rotate on the hinge. For the model, the hinge has been faked to provide a more rigid connection, so when the wings are installed they don't flop around, making installation of the struts and rigging easier. A simple steel rod is provided as a fake hinge.

First, bend the steel rod to the angle of the wing dihedral ( $1^\circ$ ). In order to maintain the  $3/32"$  gap between the outer wing panels and fuselage/center wing section, an optional spacer inserted onto the steel rod is suggested. This can be made from a piece of wood, or of aluminum or brass tubing with a  $1/16"$  inside diameter.

Drill a hole in the end of the beams through the pre-cut guide holes in the inboard ribs for inserting the fake hinge pin. Glue the rod into the holes (*Figure 1-18*). Drill a similar hole into the beams of upper wing center section. For the lower wing, there will be holes drilled in the fuselage. This will be shown in the fuselage building stage.

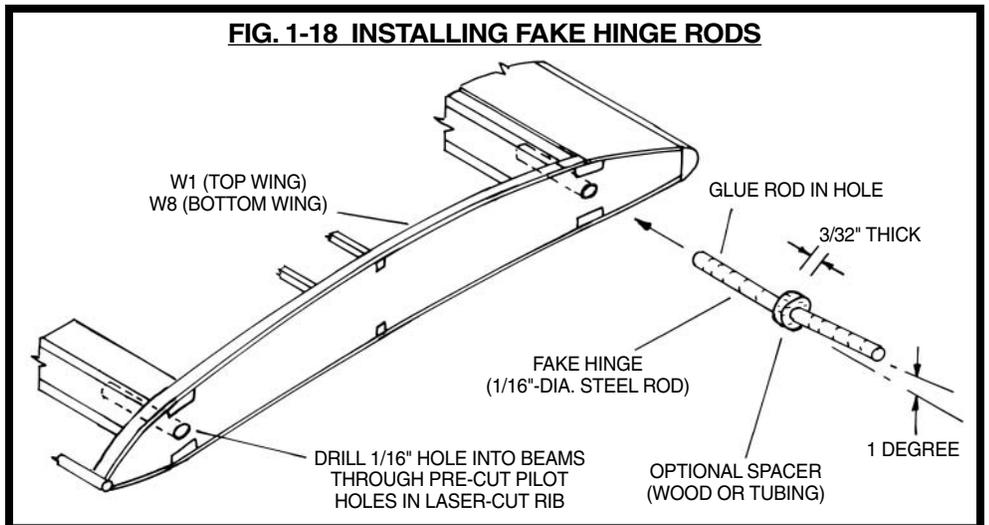
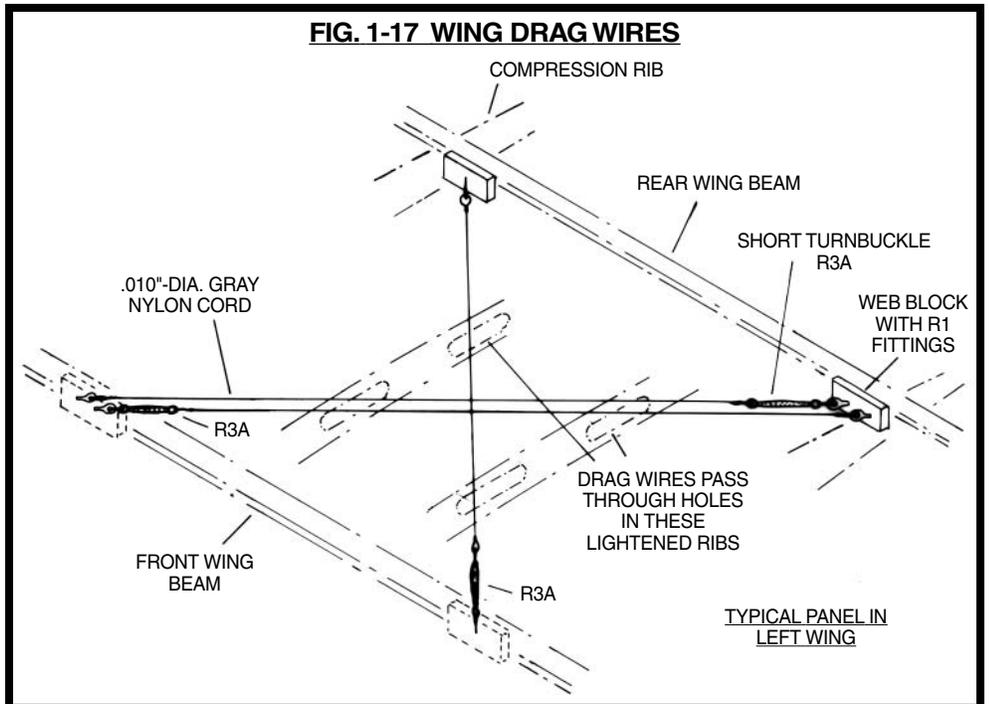
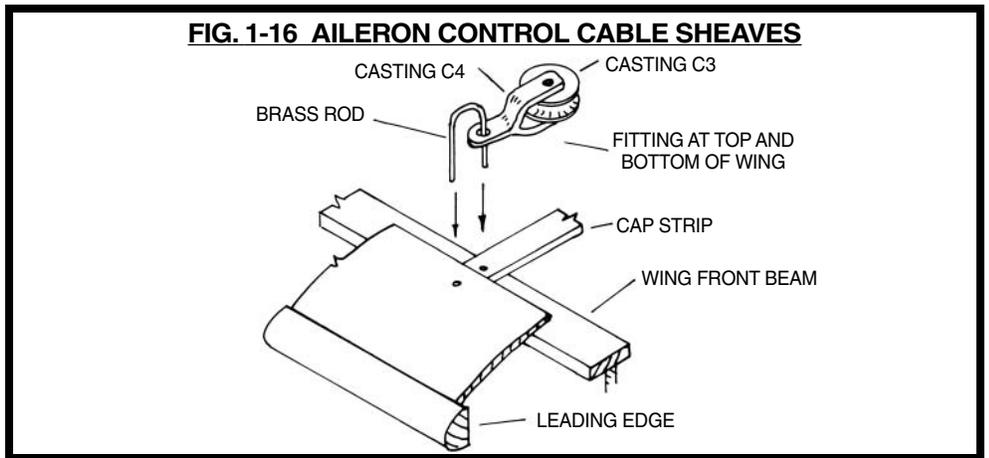
### 15. Building and Installing the Lower Wing Skids

Using the  $3/32"$  square flexible beech wood, shape the strip into a  $1/16"$  dowel. The beech bends rather easily, but can be easier and hold its shape better if it is wet first. Pin the dowel over the plan pattern and let dry. It may tend to flex back a little, but that's OK. When installed in the skid fittings, it will be secure.

Fit the cast fitting (W21) at each end under the lower wing, then glue the skids in the holes. *Figure 1-19* shows the process.

### 16. Building, Installing, and Rigging the Kingposts

The kingposts are laser-cut, but you must taper them and shape to a streamline section.



The end fittings are so small they have been omitted on the model. Paint the ends black or copper color to "fake" a fitting that is similar to the wing struts. Install the single eye rig fittings (R1) into the posts. Drill a hole in the bottom of the posts and insert a brass pin.

Insert the kingposts into the holes on top of the upper wing, then add the steel rod at top

between the front and rear posts. *See Figure 1-20*. Next, add the single eye rig fittings (R1) on the wing for the kingpost brace wires. *See plan Detail 2-E*.

The rigging for the kingposts can be accomplished at this time or wait until later. Refer to Stage 7 and Sheet 6 for details. The short turnbuckles (R3A) for the transverse wires

are at the lower end at the wing and at top of the kingpost for the fore and aft wires.

*Note:* The kingposts are perpendicular to horizontal and not at an angle like the wing struts.

### 17. Building the Upper Wing Center Section

The center section is similar to the main wing panels. The webs between the beam flanges are the same thickness as the flanges. The outer ribs are thicker than the center rib. On the real aircraft these outer ribs are actually a box – two thin ribs with top and bottom cap strips. Add the wire bracing fittings (R1) to the webs of the beams. Rig the cords with short turnbuckles (R3A).

Add the support pads and wing strut fittings (W22) under the center section, and drill the holes (if you have already not done so) for the strut fittings as you did on the wings. Notice that the upper and lower stringers on the center section are staggered fore and aft. On the main wing sections, the upper stringer is directly above the lower stringer. Why this was done on the actual aircraft is puzzling. *Figure 1-22* illustrates the completed center section.

### 18. Rounding the Leading Edge and Wing Tips

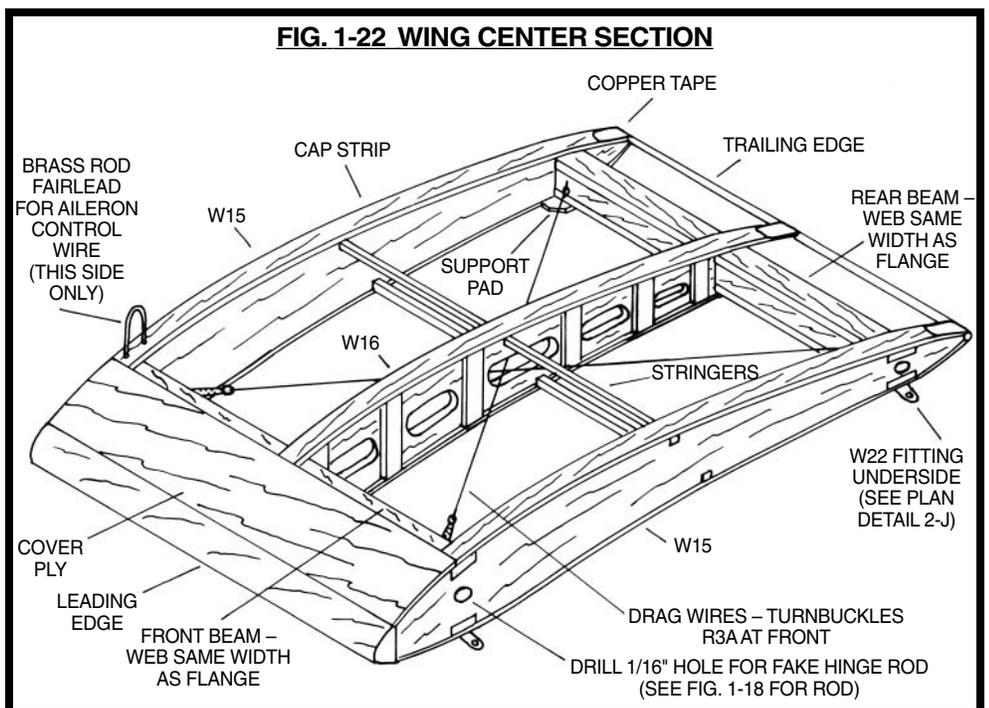
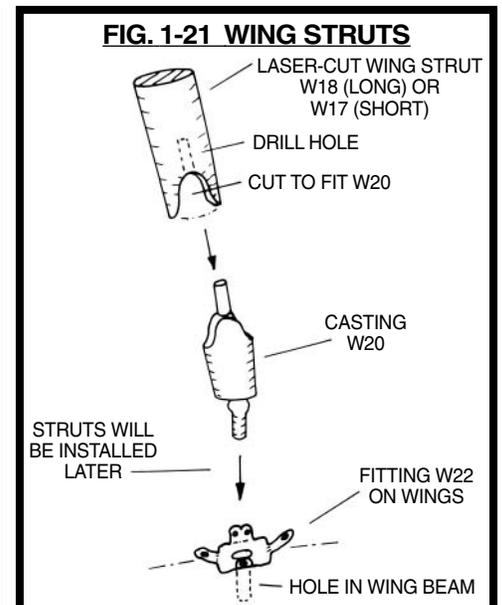
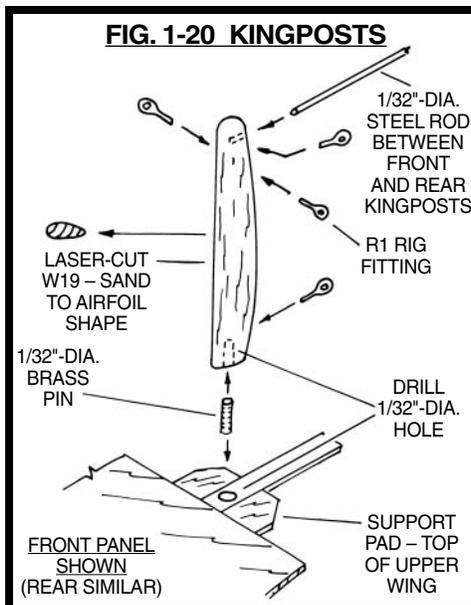
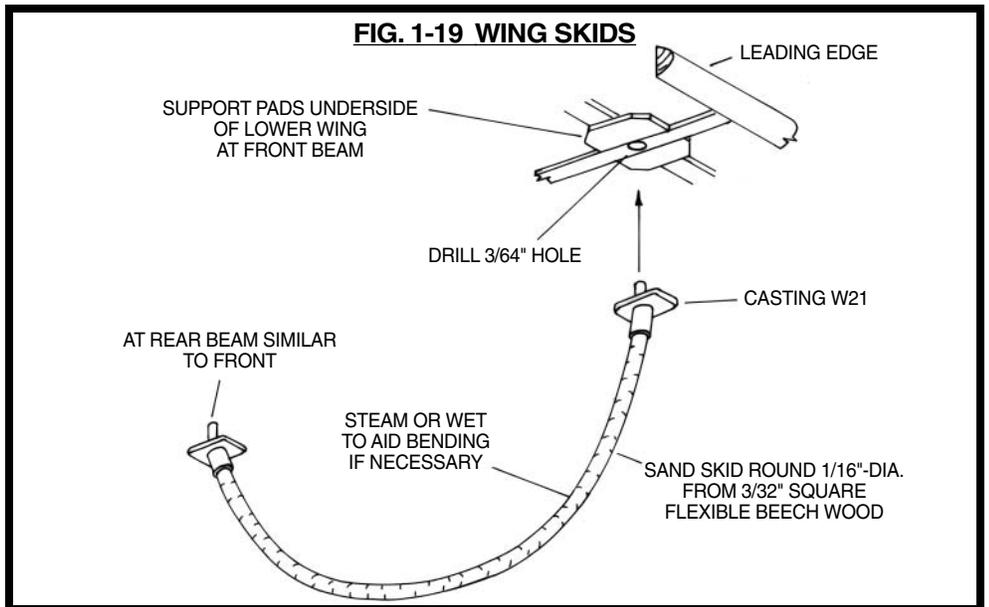
If you haven't gotten to it already, finish the wings by rounding the leading edge and wing tips. A sanding block should do the trick. See the plan for the correct shapes.

### 19. Building the Wing Struts

The fittings at each end of the wing panel struts and top of the center section struts are britannia castings (W20). The fittings are oval shaped, symmetrical in cross section front and back, so the same casting can be used at the upper and lower ends of the struts. However, the laser-cut wood struts should be tapered in between to a streamline, airfoil section as shown on the plans. On the real aircraft the end fittings are copper plate with a pin connection that pins to the strut fittings on the wings. For the model, the casting is a solid fitting with a pin extension. This pin fits through the holes in the photo-etched wing wire fittings (W22) and into the holes in the wings.

Shape the ends of the wing struts to fit the W20 end fittings and drill a hole for the casting pin extension into the strut. Epoxy the fittings to the struts for added strength. Don't install the wing struts at this time, just set aside for later. *Figure 1-21* illustrates the wing strut construction.

The wings are now complete and can be stained if desired and set aside. Store in a protective cardboard box. Lay the wings flat to help prevent warpage while stored. You have two upper wing panels, an upper wing center section, and two lower wing panels. You also have all the wing struts completed but not yet installed. The wings will be assembled during the final stage. The struts will be mounted, wings attached, rigging wires added, and aileron, rudder, and elevator control wires rigged.



## STAGE 2: BUILDING VERTICAL & HORIZONTAL STABILIZERS, RUDDER, & ELEVATOR

Plan Sheet 4 provides all the details for constructing the tail surfaces. The plan also shows the landing gear, but this will be discussed in a later stage. Also, consult Plan Sheet 6 for the control horns and other bracing wires. These brace cords can be accomplished during this stage. The following parts are required for this stage:

### Laser-Cut Wood Parts

Horizontal stabilizer ribs – 5 of S1, 2 of S2  
Elevator ribs – 4 of S3, 2 of S4

### Britannia Castings

Rudder & elevator control horns – 6 of C2

### Photo-Etched Copper Parts

Vertical and horizontal stabilizer brace wire single eye rig fitting, and fittings in the ends of the wooden horizontal stabilizer struts – 18 of R1

Elevator and rudder control horn brace wire double eye rig fitting – 8 of R2

Turnbuckles – 18 of R3A (short)

### Wood Strips (cut to length as required)

Horizontal stabilizer vertical rib stiffeners – 0.020" x 1/32"

Horizontal stabilizer and elevator rib cap strips – 0.020" x 1/16"

Horizontal stabilizer and elevator, rudder diagonal stiffeners – 1/32" x 1/32" and 1/32" x 5/32"

Rudder ribs – 1/32" x 1/16"

Horizontal stabilizer chock blocks – 3/32" x 1/8"

Horizontal stabilizer trailing edge and elevator leading edge – 1/32" x 1/8" and 1/16" x 3/32"

Vertical stabilizer leading and trailing edge, and rudder leading edge – 1/16" x 1/16"

Vertical stabilizer stiffeners and chocks – 1/32" x 1/32" and 1/32" x 1/16"

Vertical stabilizer bottom stiffener and corner chock blocks – 1/16" x 1/8"

### Steel Rod (cut to length as required)

Elevator and rudder trailing edge – 1/32"-diameter

Horizontal stabilizer leading edge – 1/16"-diameter

### Brass Strip (cut to length as required)

Rudder/elevator fake hinges – 1/64" x 1/16"

### Self-Adhesive Copper Tape

(cut to size as required)

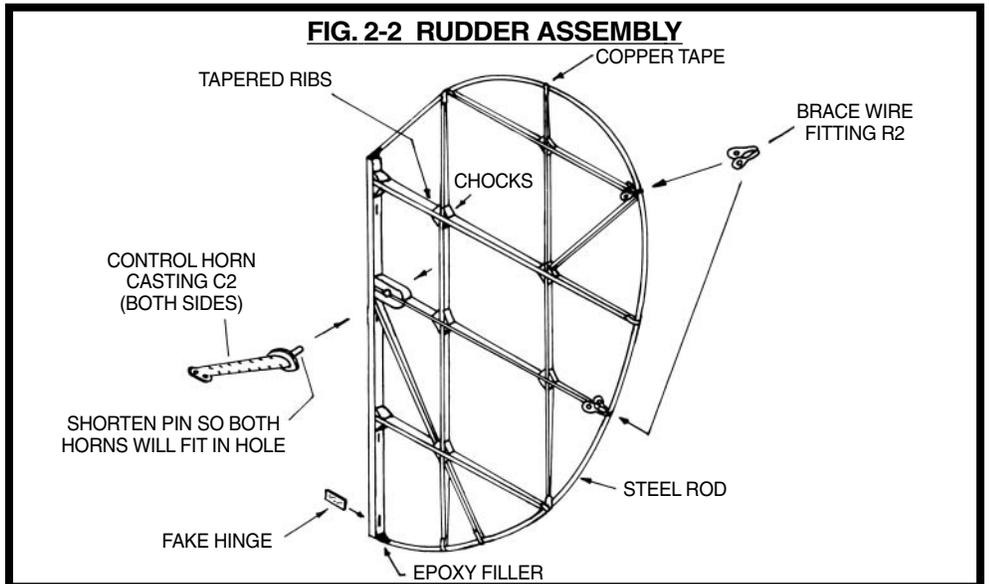
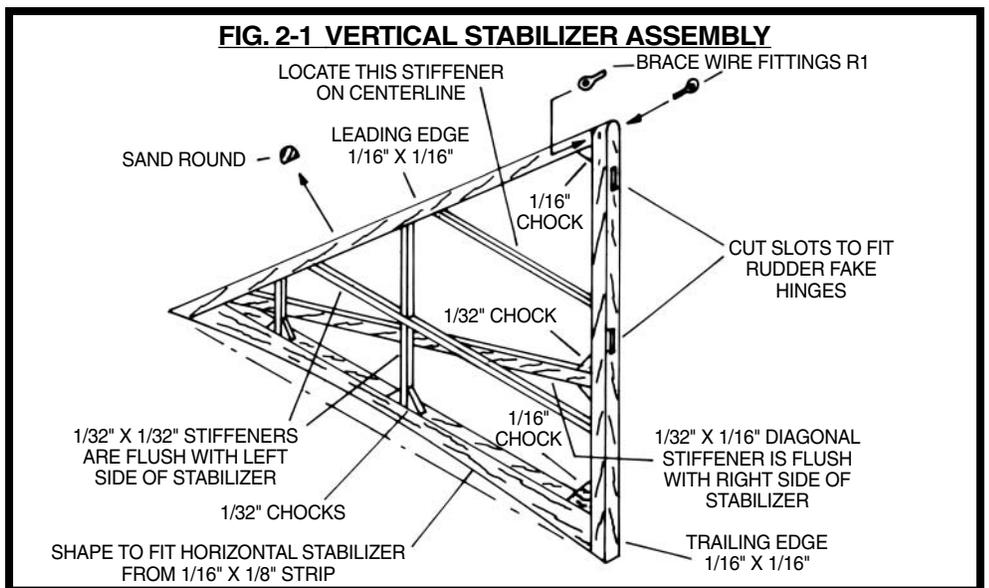
Horizontal stabilizer leading edge and elevator and rudder trailing edge bands

### Rigging Cord (cut to length as required)

Brace wires from vertical to horizontal stabilizer and brace wires for control horns – 0.010"-diameter gray nylon cord  
Wrapping cord for splices – 0.008" diameter black nylon cord

## 1. Building the Vertical Stabilizer

The vertical stabilizer is an all wooden structure. Assemble the stabilizer over the plan. Pin down the leading edge, trailing edge, and bottom piece. Preshape the curved bottom to fit the top of the horizontal stabilizer center



rib. All these pieces are the same thickness. Next, add the diagonal stiffener that fits flush with the right side of the stabilizer. Then fit the small horizontal and vertical stiffeners with their small triangular chocks. The ones crossing the diagonal stiffener fit flush on the opposite (left) side of the stabilizer. The top horizontal one fits on the center of the leading and trailing edge. Finally, round the leading edge.

Add the fittings (R1) for the brace wires at the top of the stabilizer, one on each side. Cut the photo-etched copper parts to the length required.

In the trailing edge, cut the slots that will fit the fake rudder hinges. See the note in Paragraph 2 below.

Figure 2-1 illustrates the entire vertical stabilizer assembly.

## 2. Building the Rudder

Some *Jenny's* had a rudder with a steel trailing edge and wooden leading edge, and stiffeners, similar to the elevator. Others had an

all tubular steel rudder. We have selected the former for the model because of difficulty in casting an all metal rudder.

On the real aircraft, the trailing edge was a V-shaped bent steel plate. For the model you will use a round steel rod. Bend the 1/32" steel rod trailing edge to the shape shown on the plan. Cut the 1/16" square wooden leading edge to length and slot the top and bottom to fit the trailing edge. Glue the trailing edge rod in place and add a small amount of filler between the leading and trailing edge at top and bottom.

The horizontal ribs are made from 1/32" x 1/16" basswood strip. Cut to length and taper the ribs from 1/16" at the leading edge to 1/32" at the trailing edge. Glue the ribs in place. For the vertical and diagonal stiffeners, cut from 1/32" x 1/16" basswood strips. At each location shape the stiffeners so they are flush with the ribs and taper to 1/32" at the trailing edge rod. Add the small chocks at the intersections of rib and stiffeners. Add self adhesive-copper tape strips over each

joint that intersects with the steel rod.

On the third rib from the top, add the two filler blocks above and below the rib at the leading edge. Drill the hole for the control horns.

Finally, glue the two photo-etched copper fittings (R2) for the control horn brace wires and add the britannia cast control horns (C2). Since the rudder is so narrow, shorten the pins on each horn so they both will fit in the drilled hole. Epoxy the horns in place.

Figure 2-2 illustrates the assembled rudder.

**Note:** The hinges on the real aircraft rudder are very small and so are faked on the model. 1/64" x 1/16" brass strip is provided. Cut slots in the rudder leading edge, the vertical stabilizer, and the fuselage tailpost for the fake hinge strips. Also, the control horns are actually bolted together with four bolts on the real aircraft.

For now, do not mount the rudder. It is best installed after the horizontal and vertical stabilizer are glued to the fuselage during Stage 7.

### 3. Building the Horizontal Stabilizer

The airfoil has a flat bottom, so the stabilizer can be built directly on the plan. However, it is suggested that some shims be placed under the leading and trailing edges to keep the parts off the plan a bit.

The horizontal stabilizer on the real aircraft has a steel tubing leading edge. For the model, it's just a solid steel wire. Bend it to the plan shape and pin it to the plan. The trailing edge on the real aircraft is a rabbeted wooden spar. For the model, two separate pieces are used to form the rabbet for butting the cap strips. Glue these together and taper the ends.

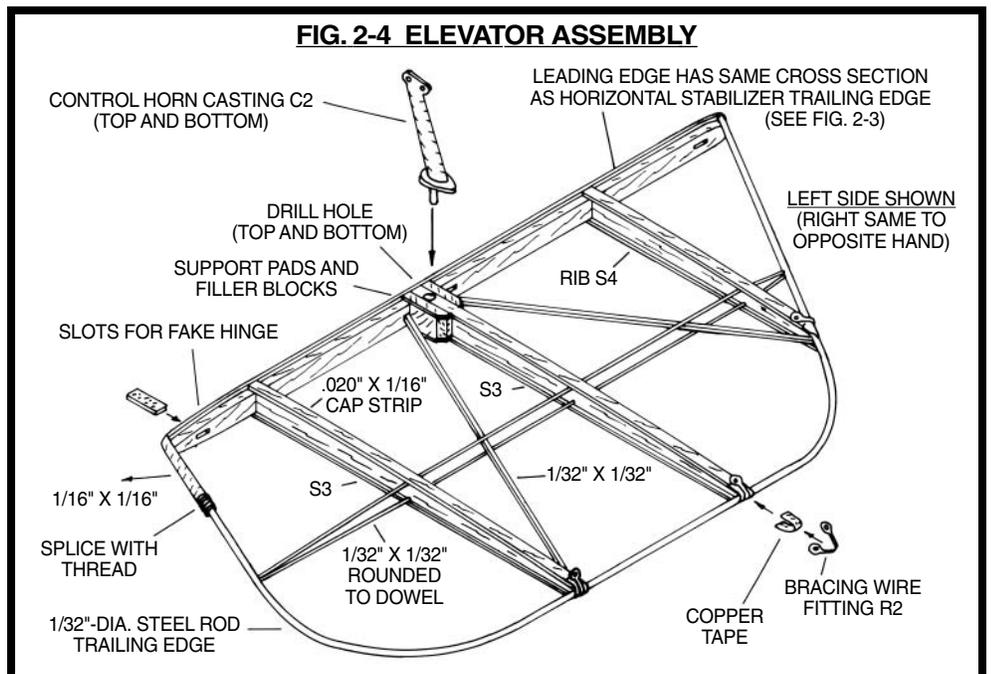
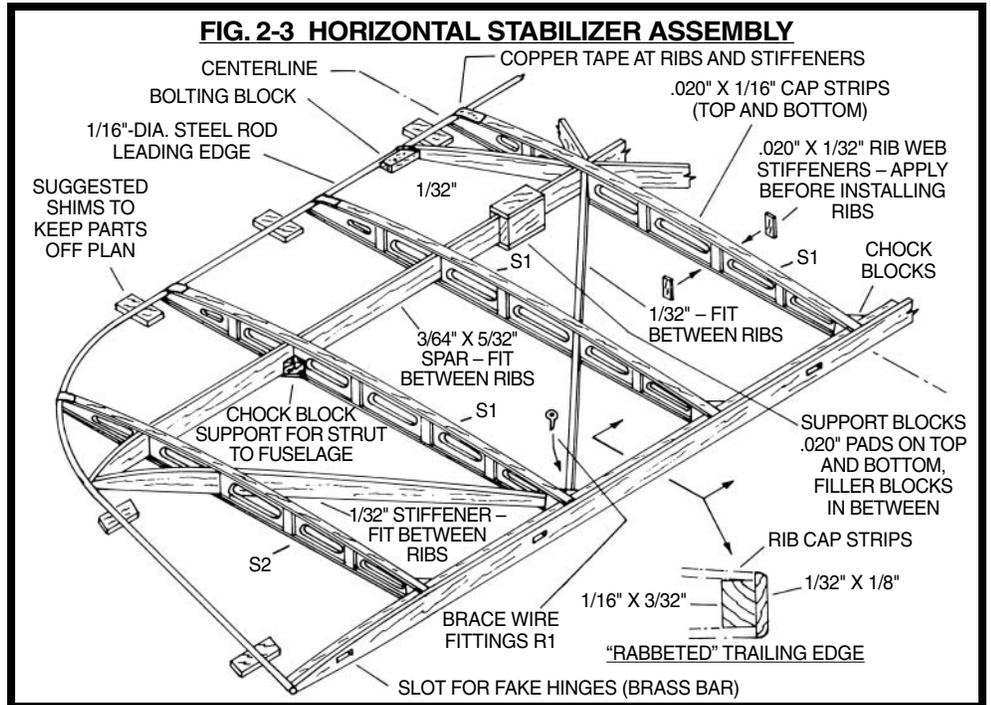
The ribs are laser-cut wood parts; the spar and diagonal stiffening are wood strips. First, add the vertical web stiffeners in way of lightening holes to each side of the ribs just like you did on the wings. Lay down the leading and trailing edge, then glue the ribs in place. Next, add the front spar. On the real aircraft this is a continuous spar, but for the model, fit pieces between the ribs. Make sure they are aligned on each side of the ribs so they look continuous. The spar tapers at the end as shown on the plan.

The main spar and the leading edge has some blocking for U bolts to secure the stabilizer to the fuselage. When installing the stabilizer you could dispense with the bolting or install thin brass or copper wire to represent the bolts. Your choice.

Install the small chocks at the trailing edge and in way of the struts under the stabilizer. Finally, add the diagonal stiffeners that taper. The upper cap strips can be added while the stabilizer is still on the plan. Add the lower cap strips after the stabilizer is removed from the plan.

**Option:** You could glue the cap strips top and bottom prior to installing the ribs. However, be sure you extend the strips past the rear end of the ribs, since the caps lie on the rabbeted trailing edge.

Cut the slots for the fake hinges in the trailing edge. Add the self-adhesive copper strips



at each rib over the leading edge. Install the brace wire fittings (R1) into the trailing edge as shown. This completes the horizontal stabilizer. The assembly is shown in Figure 2-3.

There are two wooden struts from the horizontal stabilizer to the fuselage on each side. Install these later along with the stabilizer. However, you can make them now and set aside. The struts are a streamlined section and have an R1 fitting in each end. These fittings are for bolting to the fuselage and stabilizer. For the model, they can just be glued.

### 4. Building & Installing the Elevator

The elevator leading edge is the same cross section as the horizontal stabilizer trailing edge. The trailing edge has a short piece of wood from the leading edge, then has a tube

secured to it for the remaining trailing edge. On the real aircraft the tubing was either an oval tubing or a V-shaped bent steel plate. For the model, you will use a round steel rod. At the splice between the steel rod and wooden section, wrap with black cord.

Ribs are laser-cut and are fitted with cap strips. Build the elevator like the stabilizer, over the plan. Install the upper cap strips while the elevator is on the plan. Add the blocks in way of the center ribs to provide a seat for the control cable horns.

Install the tapered diagonal stiffeners and the stringers. The stringers are located at the top and bottom of the ribs. Round the square stock into a dowel, and fit the stringers between the ribs (or, as an option, leave them square). You could also use a continuous stringer and cut notches in the

top and bottom of the ribs like the stringers of the wing ribs. These notches are not laser-cut into the elevator ribs for fear the rib may break between the upper and lower notches before assembly.

After removing the elevator from the building board, add copper tape and the fittings for the control cable brace wires (R2) at the trailing edge in way of the ribs. Mount the control horns (C2), then add the lower cap strips to the ribs. Cut slots for the fake

hinges in the leading edge, then assemble the elevator to the horizontal stabilizer using brass strip as fake hinges.

Figure 2-4 illustrates the elevator assembly.

### 5. Mounting the Vertical Stabilizer

Now is a good time to mount the vertical stabilizer on top of the horizontal stabilizer. Simply glue this on top of the center horizontal stabilizer rib cap strip. Make sure it is vertical. On the real aircraft the vertical

stabilizer is bolted on.

You can install the brace wires at this time using the 0.010" gray nylon cord. Short turnbuckles (R3A) are located at the horizontal stabilizer end.

Like the wings, store the completed tail surfaces and struts in a safe place until they are ready to be installed on the fuselage.

## STAGE 3: BUILDING THE BASIC FUSELAGE

Plan Sheet 3 shows all the details for constructing the basic fuselage. The plan also shows the cross bracing wires for the fuselage and the aluminum cockpit cowl. However, do not install the cockpit cowl or any brace wires that would interfere with installing cockpit controls. The cowl and some wires would get in the way when installing cockpit controls, seats, etc. The instrument panel fittings should be installed during this stage, as it is easier to place these in the instrument panel formers before the formers are installed. The landing gear, remaining cockpit controls, and engine installation will also be discussed in later stages. The following parts are required for this stage:

#### Laser-Cut Wood Parts

- Forward instrument panel former – 1 of F1
- Aft instrument panel former – 1 of F2
- Turtleback formers – 1 each of F3 through F10
- Fuselage building jig center piece – 1 of F26
- Fuselage building jig formers – 1 each of F27 through F32

#### Britannia Castings

- Oil pressure gauges – 2 of E1
- Altimeters – 2 of E2
- Ignition Switch – 1 of E3
- Air speed indicator – 1 of E4
- Tachometer – 1 of E5
- Water temperature gauge – 1 of E6

#### Photo-Etched Copper Parts

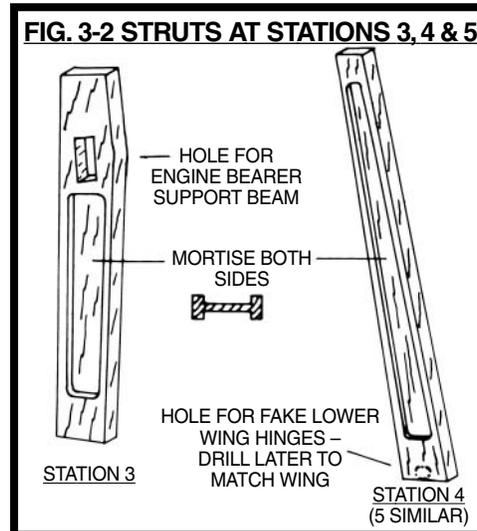
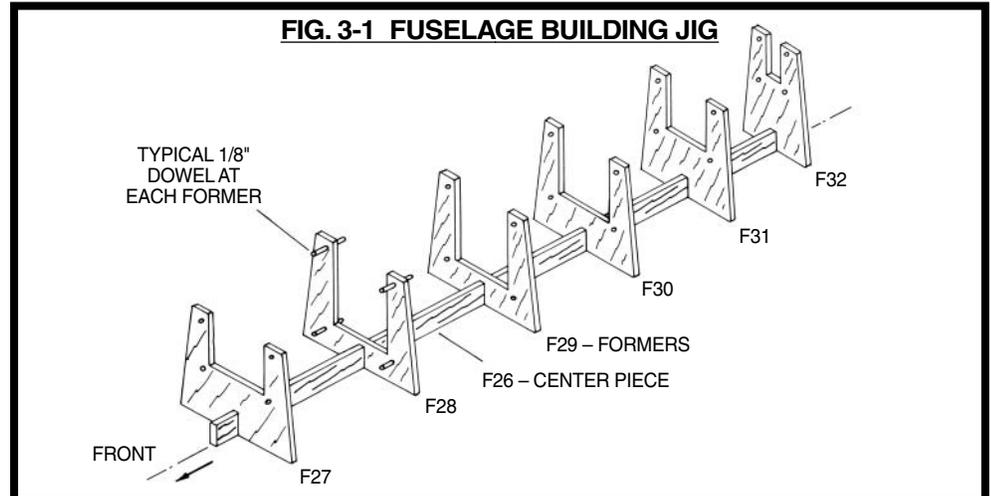
- Double eye cross brace wire fitting – 24 of F11
- Triple eye cross brace wire fitting – 18 of F12
- Strut clips Station 6 thru 11 – 24 of F13
- Nose plate front piece – 1 of F14
- Nose plate side pieces – 2 of F15
- Upper strut clip Station 2 – 2 of F16
- Lower strut clip at Station 2 – 2 of F17
- Upper strut clip at Station 3 – 2 of F18
- Lower strut clip at Station 3 – 2 of F19
- Upper strut clip at Station 4 & 5 – 4 of F20
- Lower strut clip at Station 4 and 5 – 4 of F21
- Step plate – 1 of F22
- Single eye rig fitting – 32 of R1
- Turnbuckles – 82 of R3A (short)

#### Steel Rod

- Tail skid support rods – 1/32"-dia. rod

#### Wood Strips (cut to length as required)

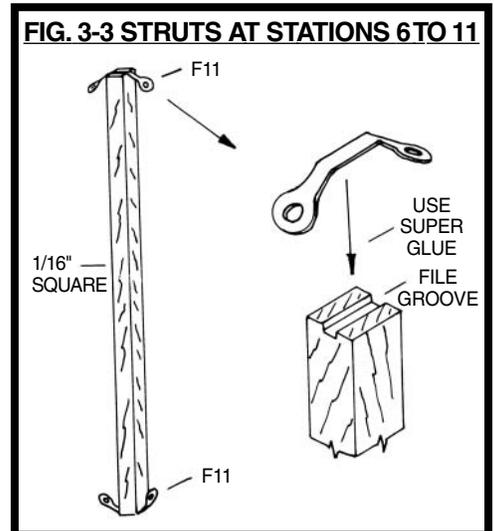
- Turtleback stringers – 1/32" x 3/64"
- Floor boards and shelf behind the rear cockpit – 1/32" x 1/2"
- Vertical and horizontal struts and vertical longitudinal seat rail struts – 1/16" x 1/16"



- Longerons – 1/16" x 3/32"
- Engine support beam – 3/32" x 3/16"
- Engine bearers – 1/8" x 3/16"
- Longitudinal and transverse seat rails and strut between rails – 1/16" x 1/8"
- Floor board supports, large vertical struts (Stations 4 & 5) and tailpost – 1/16" x 3/16"
- Large vertical struts (Station 3) – 1/16" x 1/4"

**Wood Dowels (cut to length as required)**  
Fuselage building jig dowel pins – 1/8"-diameter

**Rigging Cord (cut to length as required)**  
Fuselage cross bracing wires – 0.010"-diameter gray nylon cord  
Wrapping cord for splices – 0.008"-diameter black nylon cord



### 1. Building the Fuselage Jig

The fuselage sides can be assembled directly on the plan like the wings. Then, the sides will be transferred to a building jig. The jig will hold the sides in the correct shape so the top and bottom struts can be added, resulting in a correctly shaped fuselage.

Start by assembling the laser-cut building jig. Assemble the jig on a rigid board like a plywood board or particle board (not supplied in the kit). First, draw a straight guide line on the board. Tack or glue (or both) the jig center piece (F26) to the board, using the drawn line to get it straight. Next, insert a 1/2" long piece of 1/8" dowel through each of the round holes in all the laser-cut formers

(F27 through F32) and glue. These dowels are used for rubber banding the fuselage sides to the formers.

Fit each former in the slots in the center piece. Check with a square to see if they are perpendicular to the center piece and board. Then glue them in place. Super glue will work just fine here. *Figure 3-1* illustrates the jig. Set the jig aside for now.

## 2. Building the Sides of the Fuselage

On the plan, starting at the nose, the side vertical struts (and corresponding top and bottom horizontal struts) are labeled Station 1 through 11. I will refer to these Stations in the discussion.

The sides are to be built directly on the plan, and both are identical. Build one side then the other using the bottom plan on Sheet 3. This view just shows the longerons, vertical struts, and brace wire fittings that must be installed along with the vertical struts. To avoid gluing any parts to the plan, use some shims under the longerons. Place these just to the side of the vertical strut locations. Pin the 1/16" x 3/32" longerons over the plan. Since they are raised a bit, make sure they are located directly over the longerons on the plan. The longerons at the forward end have a rather sharp curve, so it would be wise to heat-bend the ends to conform to the curve. Heat-bending will relieve some stress so the longerons won't spring apart and break glue joints.

Using the single plan for both sides requires care in assembly. Remember that the right side of the fuselage will be the inside you are looking at. You want the other side, which will be the outside of the fuselage, to look good with no glue squeeze-out. An option, make a reverse quick copy of the plan and you will have two plans with the outside showing up.

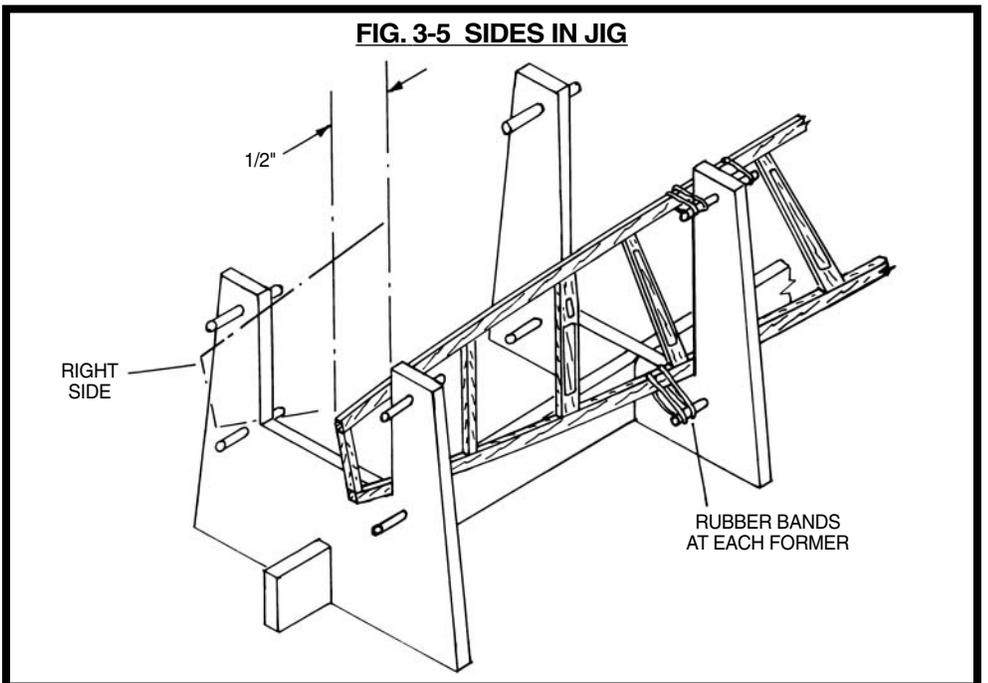
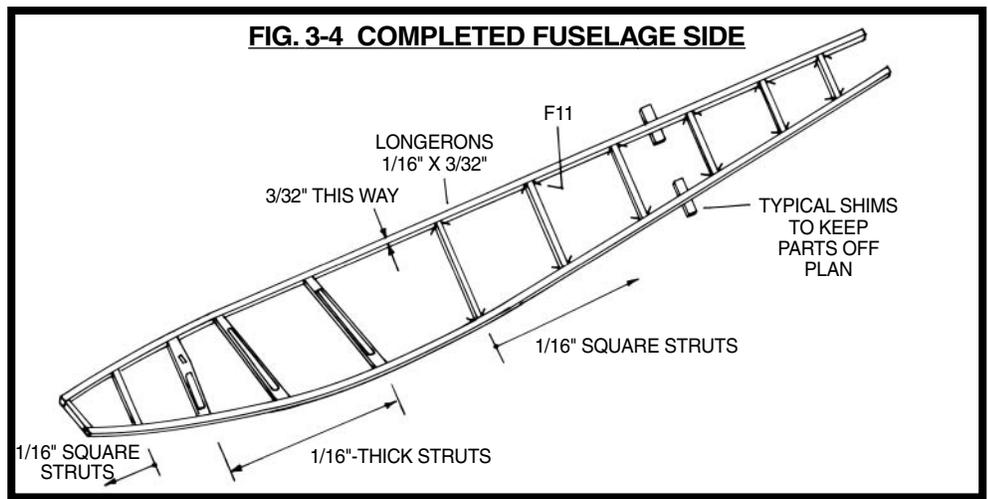
Cut the vertical struts for both sides of the fuselage at the same time, measuring lengths from the plan.

At Station 1, there is a 1/16" wooden strut that will later be covered by a photo-etched plate (F15) that fits on the outside of the longerons. On the real aircraft there is no wooden strut at Station 1, but for the model it aids assembly.

The strut at Station 2 is 1/16" square. Do not add any fittings at this time. A special fitting strut clip will be added later.

The three large struts at Station 3, 4, and 5 supporting the center section wing struts and rear end of the engine bearers on the real aircraft are heavy struts mortised out along the center on both sides. Cut these struts from stripwood. For the model, make the mortise using a hobby blade to cut the depth and a small chisel to hollow out the mortise (*Figure 3-2*).

The rear struts at Station 6 through 11 must be prefitted with a photo-etched copper two-eye cross brace wire fitting (F11) at each end before being installed. The fore and aft eyes are for the cross brace wires in the sides. File slots in each end of the wooden struts for receiving the fitting. Cut the slots to a depth



equal to the thickness of the fitting. Glue the fittings in place with super glue. Finally, bend the eyes down on each end to the angle of the cross brace wires (*Figure 3-3*).

The tailpost will be installed later between the two fuselage sides, after the sides are in the jig.

Start at the forward end of the fuselage and glue all the struts to the longerons. Careful you don't get any globs of glue into the eyes of the rigging fittings. *Figure 3-4* illustrates one completed side assembly.

## 3. Placing the Sides in the Building Jig

Set both sides in the building jig. Make sure both sides are aligned. The distance from the top front of the upper longerons to the face of the first building jig former should be 1/2". Hold the sides against the jig formers with rubber bands (*Figure 3-5*). Again, check the alignment of the sides. A little care here will eliminate a crooked fuselage.

A lot of work can be done on the fuselage with it in the jig. You may need to remove the fuselage at times, add some details, and

replace it in the jig. It's really up to you what you can accomplish with it in the jig. Do as much as you can.

## 4. Building and Installing the Horizontal Struts

At Station 1 there is no wooden strut. The nose plate (F14) will do this job and is discussed later.

At Station 2, there is a 1/16" square strut only at the bottom of the fuselage. This strut requires a double end rig fitting for the bottom cross brace wires. The detail is similar to the rear side struts as shown in *Figure 3-3*.

At Station 3, the top strut is actually a support beam for the engine bearers that will be discussed later. The bottom strut is 1/16" square. In addition, add 1/16" support blocks at each end of the strut. These blocks support the forward landing gear struts. Into the blocks add R1 fittings for the cross brace wires (*Figure 3-6*).

At Station 4 and 5, at the top, there is a 1/16" square strut with no fittings. Note that the strut at Station 5 is located at the back end of the side struts. This provides clearance for

the front seat back. At the bottom of the fuselage the struts are 3/16" square. This is strictly a model item. The large struts support the lower wing fake hinge pins, and also the rear landing gear strut. On the real aircraft there is a steel tube supporting the wing hinges. At each end of these struts, install R1 fittings for the lower brace wires (Figure 3-7).

**A word of caution:** When installing the 3/16" square bottom struts, check to make sure they are centered on the fake hinge pins in the wings. Recheck again when you install the photo-etched rig fittings. You don't want to get the struts with the copper fittings in place, then find out the wing pins won't fit the holes.

Stations 6 through 10 have top and bottom 1/16" square struts. For rigging, use three eye rig fitting (F12). Two eyes are for the top (or bottom) cross brace wires, and the third eye is for the brace wires across the fuselage at each station. At Station 6, there are no wires forward of Station 6 at the top. Cut off one of the eyes from the fittings as required (Figure 3-8).

At Station 11, the top and bottom struts are 1/16" x 3/32" (same depth as the longerons), as these struts represent a steel box on the real aircraft supporting the tail skid. Also, only a single rigging eye is required, as there are no horizontal brace wires aft of Station 11. Use a single eye rig fitting R1 for these. Also, add the two vertical steel rods between the top and bottom struts for additional support for the tail skid (Figure 3-9).

Between Stations 10 and 11, there are vertical diagonal boards which strengthen the fuselage in way of the tail skid. These fit on the inside of the longerons. See the profile view on the plan.

Install the struts, starting at the bottom of the fuselage. Note that all struts should be flush with the outside of the longerons. The longerons are deeper than the struts (except for Sta-

tion 11, which is the same as the longerons).

## 5. Longerons Splices

On the real aircraft, the longerons are spliced just aft of the cockpit between Stations 6 and 7. The forward end is oak or ash and the aft end spruce. For the model, no splice is required, but wrap the "fake" splice area with black cord. A similar wrap is used on the real aircraft. Refer to the profile view on the plan.

## 6. Building & Installing the Tailpost

Make the tailpost from stripwood. Fit two single eye rig fittings (R1) at top and bottom. Each will serve the brace wires from both sides. The slots in back of the tailpost for the fake rudder hinges can be cut later when the tail surfaces are being installed to ensure an accurate fit of the rudder. Taper the ends of the longerons on each side and glue in the tailpost (Figure 3-10).

## 7. Installing the Front and Side Nose Plates and Engine Bearers

Glue on the photo-etched side nose plates

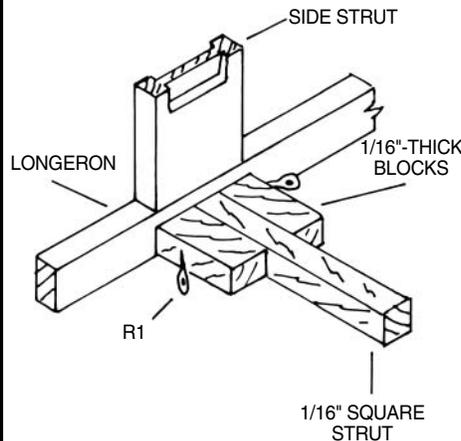
(F15) from top to bottom longerons. The front nose plate is also a photo-etched copper part (F14). Bend the top end corners to the angle of the longerons and bend the bottom end tabs forward to provide support for the radiator. Also, bend the tabs within the engine bearer holes down aft to provide support for the bearers. Fit and glue the nose plate on the fuselage.

Note that on the real aircraft, the side plates are actually a bent part of the nose plate, but they have been separated on the model.

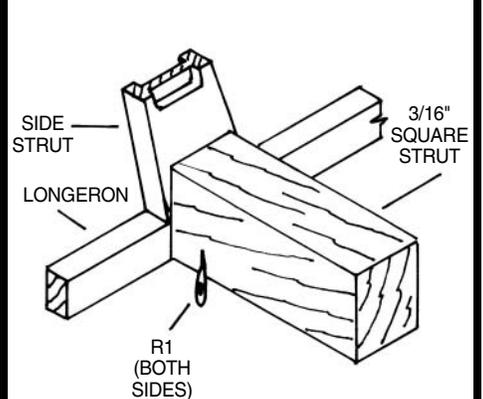
At the top and bottom of the side plates, there is a hole for inserting wing drag wire fittings (R1). Drill a hole into the longerons and insert these after F14 is glued to the longerons. See Figure 3-11 for the nose plate details.

For the engine bearers, first fit the cross beam at Station 3 which fits in the holes in the side vertical struts. Make the engine bearers from stripwood. Insert in the nose plate rectangular openings. The aft ends rest on the cross beam at Station 3. The

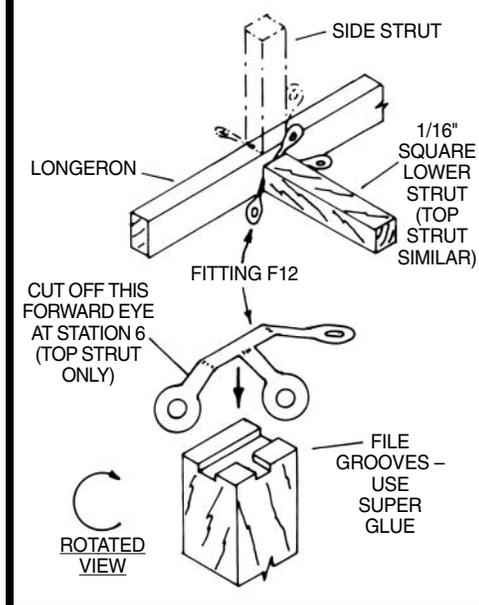
**FIG. 3-6 BOTTOM STRUT AT STATION 3**



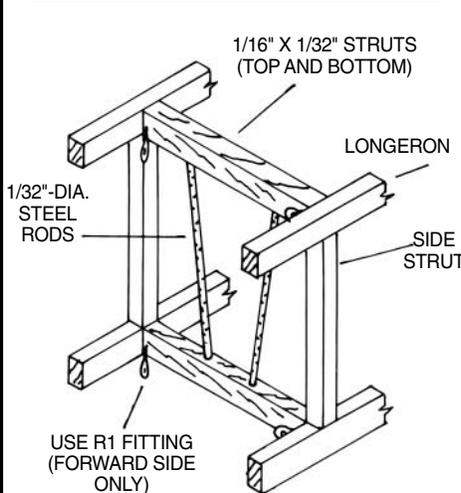
**FIG. 3-7 BOTTOM STRUTS AT STATIONS 4 & 5**



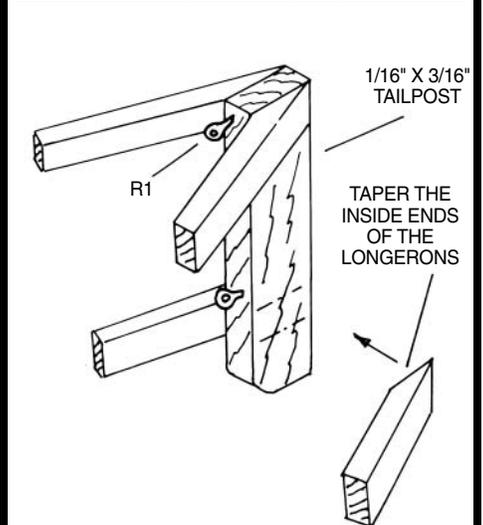
**FIG. 3-8 STRUTS AT STATIONS 6 TO 10**



**FIG. 3-9 STRUTS AT STATION 11**



**FIG. 3-10 INSTALLING THE TAILPOST**



bearers are parallel to each other, so position them thus. Glue the bearers at both ends. On the real aircraft the engine bearers are held to the support beam by U bolts over the bearers. You can use brass wire to fake these bolts or omit them. There is also an angle brace on each side securing the bearers to the side struts. Make these from brass strip (*Figure 3-12*).

Notice that the bearers slope downward providing downthrust for the propeller. Some *Jenny's* were built with the bearers level and therefore had no downthrust.

*Note:* If you elect to add the tubing, piping, and linkages for the engine (see Stage 6), you may want to hold off on rigging the side truss wires forward of Station 4 to give you better access to the interior.

### 8. Installing the Cockpit Floor Board Supports and Floor Boards

Edge glue three 1/32" basswood strips together to form the floor boards. Shape as shown on the plan. The ends of the transverse support pieces sit on top of the lower longerons. The floor boards are level so the transverse supports vary in height. *Figure 3-13* illustrates the floor boards and supports.

### 9. Installing the Longitudinal Side Seat Rails

The longitudinal seat rails, which also serve as supports for the elevator bar control fitting and aileron control sheaves, are secured to the inside of the struts in the cockpit area from Station 4 to 6. Glue these to the struts. Assure the correct angle. Between the seat support rail and lower longeron, install the two vertical supports on each side (*Figure 3-14*).

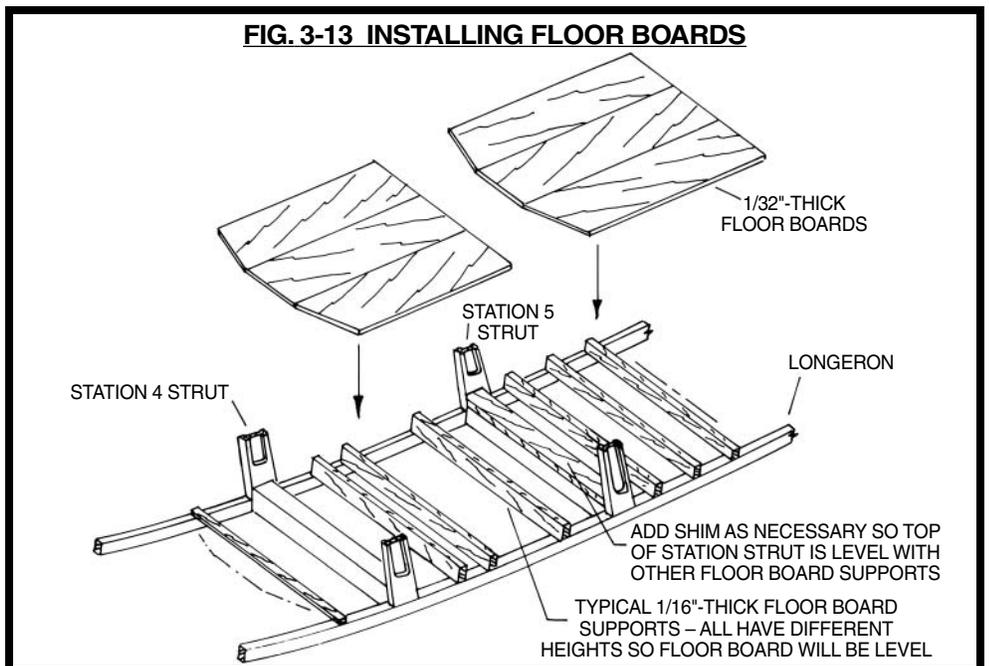
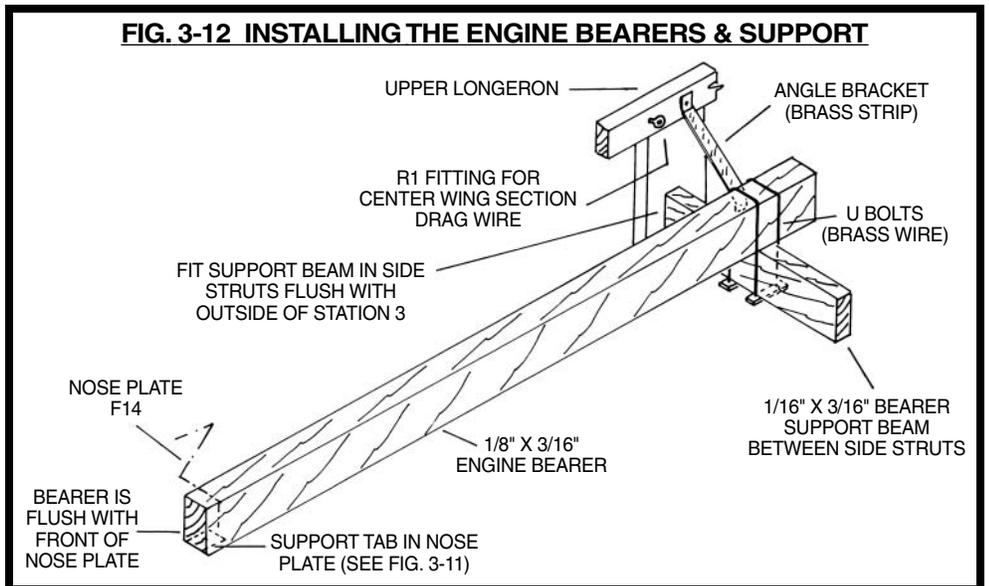
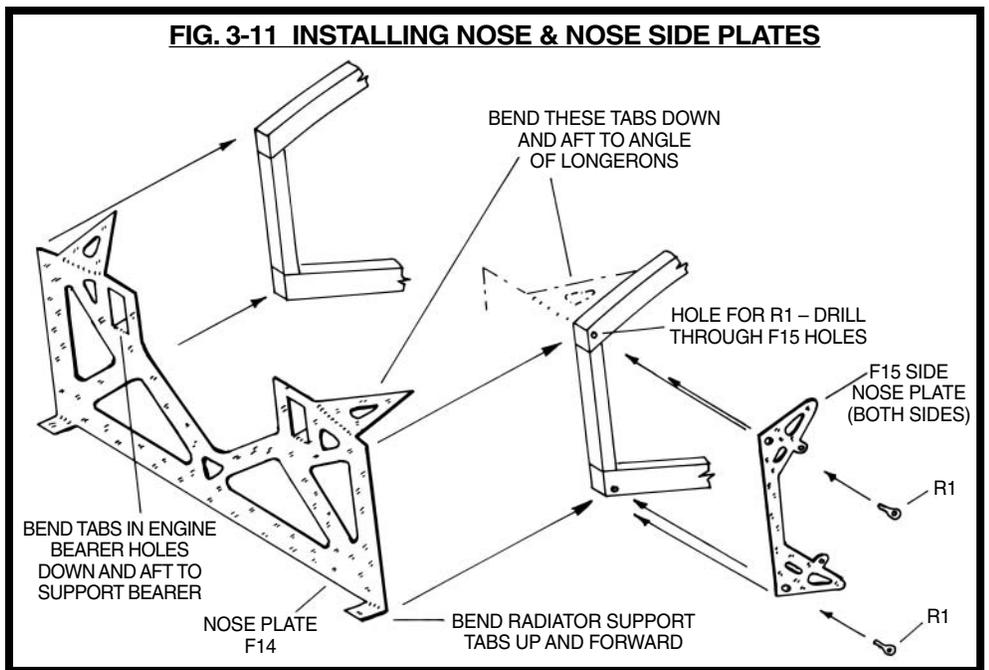
*Note:* Two transverse supports for each seat and a transverse strut between the rails at Station 5 will be installed when the seats are installed. At this point, these strips would hinder installing the flight controls on the floor boards.

### 10. Installing Forward and Rear Cockpit Instrument Panels, and Shelf Behind Rear Cockpit

**Firewall:** The real *Jenny* has a steel plate firewall at Station 3. However, I have eliminated the firewall on the model to provide a better view of the fuel tank and other internal items. You could add the firewall if desired, using aluminum sheet or plywood.

*Note:* The *Jenny* instrument panels varied from aircraft to aircraft. For our model I have selected an arrangement with the most common gauges and switches.

**Forward cockpit instrument panel:** The instrument panel former (F1) is laser-cut. Add the map case, which is simply a shallow box with a folding door fashioned from wood strip. Fit the britannia castings for the oil pressure gauge (E1) and the altimeter (E2). Beforehand, drill a hole in the back of E1



for the copper fake tubing to be added later. Glue the panel on top of the longerons just aft of the Station 4 horizontal strut in the location shown on the plan. Add a small chock at each longeron to help support the panel in a vertical position (*Figure 3-15*).

**Rear cockpit instrument panel:** The aft instrument panel former (F2) is also laser-cut. Fit the britannia cast instruments: Oil pressure gauge (E1), Altimeter (E2), Ignition switch (E3), Airspeed indicator (E4), Tachometer (E5), and Water temperature gauge (E6). Drill a hole beforehand in the back of E1 and E6 for the copper wire fake tubing to be added later. Glue the panel in place just aft of the Station 5 horizontal strut in the location shown on the plan and add a chock similar to the forward panel (*Figure 3-16*).

*Note:* The kit does not include any faces for the various instruments. You could paint the faces, or make your own decals. Cover with a clear plastic or clear varnish to represent glass. Or, omit the faces altogether; your choice.

**Shelf behind the rear cockpit:** Add the shelf using 1/32"-thick wood. The shelf extends from the horizontal strut behind the cockpit back to the turtleback former. Locate the shelf between and at the bottom of the upper longerons. The shelf often contained a small fire extinguisher. The shelf is shown on the top longeron plan on Sheet 3.

### 11. Installing the Fuselage Strut Clips

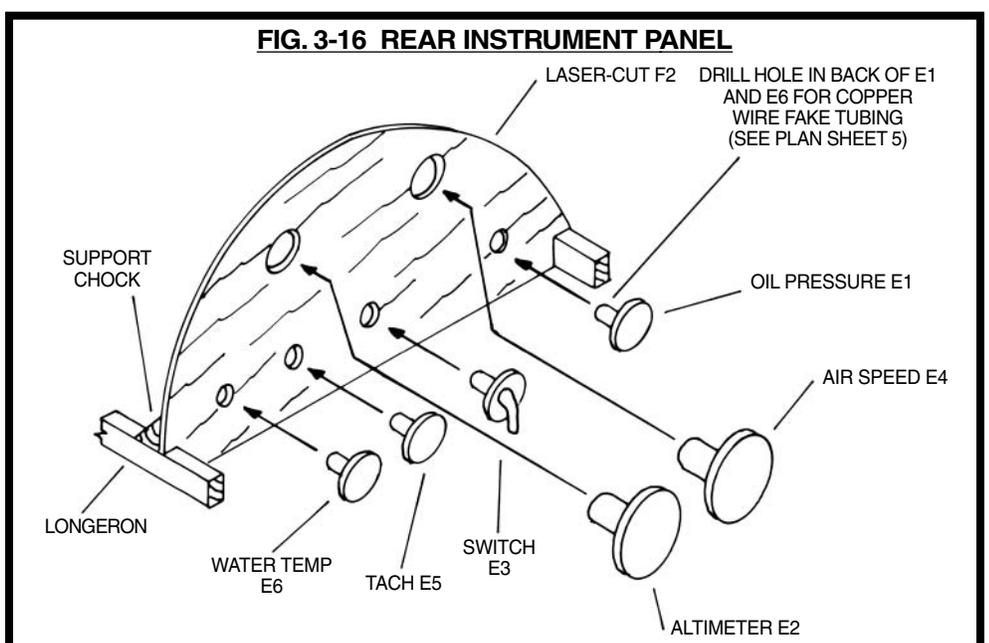
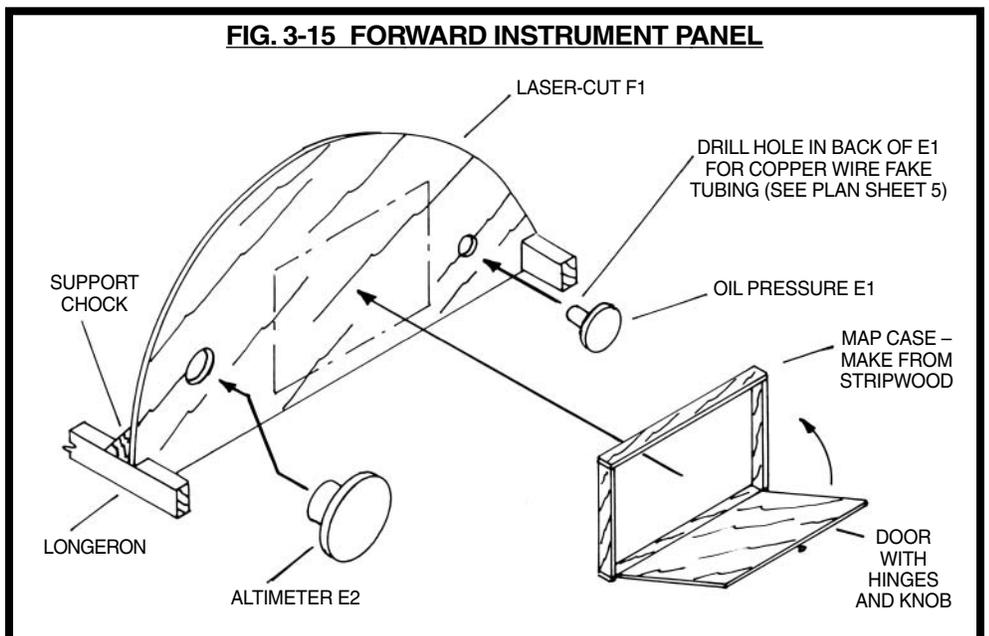
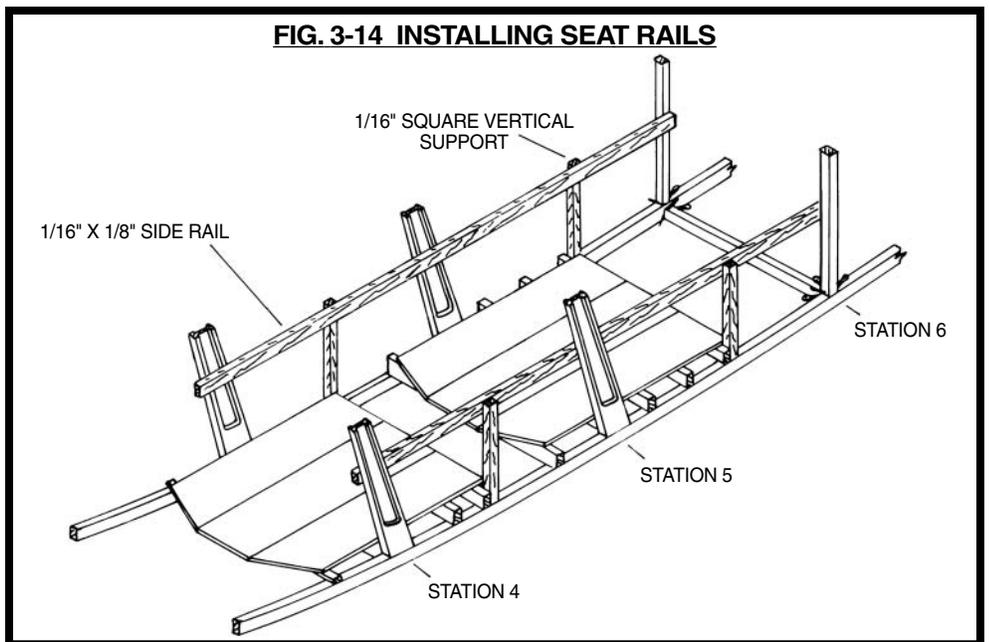
The cross brace rigging eyes have already been installed for the vertical and horizontal struts at Stations 6 through 11. As a final touch for these joints, add the photo-etched copper clips (F13) on the longerons. Bend each clip over or under the longerons as required (*Figure 3-17*). On the real aircraft, these clips are actually a bolting clip for the struts. For the model, these are just fake clips for added detail.

The ends of the vertical struts at Station 2 through 5 require some special clips (F16 through F21). These clips secure the struts to the longerons and contain rigging eyes for the side cross brace wires. The lower clips at Station 4 and 5 also have eyes for wing flying wires.

The clips at Stations 2 through 5 on the real aircraft are actually a U-shaped clip, so the clip is the same on both sides of the longerons. However, for the model these are designed to be installed only on the outside, where they can be seen. Glue the clips in place and bend the tabs around the struts for added support. They might fall off while rigging if only glue is used. The tabs on the upper clips at Stations 4 and 5 form a socket for the lower ends of the center section wing struts.

At Station 2, the upper strut clips bend over a horizontal 1/16" square strut. The front of this strut will be secured to a bracket on the radiator when it is installed.

Note that the lower fitting at Stations 4 and 5 is saddled over the holes in the fuselage for the lower wing fake hinges pins. To accurately locate the fittings, use the completed wing hinge pins as a guide.



Figures 3-18 through 3-20 illustrate the strut clips at Stations 2 through 5.

The side brace wires from Stations 1 to 5 are double on the real aircraft, side to side. The inboard wire would connect to the inner side of the strut clips. However, since there is no inner clip to attach brace wires, I have eliminated the second inboard wire on the model. If such an omission bothers you, install a single eye rig fitting (R1) into the inner side of the vertical struts and add the inner wires.

### 12. Installing Cross Brace Wires

Some of the cross brace wires can be installed during this stage. The wires are rigged with the 0.010"-diameter gray nylon cord and the short turnbuckles (R3A) similar to wing drag wires. However, do not install any wires at this time that would interfere with installation of the cockpit controls. Also, if you elect to add the tubing, piping, and linkages for the engine, you may want to hold off on rigging the side brace wires forward of Station 4 to give you better access to the interior.

Install the wires at top of the fuselage in way of the turtleback before installing the turtleback discussed in the next paragraph. It would also be wise to install the brace wires across the fuselage at Station 6 aft, since these internal wires will be a little difficult to install.

### 13. Building and Installing the Turtleback

On the real aircraft, the turtleback was secured to the fuselage with screw clips so it could be removed. For the model, you can permanently glue it in place. All the formers for the turtleback are laser-cut (F3 through F10).

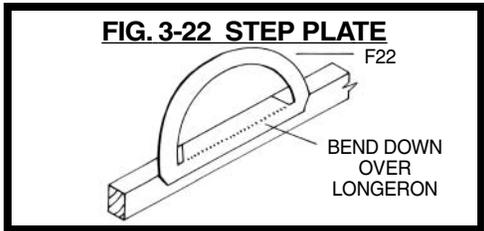
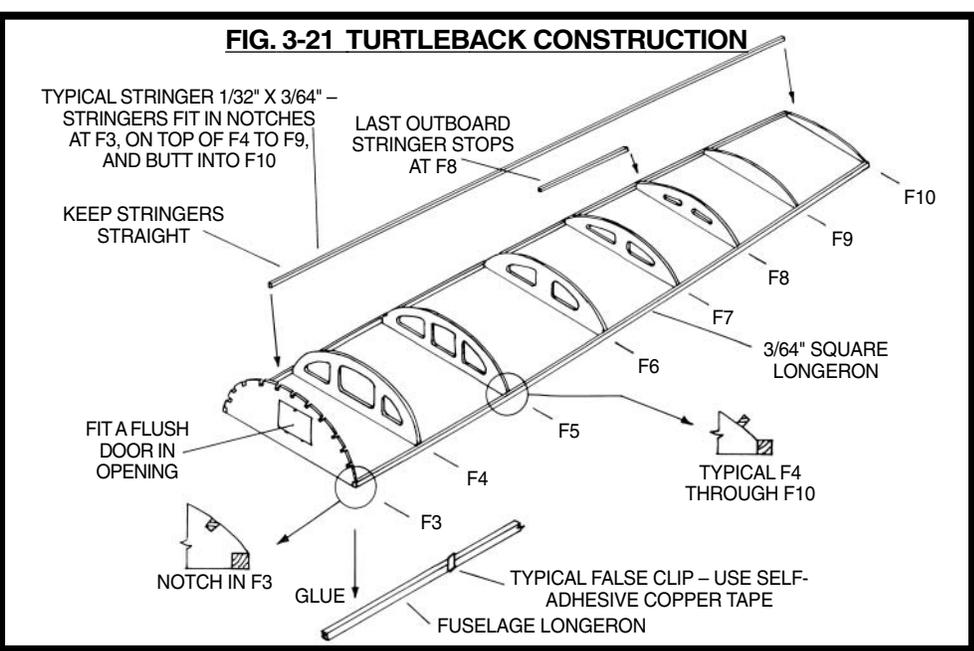
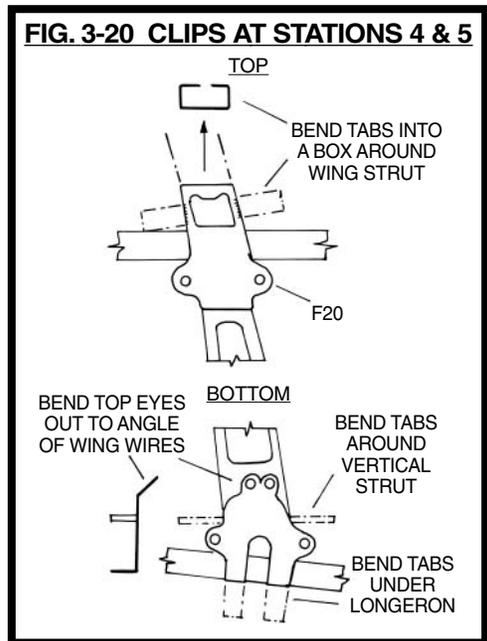
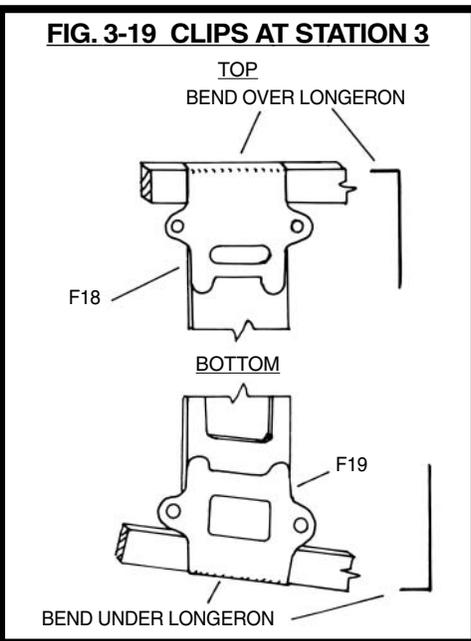
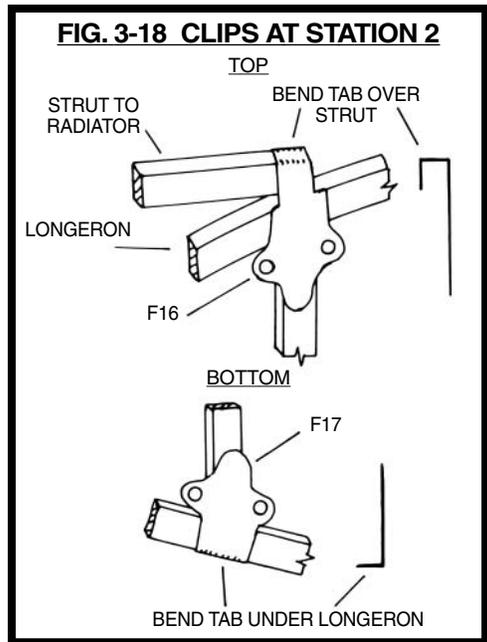
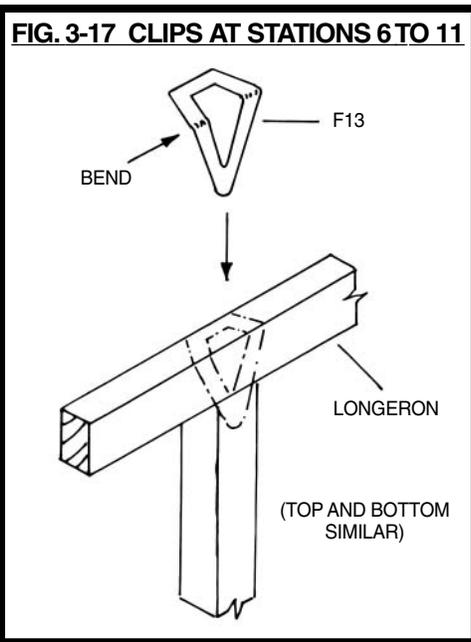
First, glue the side strips on top of the longerons, then add the formers. Notch out the strips in way of the side strut clips that lay over the longerons at Station 6 to 10. The forwardmost former has a small access door, probably a viewing port to the back of the fuselage. Next, install the stringers in the laser-cut slots of the first former. The rest of the formers do not have slots. Glue the stringers on top of them, but carefully mark the formers in pencil beforehand so you align them according to the plan. The aft ends of the stringers butt into the formers (Figure 3-21). Finally, add the securing screw clips along the edge. These are faked using a piece of self-adhesive copper tape. Figure 3-21 illustrates the turtleback construction.

**Option:** If you want the turtleback to be removable, build it directly on the plan, but make sure it will fit the fuselage longerons.

**Option:** If you want the turtleback to be removable, build it directly on the plan, but make sure it will fit the fuselage longerons.

### 14. Installing the Step Plate

Fit the photo-etched copper step plate (F22) only on the left side of the fuselage (looking forward). Bend the center tab down on top of the longeron and glue in place (Figure 3-22).



## STAGE 4: INSTALLING COCKPIT CONTROLS AND SEATS, AND ADDITIONAL RIGGING

Plan Sheet 5 illustrates all the details for installing cockpit controls. For the cross brace wires and seats, refer to Sheet 3. The following parts are required for this stage:

### Laser-Cut Wood Parts

- Rudder bars – 2 of C6
- Seat bottoms – 2 of F25

### Britannia Castings

- Aileron control wire sheave – 4 of C3
- Aileron control wire sheave bodies – 2 of C4
- Rudder bar supports – 2 of C5
- Joysticks – 2 of C7A
- Joystick shaft and supports – 1 of C7B
- Joystick forward connecting link – 1 of C7C
- Joystick aft connecting link – 1 of C7D
- Aileron control wire quadrant – 1 of C8
- Elevator control beam shaft – 1 of C9
- Elevator control beams – 2 of C10
- Elevator control beam shaft end fittings – 2 of C11
- Magneto switches – 2 of E7
- Throttles – 2 of E8

### Wood Strips (cut to length as required)

- Transverse seat supports and strut between longitudinal rails – 1/16" x 1/8"

### Photo-Etched Aluminum Parts

- Seat backs – 2 of F23

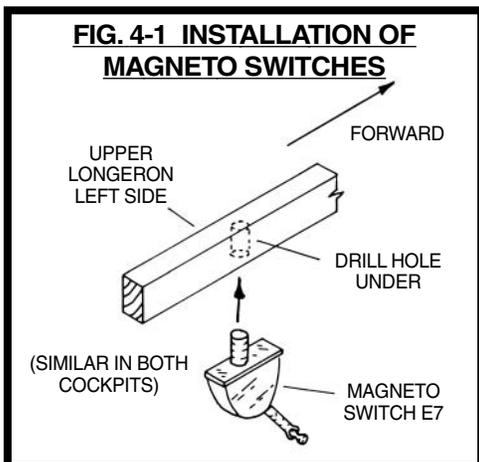
### Brass Rod (cut to length as required)

- Throttle control linkage – 0.016"-diameter brass rod
- Note that the rigging cord and turnbuckles are listed in Stage 3.

### 1. Installing the Joysticks and Other Flight Control Fittings

This work involves the use of britannia castings. Clean up the castings before starting. Check all the small holes to see if they are fully open and will fit other parts. Ream out with a drill bit or reamer if necessary.

**Magneto switches:** Install a magneto switch (E7) in each cockpit under the left longeron. Drill a hole under the longeron for the pin on the casting (*Figure 4-1*). Obviously, there is wiring from this type of fitting but wiring of this nature has been omitted on the model.



**Throttles:** Install a throttle (E8) in both cockpits on the right longeron. While you are at it, add the throttle linkage to the engine. It can be attached to the engine after it is installed. Use 0.016"-diameter brass rod for the linkages. The rods attach to the throttles in each cockpit, then to an arm secured to the right fuselage strut at Station 3. From the arm, there is a rod going to the carburetor. The arm at the fuselage side and the plate supporting the rod are not provided as a fitting in the kit. Make these from brass stock. *Figure 4-2* shows the entire setup.

**Rudder bar assembly:** Fit and glue the laser-cut wood rudder bars (C6) on the support castings (C5), and install in the model on top of the floor boards. Drill a hole in the floor boards for the pin on each fitting. The real aircraft has a thin flange plate to hold the bars in place. For the model, simulate this by painting a black circle as shown on the plan, or use a piece of self adhesive copper tape.

The control wires for the rudder can be installed at this time if desired. For the cord coming off the rear rudder bar, coil enough cord

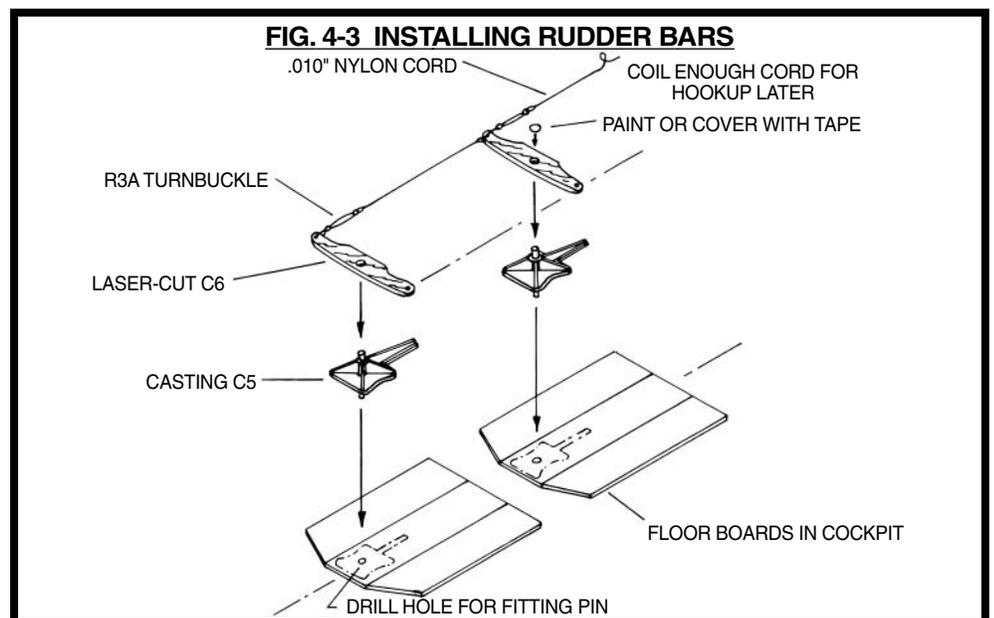
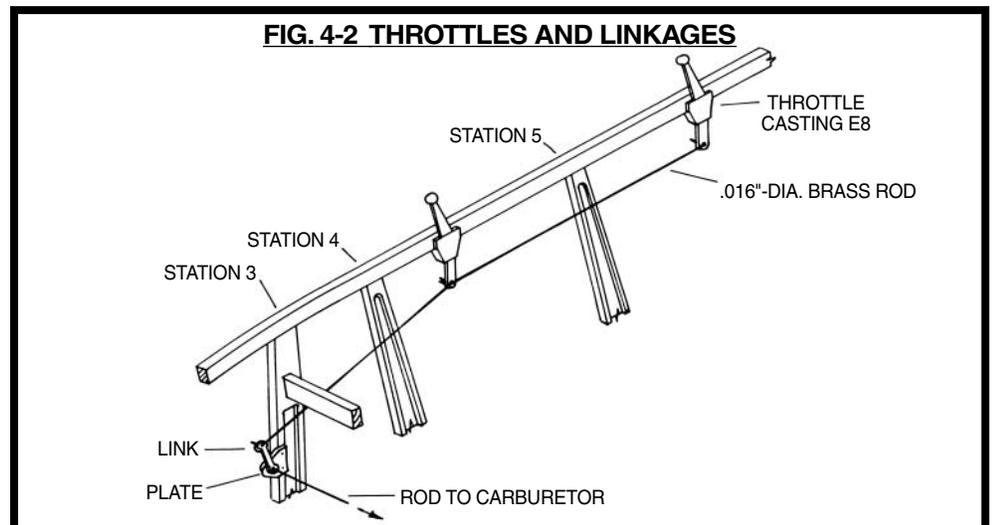
and leave it in the fuselage. You can attach it to the rudder control horns later (*Figure 4-3*).

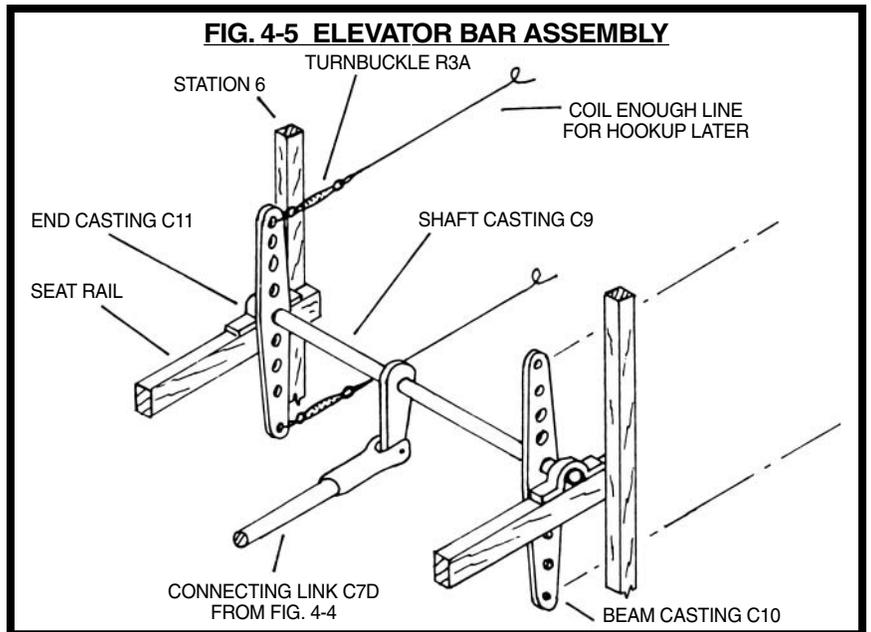
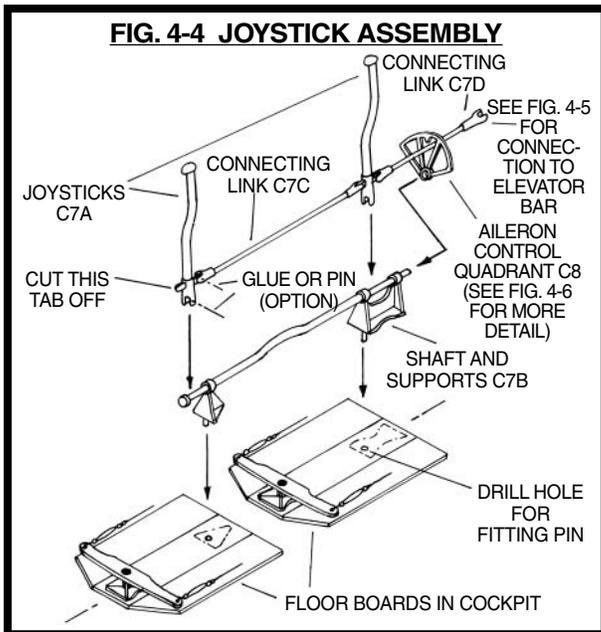
**Joystick assembly:** The two joysticks (C7A), shaft and supports (C7B), connecting linkages (C7C, C7D), and aileron control quadrant (C8) are best preassembled outside the model. Glue all parts together. If you want a better, stronger joint at the joysticks, drill a hole through the joystick bottom and the support bar and insert a brass pin. Likewise, as an option, drill holes through the ends of the connecting linkages and tabs on the joysticks.

On the joystick you select for the forward cockpit, cut off the front tab for the connecting link. This particular tab is not used at this location.

The quadrant fits the end of the shaft. Before installing, drill a small hole on each side of the quadrant at the top. The control wires go over the top in the quadrant grooves, through the holes and seize to the tab at the upper center of the quadrant. This detail is shown in *Figure 4-6*.

To install the entire assembly, drill two holes in the floor boards to receive the pins under the supports (*Figure 4-4*).





**Elevator bar assembly:** Slide the elevator control beams (C10) onto each end of the shaft (C9). Place the shaft on top of the longitudinal seat rails and connect the center connector to the rear joystick connecting link (C7D). Finally, add the end fittings (C11) over the shaft ends and glue to the seat rails. The elevator cables can be installed at this time. Leave enough cord for later hookup (Figure 4-5).

**Aileron control wire lead sheaves:** Install the forward lead sheaves (C3) – one on each side of the fuselage) on top of the longitudinal seat rail at the front vertical rail support. For the aft lead sheaves, assemble a sheave (C3) into a body (C4). Install the fittings on top of the seat rail at the rear vertical rail support (Figure 4-6). This figure also shows the quadrant detail and the aileron control lines.

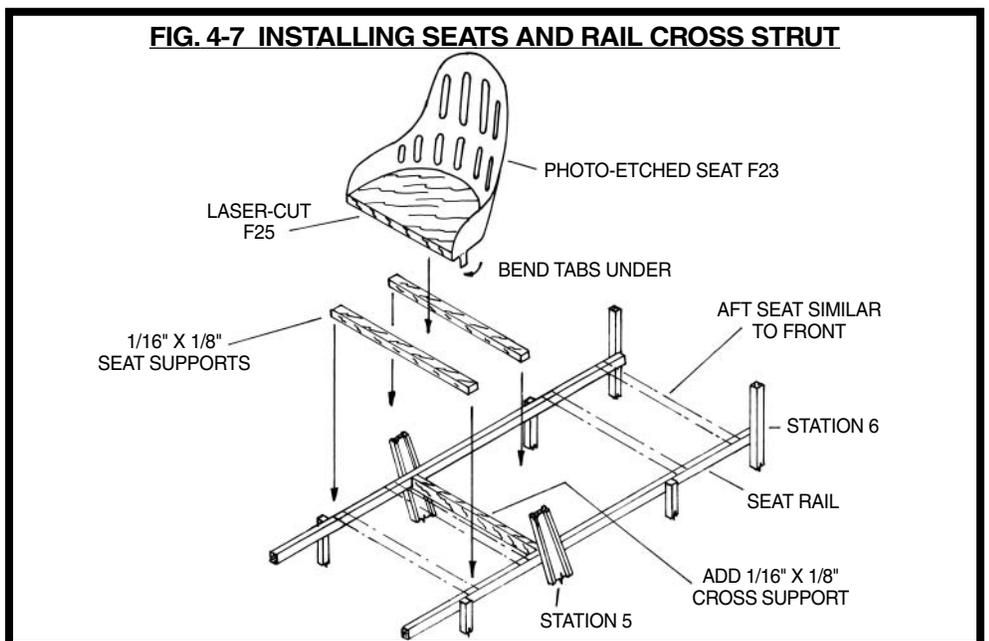
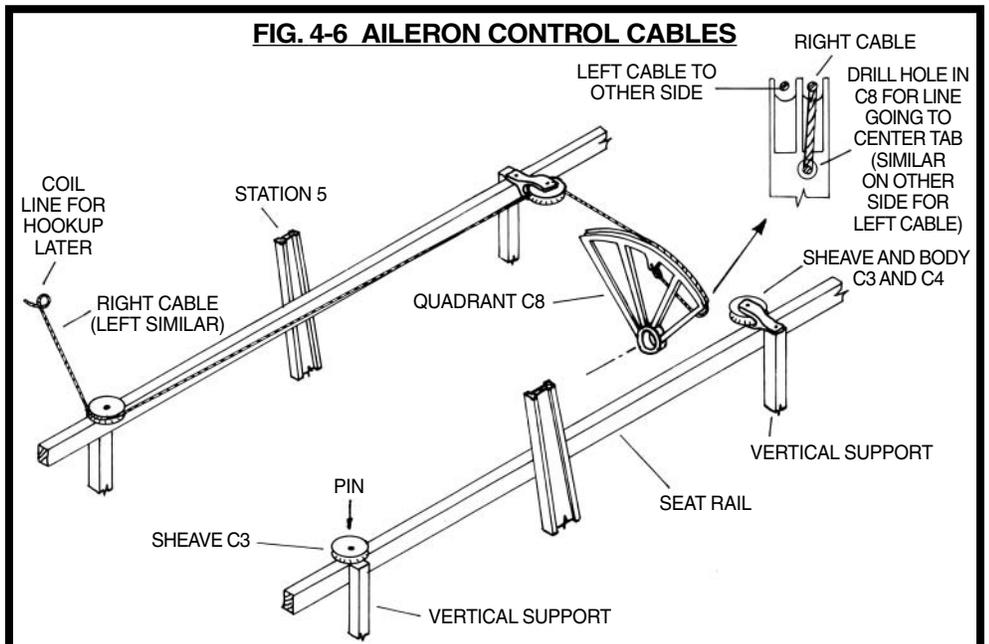
## 2. Building and Installing the Seat Supports, Seats, and Rail Cross Strut

Install the transverse seat supports (two per seat) on top of the longitudinal seat rails and also the cross strut between the rails at Station 5 that we put off earlier. The seat bottom is laser-cut. The back is photo-etched aluminum. Bend the back to the shape of the bottom and glue to the bottom. There are some tabs on the aluminum back to be bent under the wood seat bottom. Glue the seats to the transverse seat supports (Figure 4-7).

*Note:* On the real aircraft, the seat edges and back were usually covered with padded fabric, and a cushion was used in the bottom. These are not included in the kit.

## 3. Rigging More Fuselage Cross Brace Wires

Now that many parts are installed in the fuselage, you can rig more of the cross brace wires using the 0.010" gray nylon cord. But hold off in way of the engine. The locations of the turnbuckles and wires are shown on the plans. Rig the wires just as you did the drag wires in the wings.



## STAGE 5: BUILDING AND INSTALLING THE OX-5 ENGINE, RADIATOR, FUEL TANK, AND PROP, AND FINAL RIGGING OF CROSS BRACE WIRES

Plan Sheet 5 covers all the details for the engine and engine component installation. A propeller detail is also shown on Sheet 5. The following parts are required for this stage:

### Laser-Cut Wood Parts

Prop laminates – 9 of E44

### Britannia Castings

Radiator frame – 1 of E9A

Fuel tank frame – 1 of E10

Fuel tank cap – 1 of E12

Fuel tank fuel gauge – 1 of E13

Fuel tank sediment vial – 1 of E14

Upper engine block – 1 of E15A

Upper engine block bolting feet – 6 of E15B

Lower engine block – 1 of E16

Prop shaft housing – 1 of E17A

Oil pump and housing 1 of E17B

Prop clamp plates – 2 of E18

Prop shaft hub – 1 of E19

Oil fills – 2 of E20

Prop shaft housing top double bracket – 1 of E21

Sump cover – 1 of E22

Carburetor/V intake manifold support – 1 of E23

Carburetor and filter – 1 of E24

Cylinders – 8 of E25A

Spark plugs – 8 of E25B

Water outlet pipes on top of cylinders – 2 of E26B

Intake rocker actuating spring and housings – 8 of E27

Intake valve rocker arms – 8 of E28

Exhaust valve rocker arms – 8 of E29

Water pump, front half – 1 of E30A

Water pump, rear half – 1 of E30B

Water inlet pipes on side of cylinders – 2 of E31

Water inlet pipe curved section, long right – 1 of E32

Water inlet pipe curved section, short left – 1 of E33

Lower intake water pump pipe from radiator – 1 of E34

Camshaft gear box – 1 of E36

Magneto, gear box, and distributor block – 1 of E37

V intake manifold at carburetor – 1 of E39

Intake manifold pipes, long sections – 2 of E40

Intake manifold pipe, long section right – 1 of E41A

Intake manifold pipe, short section left – 1 of E41B

Intake manifolds – 2 of E42

Exhaust manifolds – 2 of E43

### Photo-Etched Copper Parts

Fuel tank hold down – 2 of R1

### Photo-Etched Nickel Silver Parts

Radiator grill – 1 of E9B

Fuel tank front and back plates – 2 of E11

### Brass Strip (cut to length as required)

Fuel tank support and hold-down straps, and hanger for engine water inlet pipe – 1/64" x 1/16" brass strip

FIG. 5-1 FUEL TANK ASSEMBLY

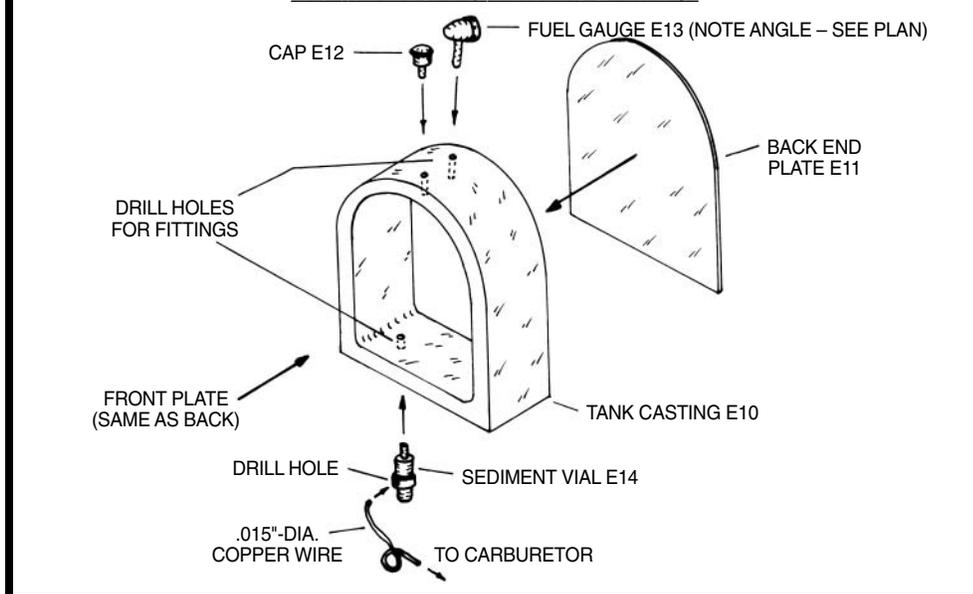
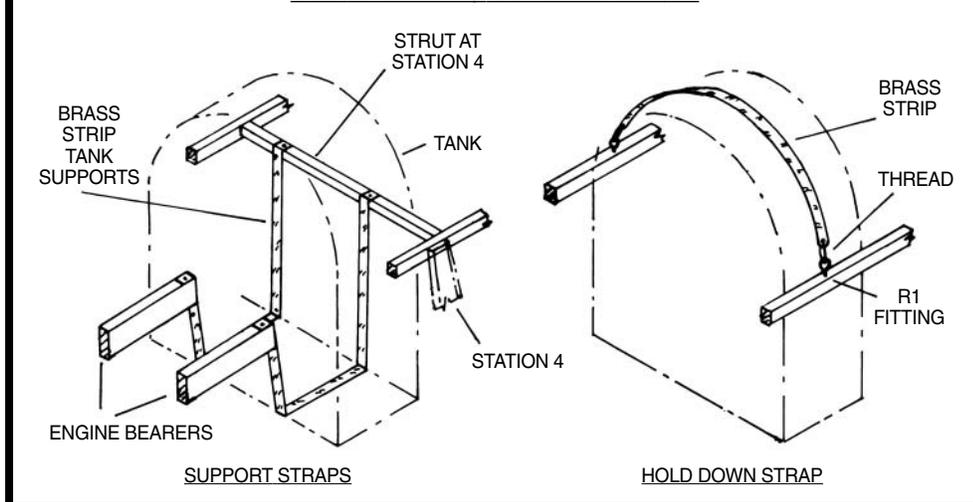


FIG. 5-2 FUEL TANK SUPPORTS



### Copper Wire (cut to length as required)

Water, fuel, and oil pump tubing – 0.015"- and 0.025"-diameter copper wire

### Tubing (cut to length as required)

Radiator and engine flex hoses and pipe joints – 3/32" o.d. clear PVC tubing

### Self-Adhesive Copper Tape

(cut to length and width as required)

Wiring harness tube straps

### Wood Dowels

Ignition wiring harness tubes – 1/16"-dia.

### Flexible Covered Stranded Wire

(cut to length as required)

Ignition wiring

Note that the fuselage cross brace wire cord and turnbuckles are listed in Stage 3.

This stage requires the assembly of a large number of britannia castings. Because of casting limitations, or excessive mold cost, it will be necessary to drill some holes in many of the castings for fitting other parts. The

holes required are shown on the plans and described in this section. Most holes require a 3/64" (or #55) or 1/16" (or #52) drill bit. Mark the location of the holes carefully before drilling. Britannia is fairly soft, so a pin vise should suffice, or use a drill press.

### 1. Assembly and Installation of the Fuel Tank

First, mark and drill the two holes at the top of the fuel tank frame (E10) and the hole in the bottom. Glue the britannia cast fuel gauge (E13) and fill cap (E12) in the holes in top of the frame, then glue the sediment vial casting (E14) in the bottom hole.

Glue the photo-etched front and back plates (E11) to the tank frame (E10). Flip-flop the plates to see which side fits the best. The casting may not be exactly symmetrical and the pattern for the end plates was taken from the casting. File the edges smooth. Figure 5-1 illustrates the tank assembly.

The fuel tank is supported by two brass straps, one end hanging off the rear ends of the engine bearers and the other ends hanging on the top horizontal strut at Station 4. This is just one method of supporting the tank. Other arrangements have been found in photos of the real aircraft. Place the tank onto the support straps.

In the right and left top longerons at the center of the tank, insert a single eye rig fitting (R1). Drill a hole in each end of a hold-down strap made from brass strip. Bend and fit over the tank, then use gray rigging cord to tie the strap down to the single eye fittings. (Figure 5-2).

**Caution:** Make sure the fuel tank is correctly located according to plan. If it is too far forward it will hit the water pump at the rear end of the engine.

## 2. Building the OX-5 Engine

Sheet 5 illustrates various views of the assembled engine at model scale. The sheet also shows some enlarged details for assembling the basic castings. These views are helpful, as the engine to scale has some very small detail.

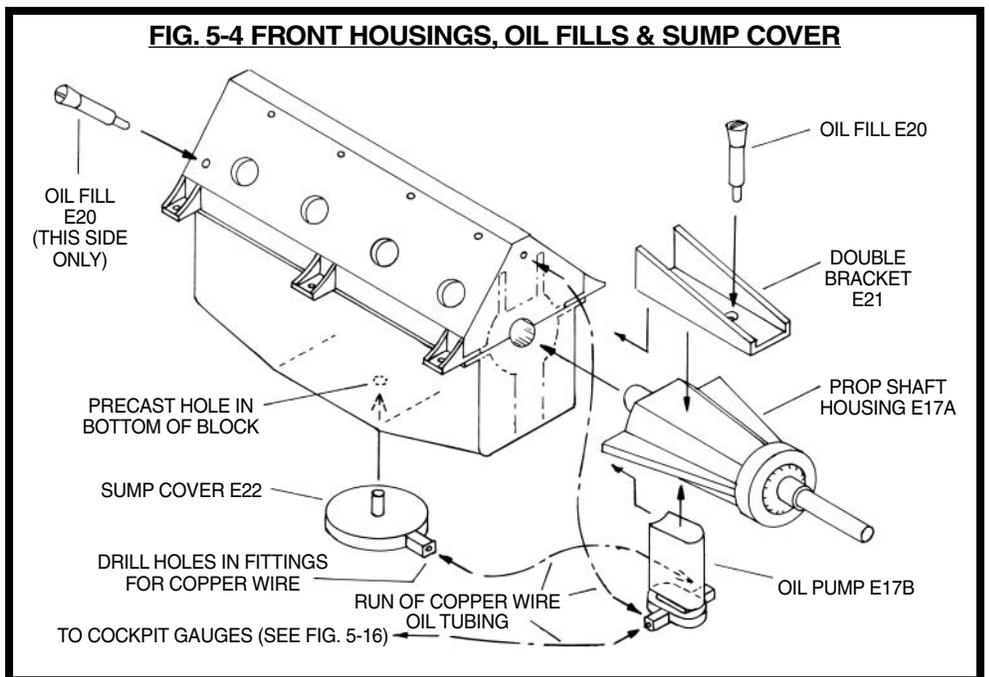
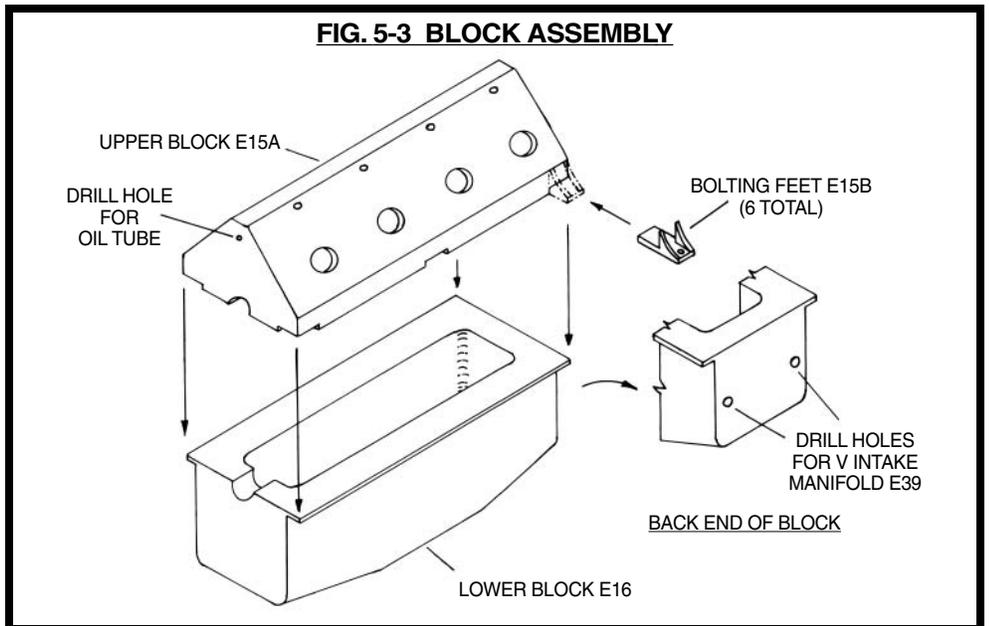
In addition to holes you need to drill yourself, there are a number of precast holes. There is a possibility some of these holes may not cast well because of the small size. Ream the holes out with a drill bit and test fit the parts in the holes to make sure the assembly can be accomplished. Clean off any remaining flash on the castings.

**Engine block assembly:** Before assembling the upper and lower engine blocks (E15A & E16), locate, mark, and drill a hole in front of the upper block for the oil tube from the oil pump. On the lower engine block, drill the two holes in the back of the block for the V intake manifold (E39). The plans indicate the location of the holes relative to the top of the lower engine block.

Glue the six engine bolting feet (E15B) into the bottom slots of the upper engine block (E15A). Make sure the feet are flush on the bottom. If necessary, file them flush so the entire bottom of the block is flat. On the real engine, these are a part of the upper block casting, but for the model they have been cast separately. Then, glue the upper engine block assembly to the lower block. Make sure the semicircular holes at the front of the blocks are aligned, and that the side flanges of the lower block are flush with the flat sides of the upper block (Figure 5-3).

Glue the rear oil fill fitting (E20) into the upper engine block hole on the right side of the block. Clean the precast hole if necessary. Glue the double bracket fitting (E21) on top of the prop shaft housing (E17A). Glue the oil fill (E20) into the hole at the center of E21. You may need to shorten E20 a bit or drill the hole deeper into E17A.

Glue the prop shaft housing assembly into the front hole in the assembled engine



block. Make sure it is aligned evenly. Glue the oil pump and housing (E17B) to the front of the lower engine block and bottom of E17A. The fitting should be vertical, as shown on the plan. There are no alignment pins for this fitting. Glue should suffice, but you could add a pin if you so desire.

Install the sump cover (E22) in the precast hole in the bottom of the lower engine block. Clean out the hole if necessary. Using copper wire to represent tubing, add wire between the oil pump and top front of the engine block (hole you drilled), and from the oil pump to the sump cover. There is also a wire from the oil pump to the cockpit gauges. This will be discussed and installed later during this Stage (see Paragraph 5). Drill holes as necessary in the fittings for inserting the wire. Figure 5-4 illustrates the addition of the front housings, oil fills, sump cover, and associated tubing runs.

**Note:** The prop shaft housing includes the prop shaft molded into one casting. On the real engine the housing is really a part of the engine block. Likewise, the oil pump housing is a part of the lower engine block.

**Carburetor/V intake manifold support, V intake manifold, and carburetor (Figure 5-5):** Glue the carburetor/V intake manifold support (E23) into the two holes in the bottom of the lower engine block. This fitting supports both the carburetor and the V intake manifold. If necessary, bend both ends of the support so that the front end and aft end are parallel. This fitting is not quite horizontal from bottom of the engine block to bottom of the V intake manifold.

Drill holes into the sides of the V intake manifold (E39) that will take wire (water tubing) later. Then, install the V intake manifold. Insert the bottom pin through the hole in the carburetor support plate, and glue the upper pins into the holes that

you drilled on each side of the rear face of the lower engine block.

Drill a hole into the carburetor filter for the fuel line wire, and add the fitting and hole for the throttle arm wire coming from the cockpit. Next, glue the carburetor and filter casting (E24) onto the pin at bottom of the V intake manifold coming through the support casting.

**Magneto, camshaft gearbox, and water pump (Figure 5-6):** Glue the two halves of the water pump (E30A & B) together. Drill a hole on each side of the extension from the water pump for the wire (tubing) that will go between the pump and the V intake manifold, but don't install the wire. This will be done after engine installation in the model. Glue the assembled pump into the hole in the camshaft gear box. There is a pin on the bottom of the pump for the piping to the radiator, but this will be installed later when the engine is in the aircraft.

Fit and glue the camshaft gear box (E36) square guide pin into the slot in the upper engine block. Glue the magneto (E37) pin fitting in the hole at top of the camshaft gearbox and to the top of the engine block.

*Note:* If you intend to insert ignition wires into the distributor block of the magneto, drill these holes before installing the magneto. Refer to the paragraph on ignition wiring below for other options.

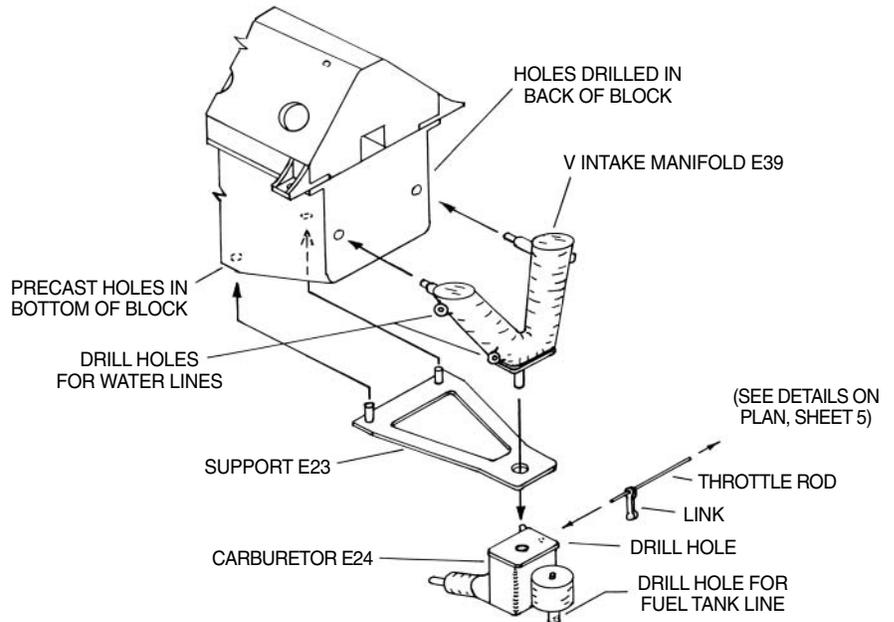
**Cylinder installation (Figure 5-7):** On real OX-5 engines, some have cylinders which are secured in place with four steel rods through spider ends, and some have no such hold-downs. I elected the latter to simplify the castings and assembly.

The cylinders (E25A) are to be installed with the lower hole for the water inlet pipe pointing outboard. But before installing the cylinders, drill the hole in the top of each cylinder and glue in the spark plugs (E25B). Note that the spark plug for the cylinders on the left side of the engine are on the back side of the cylinder and the right side has the plugs on the front side. Locate the holes correctly according to the plan so the plugs do not interfere with the water outlet pipe.

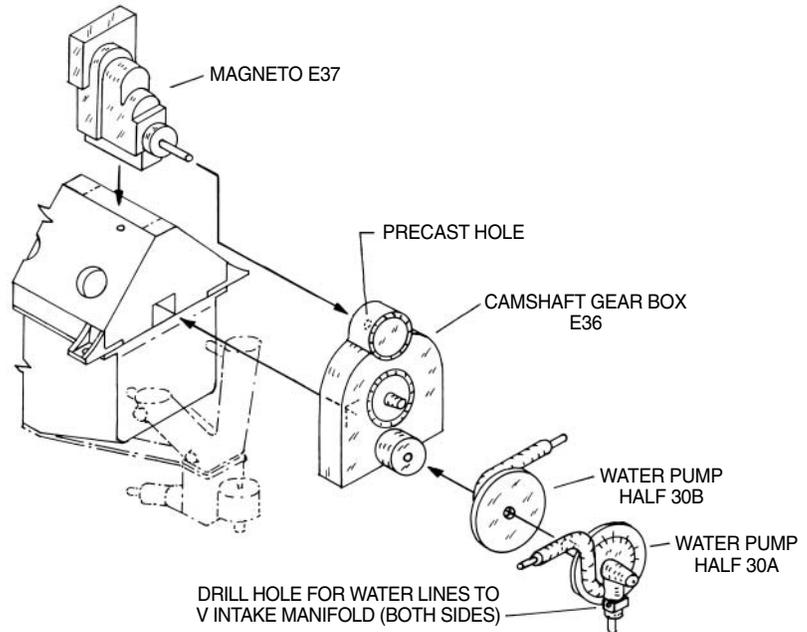
The cylinders have an extension on the bottom for inserting in the holes in the upper engine block.

**Caution:** Before gluing the cylinders in the block holes, prefit the intake manifolds (E42, exhaust manifolds (E43), and water inlet pipes (E31) in the holes on the side of the cylinders. You must also insure that the rocker support casting on top of each cylinder is aligned so the rocker arms will be perpendicular to the engine block. When all these parts fit, mark the cylinders and block for guidance, then glue the cylinders in the holes. It may be necessary to file the sides of the four pins of the manifolds and inlet pipes to get all pins fitting into the cylinder holes. As an option, when everything is aligned, permanently glue

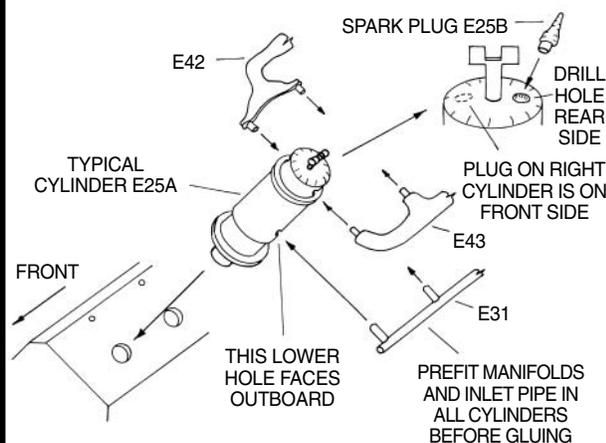
**FIG. 5-5 V INTAKE MANIFOLD & CARBURETOR**



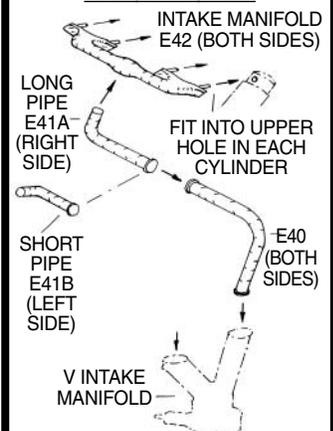
**FIG. 5-6 MAGNETO, CAMSHAFT GEAR BOX & WATER PUMP**



**FIG. 5-7 CYLINDER INSTALLATION**



**FIG. 5-8 INTAKE MANIFOLD INSTALLATION**



one or more of the pipes or manifolds to hold the alignment, then glue the four cylinders at once. Anyway you choose will be acceptable. The important issue is that all these parts fit together properly. Adjustments would be difficult with a cylinder out of alignment.

**Installing the intake manifolds and manifold piping (Figure 5-8):** Note: The intake manifolds must be installed before the cylinder rocker arms and actuating spring and housing, so follow the assembly sequence below.

On top of each side of the V intake manifold, install the intake manifold pipes (E40). Between E40 and the manifold, there is a long section (E41A) on the right side and a short section (E41B) on the left side). Glue the intake manifolds (E42) in the holes on the cylinders, and glue the piping on the underside of the manifolds. Note that there are no holes or pins in the piping or intake manifolds so that you can file the ends for fine adjustment if necessary. Gluing the piping should suffice. However, you can drill holes in the piping and manifolds and insert pins if you want more secure connections. This is shown on the plans as an option.

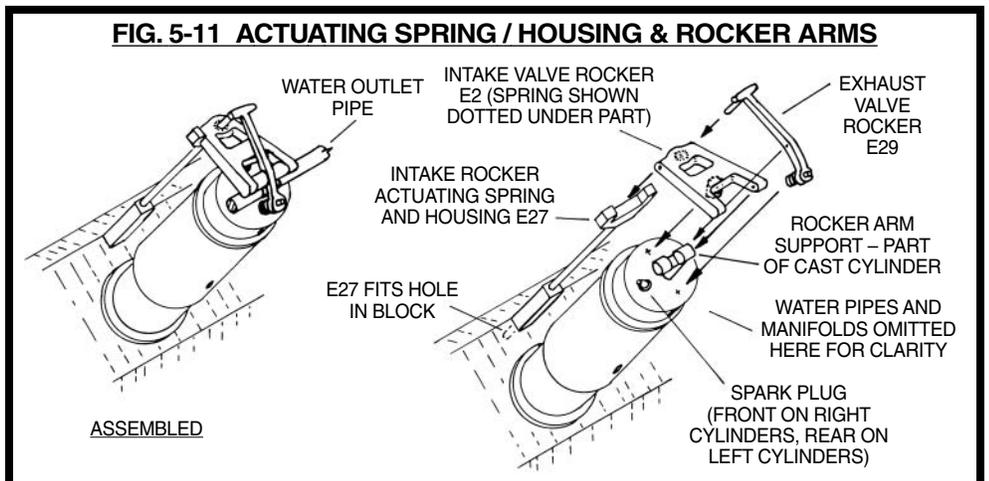
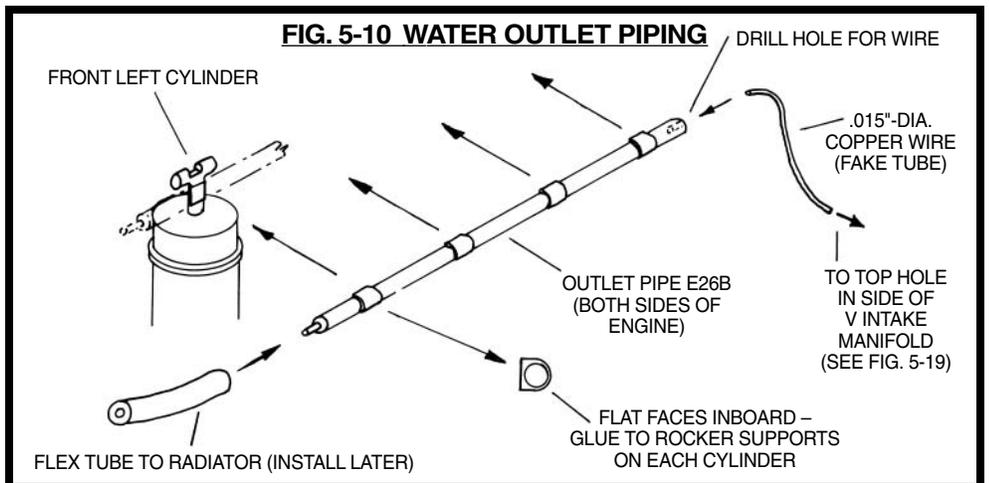
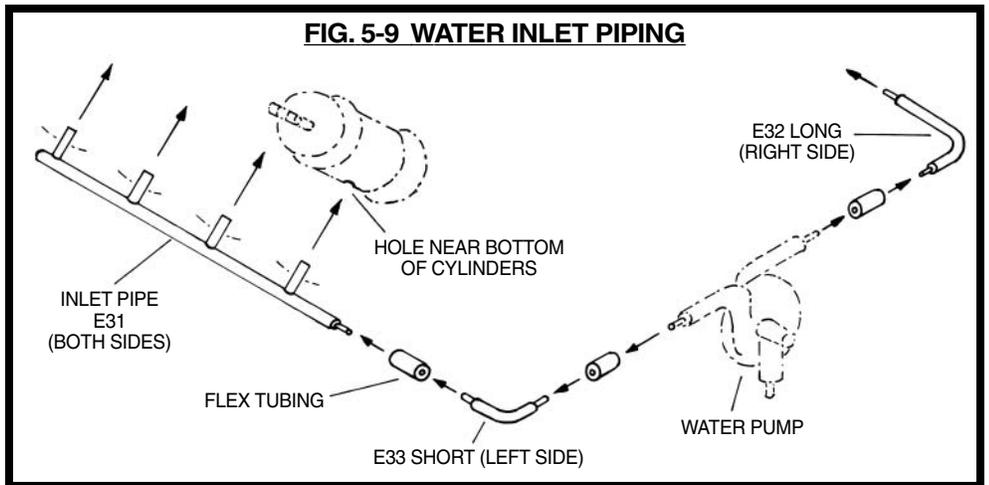
**Installing the water inlet piping (Figure 5-9):** Install the water inlet pipes (E31) in the lower outboard holes on the side of the cylinders. Then install the long right (E32) and short left (E33) curved sections of the pipes between the side pipes and the water pump. To join, use short pieces of PVC flex tubing.

Note: The flexible tubing mentioned for the engine piping connections supplied is clear tubing. The tubing should be black or possibly a dull red color, so paint the tubing with matte acrylic paint.

Note: There is a pipe from the underside of the water pump to the radiator and tubes from the water pump to the water jacketed V intake manifold, but don't install these at this time. The engine must be mounted in the fuselage first. These pipes or tubing will be discussed in later paragraphs.

**Installing the water outlet pipes (Figure 5-10):** Glue the water outlet pipes (E26B) to the outsides of the rocker support atop each cylinder. Make sure they are correctly located fore and aft, since there are no alignment pins for the installation. On the real engine, the water exits the cylinders via the center support then into the side pipes. The front of the pipes will have a flex tube connecting the pipe to the radiator, but this will be installed after the engine is installed. From the back of each pipe, run a copper wire (fake tubing) from the pipe down to the top holes drilled in the sides of the V intake manifold. Drill a hole in the end of E26B for the wire.

**Installing the intake rocker actuating spring and housing, and rocker arms (Figure 5-11):** This is probably the most difficult effort in building the engine, so take



your time. Make sure all the castings are clean and fit correctly. Note that the valve springs are cast as a part of the rocker arms. If you so desire, you can cut these off and substitute a real spring or coiled wire.

Remember, the intake manifolds must be installed before you start the rocker arm installation.

First, install the intake rocker actuating spring and housings (E27) into the holes above the cylinder holes on the block. Make sure the long side of the fork at the top is in line with the engine block. Glue the intake rocker arm on the support on top of the cylinders and the outer end in the fork on the actuating spring rod, and also glue the

bottom of the rocker arm spring to the top of the cylinder.

Glue the exhaust rocker arm in place. The spring at one end glues to the top of the cylinder. The center glues to the support on top of the cylinder. The short pin on the other end glues into the recessed hole on the top of the intake rocker arm. On the real engine, this pin is actually a rod that goes through the actuating spring tube into the engine. Careful – don't use too much glue on these fittings and obscure detail.

**Installing the exhaust manifolds (Figure 5-12):** Glue the exhaust manifolds (E43) into the holes in the cylinders. Note there is a pin on both the top and bottom sides

of the manifolds. This pin is for the flex air heater tubing between the exhaust manifold and carburetor. Since the manifold casting is identical for both sides, cut the top pin off each casting. Do not install the flex tubing at this time. It must be installed after the engine is mounted in the fuselage.

To make the manifolds look more realistic, grind out the exhaust exit deeper and the wall thinner. The manifolds are actually sheet metal. Paint the ground out area black so you cannot see the limited depth.

**Ignition wiring (Figure 5-13):** On the real engine, the wiring from the spark plugs to the distributor block feeds through fiber wiring tubing strapped to the intake manifolds. For the model, these tubes are made from a 1/16"-diameter wood dowel, so paint them a light brown to look like a fiber tube.

Drill holes into the dowel where wires will be fitted. Then, strap the dowels to the intake manifolds with strips of self-adhesive copper tape. Finally, install the wiring using the flexible wire provided. First, glue the wires to the top of the spark plugs and into the holes you drilled in the dowels. The four wires on each side exit the dowel from holes or a slot. Glue them in the slot. To attach the wires to the distributor block, drill holes in the block (you were cautioned to do this before installing the magneto earlier). Another option to drilling holes, glue the wires in bunches directly to the block. Just forward of the distributor block, the wires on the real aircraft are seized together with a small clip. On the model they can be tied together with thread, tape, or omitted.

*Note:* The jacket on the flexible wire supplied in the kit may be white instead of black (depends on availability). If white, paint the wire black using matte acrylic paint. Also, the wire may be two strands molded together. Simply strip the two apart for the single wire.

### 3. Installing the Engine and Radiator

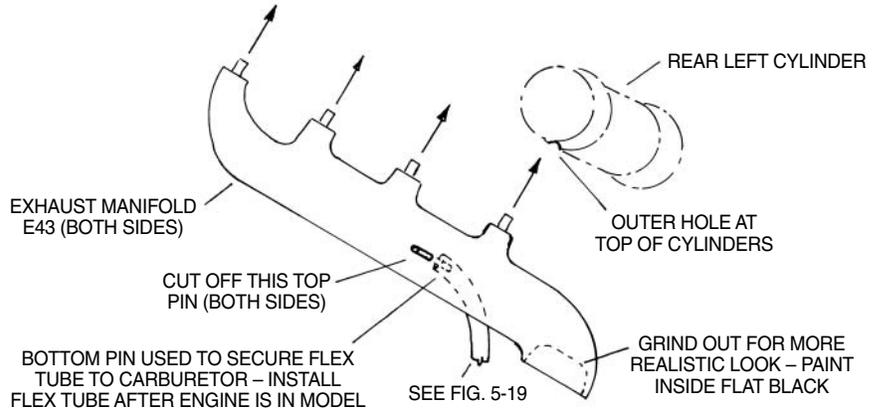
**Important:** Install the engine on the engine bearers before installing the radiator.

Glue or pin the engine to the engine bearers in the location shown on the plan. Actually, the location is pretty much set because the transverse beam supporting the aft end of the engine bearers fits between the V intake manifold and the water pump of the engine. Once set in this location, the engine cannot move forward or aft very much (Figure 5-14).

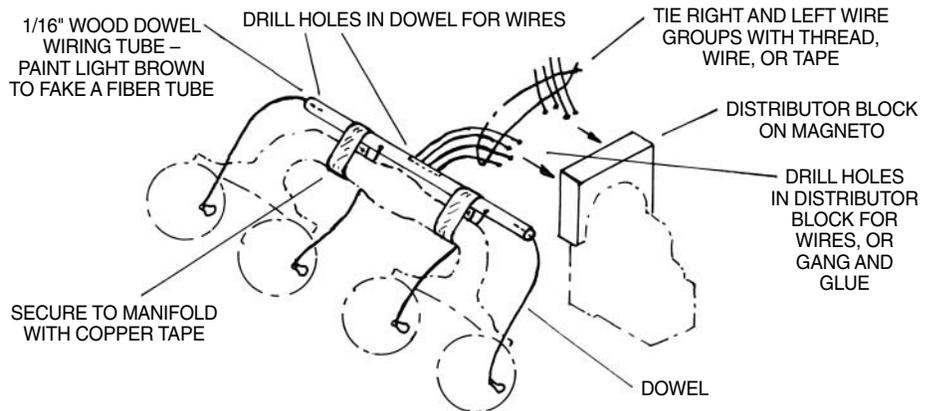
**Radiator (Figure 5-15):** Glue the photo-etched radiator grill (E9B) in the front of the radiator frame casting (E9A). The hole in the center of the grill and the edges have some excess material. It will therefore be necessary to cut or file these areas so they fit the radiator casting ledges. Then, install the radiator on the front of the fuselage. It sits on the tabs of the fuselage nose plate that have been bent forward.

Secure the upper end with a 1/16" basswood strut on each side of the fuselage. These struts are shown on the fuselage plan. The struts

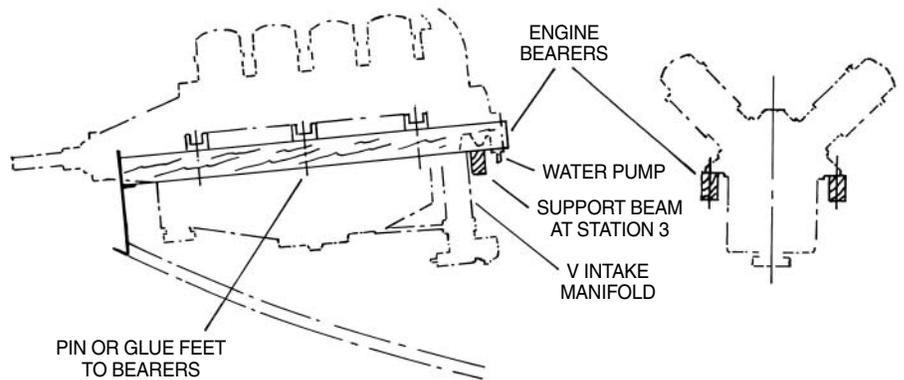
**FIG. 5-12 INSTALLING EXHAUST MANIFOLDS**



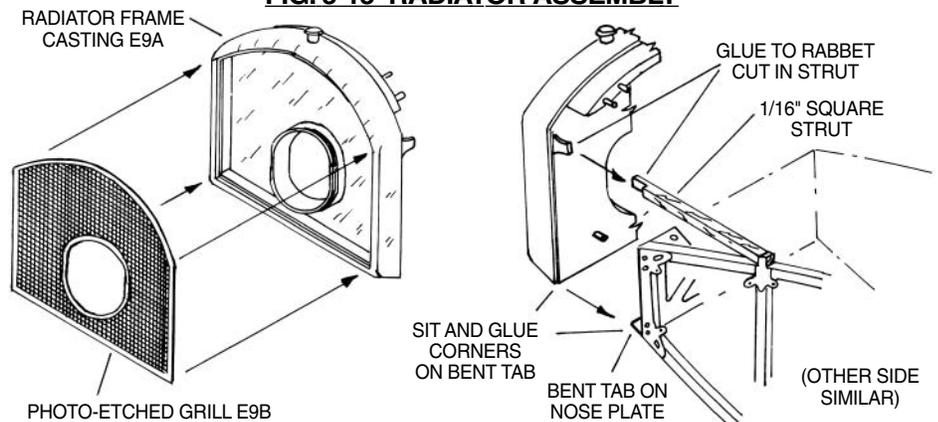
**FIG. 5-13 IGNITION WIRING**



**FIG. 5-14 ENGINE INSTALLATION**



**FIG. 5-15 RADIATOR ASSEMBLY**



attach to the upper fuselage strut fittings at Station 2 and are secured at the clips molded into the sides of the radiator. Cut a rabbet in the end of the strut to accept the clip on the radiator as shown in the figure and on the plan.

#### 4. Installing Engine Piping, Tubing, and Control Linkages

The plans show most of the basic items and they are described below. What's missing are some details such as small switches, wiring to switches, magneto, and tachometer cable. To be honest, no plans or details were found describing these specific items, but they are really considered insignificant for the model.

##### ***Tubing for the oil pressure gauges and tubing for the water temperature gauge (Figure 5-16):***

For the oil pressure gauge tubing, use 0.025"-diameter copper wire to represent the tubing. The wire is located on the right side of the fuselage and runs from the oil pump under the engine to the rear cockpit oil pressure gauge, with a feed off to the front cockpit gauge. The wire can be secured in place with some small brass staples, or just glue at several spots.

For this and other tubing, notice the coils at some ends that provide for expansion of the tubing.

For the water temperature gauge tubing, use 0.015"-diameter copper wire to represent the tubing. The wire is located on the left side of the fuselage and runs from the pin at the top of the radiator to the water temperature gauge in the rear cockpit.

##### ***Flex tubing from the radiator to the engine water outlet pipes (Figure 5-17):***

Use flexible PVC tubing between the radiator water inlet pins and the water outlet pipes on the engine. There is one on each side. Paint the clear tubing black.

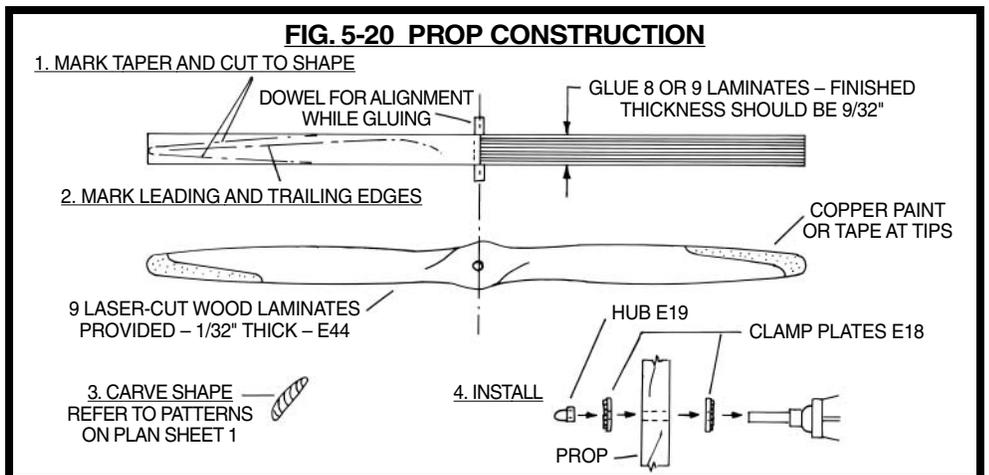
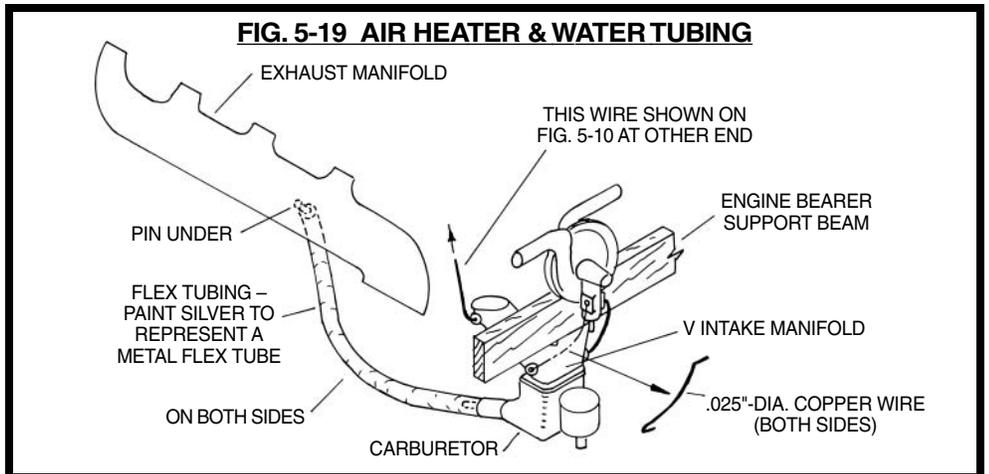
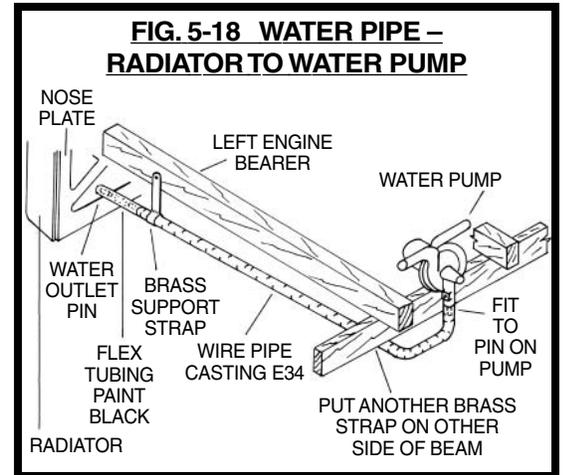
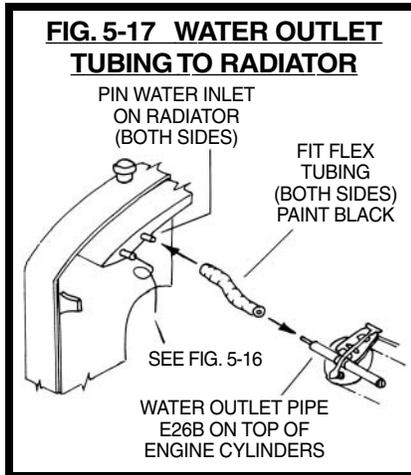
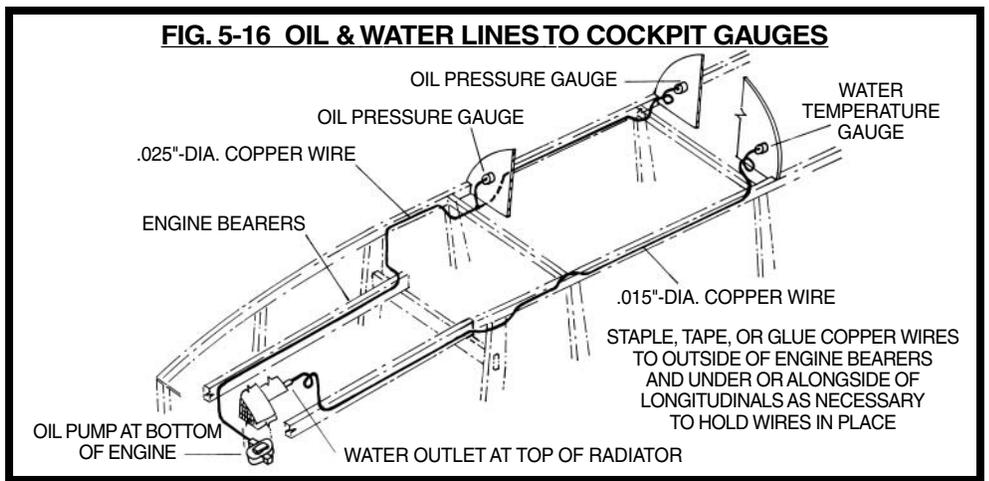
##### ***Outlet water piping from the radiator to water pump (Figure 5-18):***

The lower water pipe (E34) runs on the left side of the engine from the bottom of the radiator to the engine water pump. Hang the pipe with a brass strap from the left engine bearer. Connect the end of the pipe to the radiator with a short section of PVC tubing.

##### ***Flex air heater tubing from the exhaust manifolds, and water tubing from the V intake manifold to the water pump (Figure 5-19):***

Use clear PVC tubing from the two angled openings at the base of the carburetor up to the pins on the underside of both exhaust manifolds. Since these tubes are actually metal flex tubes, paint the tubing silver. These tubes provide heat from the exhaust to the carburetor.

The V intake manifold is a water-jacketed unit. Rubber tubes on each side provide water to the manifold from the water pump. These could not be installed initially on the engine because they must go around the transverse engine-bearer support beam, as does the lower inlet water pipe. These can be installed using copper wire. Fit the wire between the holes you drilled on the



sides of the water pump and the lower holes you drilled in the sides of the V intake manifold.

*Note:* You should have already installed the wire between the upper holes of the V intake manifold up to the ends of the outlet water pipes on the engine, as these could be installed on the engine earlier.

**Linkages from the throttles:** This linkage was already discussed in Stage 4 when the throttles were installed in the cockpit, and in this Stage when the carburetor was installed. Refer back to these paragraphs, then make the connection at the carburetor.

## 5. Rigging Final Fuselage Cross Brace Wires

Now that all parts are installed in the fuselage, you can rig the rest of the cross brace wires using the 0.010" gray nylon cord. The locations of the turnbuckles and wires are shown on the plans.

## 6. Building and Installing the Prop

The prop shown on the plans is patterned after the white oak Flottorp tractor prop manufactured by the Flottorp Manufacturing Co. in Chicago. It's a fairly straight prop. Another popular prop had heavily curved ends. This was a Paragon tractor prop (manufacturer unknown), made of six laminations of walnut or mahogany.

First, insert a dowel through the center hole of all nine prop laminates (E44). Check to make sure the edges of all the laminates are flush. You may need to flip-flop several laminates until all the outer edges are aligned. Then, glue the laser-cut laminates together one by one. Check the overall thickness of the laminates and sand to the proper thickness (9/32"). You may be able to eliminate one of the laminates depending on how much glue is used, so check the thickness after the eighth laminate has been glued. Next, taper the ends of the prop as shown

on the plans. Before carving the shape of the prop, mark the leading and trailing edges, then carve to the cross section shapes shown on the plan.

The real prop has copper sheet edges at the tips. For the model, use the self-adhesive copper tape in the kit, or fake it with copper paint.

This next step can really wait until the entire model is finished but is discussed here for convenience. Of course, no one would ever forget to install the prop. Slide one of the prop clamp plates (E18) onto the prop shaft, then install the prop. Finally add the outer clamp plate, then glue on the hub (E19). If you want the prop to rotate, glue the clamp plates to the prop and make sure the hole has enough play to rotate.

Figure 5-20 illustrates the prop construction and installation.

# STAGE 6: BUILDING AND INSTALLING THE LANDING GEAR AND TAIL SKID

Most of the previous work on the fuselage could be installed while the fuselage is still in the building jig. It must now be removed for installation of the landing gear. Plan Sheet 4 details the landing gear and tail skid. Plan Sheet 6 shows the cross bracing between the landing gear struts, which you may want to do at this time for added strength. The following parts are required for this stage:

### Laser-Cut Wood Parts

- Front landing gear struts – 2 of L1
- Rear landing gear struts – 2 of L2
- Landing gear strut lower end blocks – 2 of L3
- Landing gear front fairing strut – 1 of L4
- Landing gear rear fairing strut – 1 of L5
- Tail skid – 1 of L11

### Britannia Castings

- Front upper left landing gear strut fitting – 1 of L7L
- Front upper right landing gear strut fitting – 1 of L7R
- Rear upper left landing gear strut fitting – 1 of L8L
- Rear upper right landing gear strut fitting – 1 of L8R
- Landing gear axle shock cord fittings – 4 of L9
- Tail skid support (Part 1) – 1 of L10A
- Tail skid support (Part 2) – 1 of L10B
- Wheel hubs – 2 of L12
- Wheel half-rims – 4 of L13

### Photo-Etched Copper Parts

- Landing gear strut end lower plates – 2 of L6
- Brace wire end fittings – 8 of R1
- Turnbuckles – 4 of R3B (long)

### Photo-Etched Nickel Silver Parts

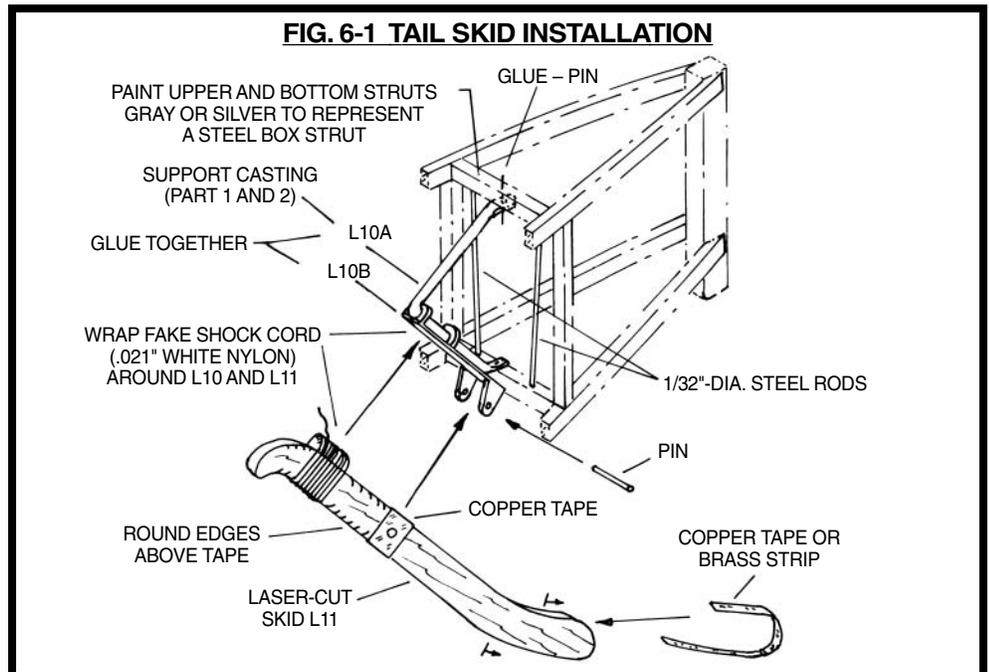
- Wheel spokes – 4 of L14

### Rubber Parts

- 1-5/8" o.d. black O ring tires – 2

### Steel Rod (cut to length as required)

- Vertical struts in way of tail skid in



- fuselage – 1/32"-diameter
- Landing gear axle – 3/32"-diameter
- Rigging Cord (cut to length as required)**
- Cross bracing wires – 0.010" gray nylon cord
- Fake shock cord for axle and tail skid – 0.021"-diameter white nylon cord
- Wrapping cord for landing gear struts – 0.008"-diameter black nylon cord

The tail skid is fairly easy to install, but the landing gear is more difficult to assemble accurately. Remove the fuselage from the building jig and flip it over. You could place the fuselage back in the building jig, but it will require some additional shims or clamps. Place the fuselage in the jig or another jig of your choice so the upper aft longerons (lower ones with fuselage upside down) are parallel to the building board.

The fairing struts between the landing gear are parallel to the upper longerons, so this will give you an accurate way to measure.

## 1. Installing the Tail Skid and Supports

The tail skid is composed of a laser-cut wooden skid (L11) and a britannia cast support made up of two parts (L10A and L10B). Round the laser-cut skid above the center hole. Add self-adhesive copper tape around the skid in way of the hole. Glue the support parts together (L10A and L10B). Fit the skid in the support and pin the lower end into the support fitting. At the top end, wrap 0.021" white nylon cord around the skid and support. This cord represents a shock cord. At the bottom of the skid, add a brass strip or self-adhesive copper tape to represent

a protective metal strip for the wooden skid. Fit the support fitting in the fuselage, gluing (or pinning) the upper end under the fuselage Station 11 upper horizontal strut, and the lower end on top of the lower strut. Note that on the real aircraft the horizontal fuselage struts are actually steel boxes, but we have used wood for the model. Paint both struts gray or silver to represent a steel box strut. Between the top and bottom fuselage struts, there are two vertical steel support bars, but these should have been added when you assembled the fuselage. If not, do it now. *Figure 6-1* illustrates the entire tail skid installation.

## 2. Building and Installing the Landing Gear

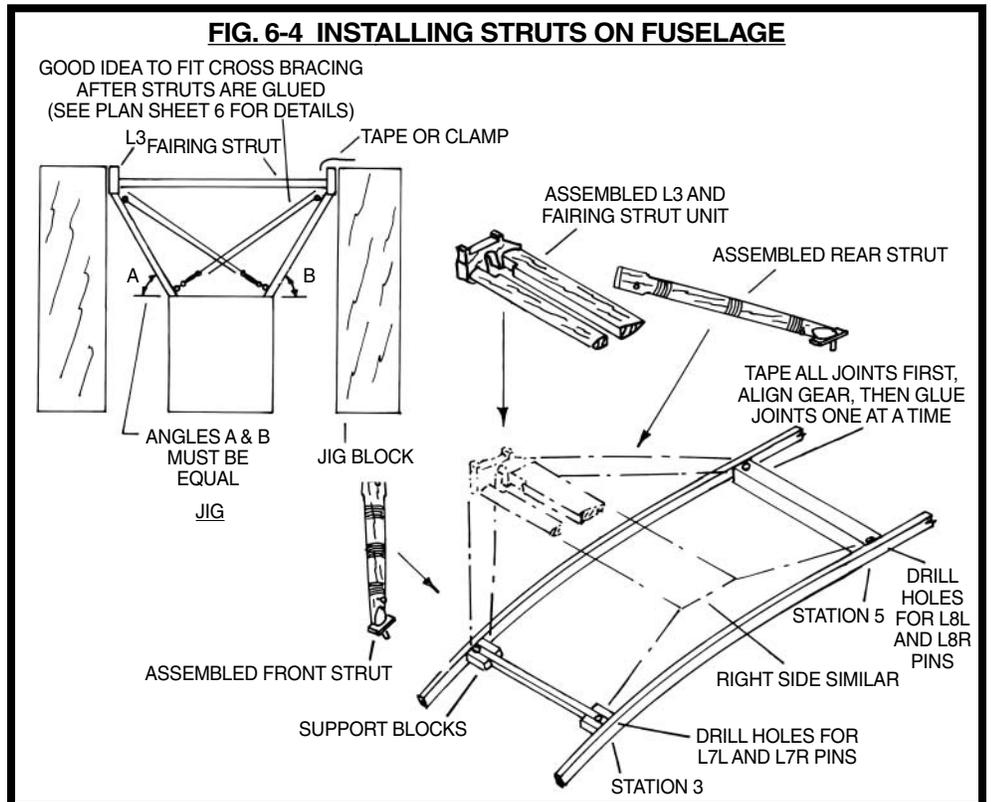
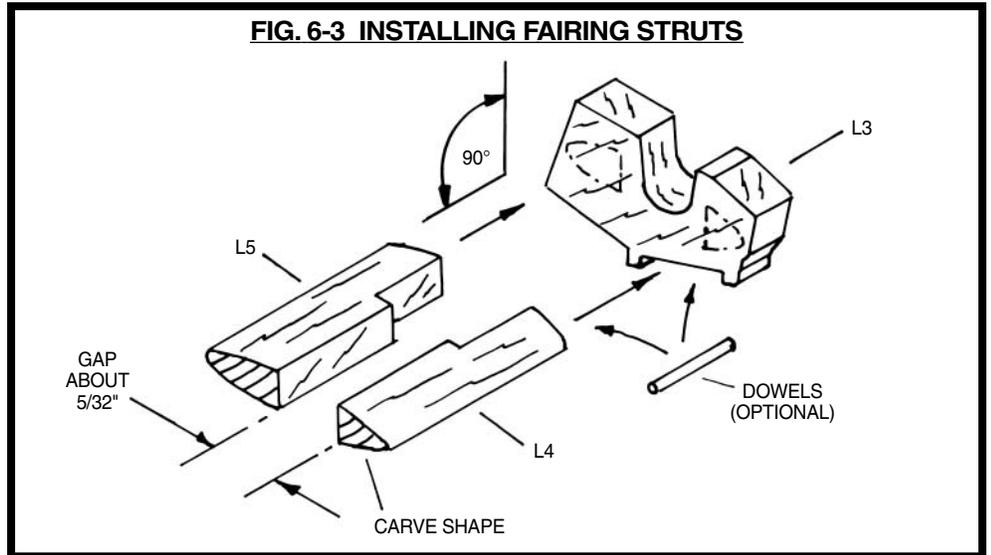
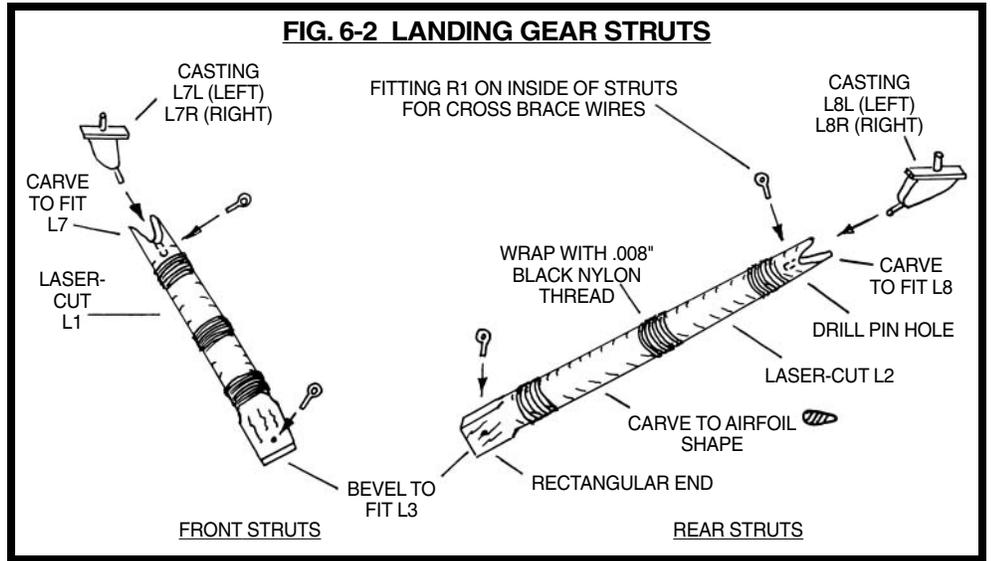
**Preparing the struts:** The four landing gear struts are laser-cut but must be shaped. The lower ends are rectangular, then progress into a streamline shape in cross section. The lower ends also must be beveled to fit the lower laser-cut strut blocks (L3). At the upper ends of the struts, cut the struts to fit the fittings at the fuselage (L7 and L8) and drill the holes for the castings pin extensions. When done, wrap the struts with black thread in the locations shown on the plan. The wrappings strengthen the struts on the real aircraft. Complete the struts by adding the R1 rigging fittings to the struts. Note that we have deviated a little here. On the real aircraft, the rigging fittings are actually a part of the metal end fittings. *Figure 6-2* shows the completed struts.

Next, shape the horizontal fairing struts (L4 and L5) and glue them to the laser-cut end blocks (L3). Make sure that the two fairing struts are correctly spaced. The axle must fit in between the two struts. For more strength, insert a dowel or pin in the joints. Also, make sure that the L3 blocks are perpendicular to the struts (*Figure 6-3*).

**Installing the struts on the fuselage** (*Figure 6-4*): At fuselage Station 3, you should have already added the support blocks for the front strut fittings on either side of the lower fuselage strut. These are important so add them if you did not. Drill holes for the strut end fittings. At Station 5, no support blocks are required as the lower fuselage strut is already large enough for support, since it also supports the wing hinges. Just drill the holes for the rear strut end fittings.

Place some wood blocks on each side of the fuselage to correctly locate the L3 fairing strut unit. L3 can be taped to the blocks. Fit the front and back struts into the bottom holes and just tape them down temporarily. Next, fit the lower L3 fairing strut unit. Tape the struts to the L3 blocks. Before gluing the struts to the fuselage or L3, check the alignment of the gear. The angles of the right and left struts should be the same relative to the sides of the fuselage. When all looks aligned, glue the joints, one at a time.

At this point it would be a good idea to rig the cross bracing wires between the struts. This will provide the necessary strength



to hold the gear rigid. The turnbuckles for the landing gear are the long ones, R3B, and are located at the fuselage end. Refer to Plan Sheet 6 for wire details.

**Completing the details (Figure 6-5):**

To complete the basic gear structure, glue the photo-etched end plates (L6) to the end blocks (L3). Keeping the center of the fittings vertical (where the long axle hole is located), bend the ends down onto the front and rear struts and glue. On the real aircraft, the fitting is actually made of three different plates, with the plates bolted to the struts and to the horizontal fairing struts.

**Installing the axle rod (Figure 6-6):**

Insert the 3/32" steel rod axle through the long slots of the photo-etched parts L6. Cut the rod to the correct length shown on the plan and locate it so it has the same amount of rod projecting from each end. Tape it down so it stays put. Then glue the shock cord fittings (L9) on top of the axle on each side of the L3 block and end fitting L6. Finally, wrap the fake shock cord (0.021"-diameter white nylon cord) from one side under L3 to the other side, back and forth until you fill the space on top of the L9 fittings.

**Building and installing the wheels**

**(Figure 6-7):** The wheels on a *Jenny* are spoked wheels. The spokes are often canvas covered, but for the model why cover up the nice looking spokes? The kit contains simulated wheels using a britannia cast hub (L12), rim castings (L13), and photo-etched spokes (L14). Since the spokes go outward from the rim to the hub, it is essential that the hub be properly centered. A simple wooden jig can be used to keep the parts centered. Use a 3/32" wood dowel through the hub, and tape or clamp the hub in the centered position as shown on the sketch.

First, glue the half-rim castings together and sit the assembled unit on the jig. Bend the spoke plates as shown on the sketch, so the spoke plate will contact the hub and rim. You will notice there are four gaps around the photo-etched edge. This permits bending the spokes without buckling. Glue the spoke edge plates to the rim and center to the hub. Take your time.

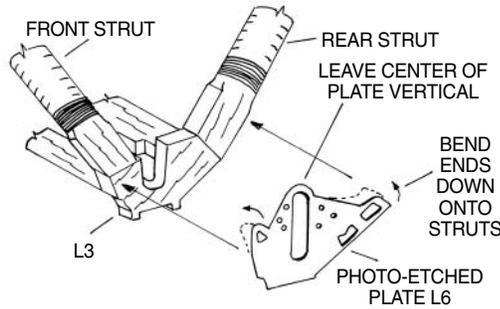
When one side is complete, flip the rim and hub on the jig and do the other side.

*Important:* When doing the second side, rotate the spokes so they are staggered halfway between the spokes on the other side. This is shown on the sketch.

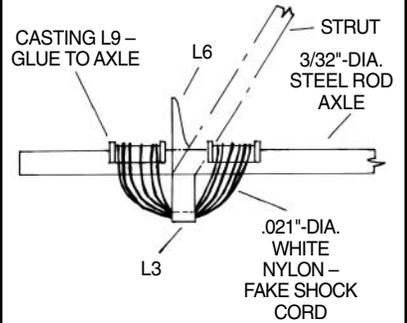
When the wheel assembly is completely dry, stretch the O-ring tires onto the rim.

Insert the completed wheels on the final model axle. From most photographic evidence, the wheels were retained on the axle by a simple large cotter pin. For the model, wrap a wire around the axle to represent the cotter.

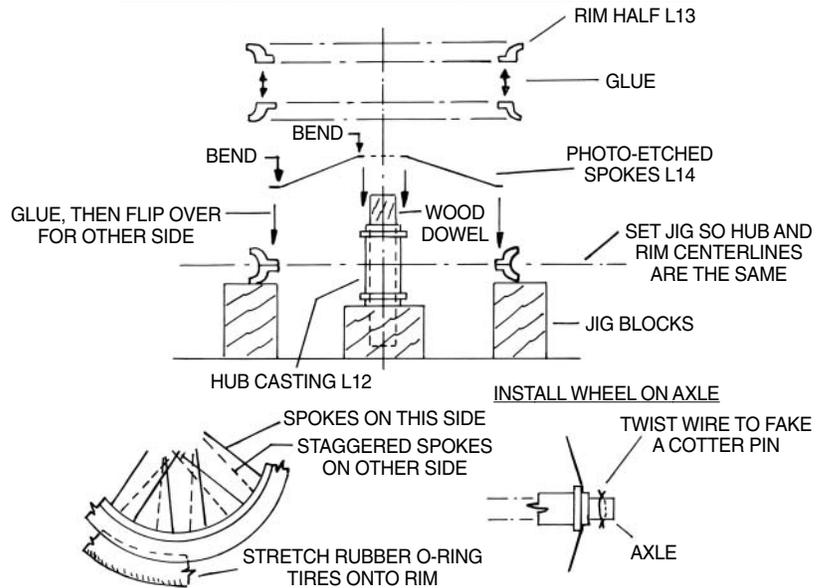
**FIG. 6-5 INSTALLING GEAR PLATES**



**FIG. 6-6 AXLE INSTALLATION**



**FIG. 6-7 WHEEL ASSEMBLY & INSTALLATION**



*Landing gear with spoked wheels on the restored Jenny at the Smithsonian Institution*

## STAGE 7: INSTALLING THE COCKPIT COWL, WINGS, STABILIZERS, RUDDER, AND ELEVATOR, AND COMPLETING THE RIGGING

Plan Sheet 6 shows the aileron, rudder, and elevator control line rigging, and the structural rigging. In addition, refer to Sheet 3 for the cockpit cowl that is to be installed during this final stage. The following parts are required for this stage:

### Photo-Etched Parts

Cockpit cowl (aluminum) – 1 of F24  
Turnbuckles (copper) – 33 of R3A (short), 36 of R3B (long)

### Rigging Cord (cut to length as required)

All flying, landing, brace, and control wires – 0.010"-diameter gray nylon cord

### Rubber Tubing

Cockpit edging – 1/8"-diameter hollow brown rubber tubing

### Self-Adhesive Copper Tape

(cut to length and width as required)  
Copper strip at bottom of cowl windshields

### Plastic Sheet

Cowl windshields – 0.010" clear plastic sheet

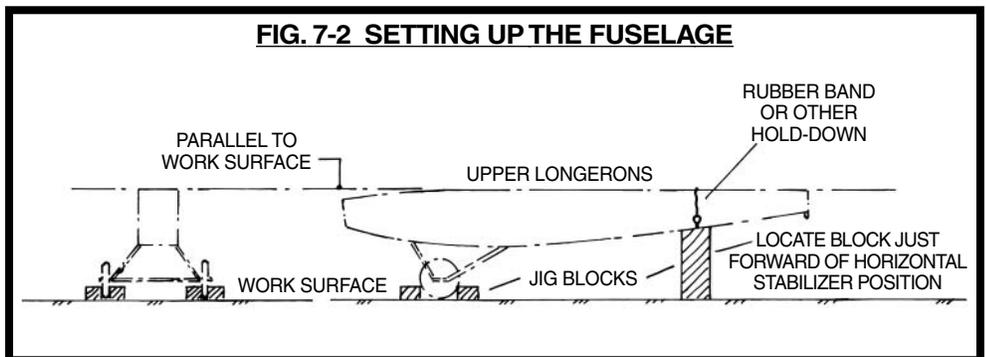
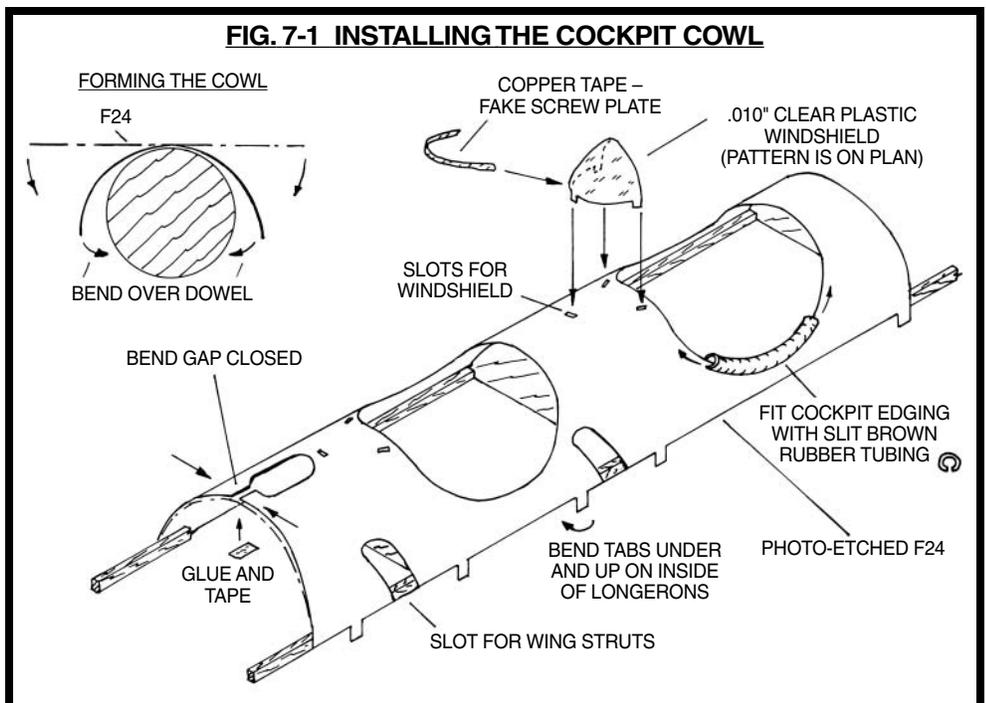
### 1. Installing the Cockpit Cowl, Windshields, and Cockpit Edging

See *Figure 7-1*. The cowl (F24) is a flat photo-etched aluminum plate, so must be formed to fit the fuselage formers. Preform the cowl to the formers curve as close as possible so it will fit reasonably well without springing open. One way to do this; carefully (to avoid any wrinkles or dents) roll the cowl over a 3/4" to 1" wooden dowel, or tubing. When the cowl is removed it should spring out a bit, but it will be close to the correct shape. Clamp one side of the cowl to the longeron with several clamps (like clothespins). Locate the clamps so as not to cover the six protruding tabs at edges of the cowl. The basic edges (excluding the tabs) of the cowl should be flush with the bottom of the longerons on both sides. If not, something went astray. You may need to trim the bottom of the aluminum cowl.

Make sure the cowl is located correctly, which allows the center section wing struts to come through the slots in the side of the cowl. When you are sure that the cowl is correctly located, bend each tab under the longerons and up on the inside. Touch with a dab of epoxy on the inside.

*Note:* The tabs on the cowl are purely a model aid. You can cut the tabs off if you like and just rely on correct forming of the cowl and gluing to the longerons. If you do this, it might be a good idea to drill a few holes along the bottom of the cowl and insert small pins to better secure the cowl to the longerons.

The forward end of the cowl is split at the center, back to the opening for the fuel tank gauge. The top of the cowl from the forward end to the front instrument panel is almost



level (parallel to the upper longerons) and tapers aft from there. The split allows closing the cowl to lower the height of the cowl at the front. After closing the gap, glue together at the joint. Add a piece of tape under the gap if necessary to help hold it together.

Next, install the cockpit edging. Slit the brown hollow rubber tubing on one side, then fit it over the cockpit edge. Where the ends meet (make it at the center of each cockpit at the back) add a little epoxy in the joint. If the rubber does not want to stay put, add some glue on the underside to glue it to the cowl.

Cut the windshields from the clear plastic sheet provided, using the pattern on the plan. Insert the three tabs on each windshield through the precut slots in the cowl and glue. Cut a 3/64"- to 1/16"-wide strip of self-adhesive copper tape and stick it to the bottom edge of the windshields, overlapping onto the cowl. This is to represent a screw plate for the windshields.

Note that on the real aircraft, the shape of the cockpit openings and the shape of the

windshields varied on many aircraft. I selected a common configuration.

### 2. Installing the Vertical and Horizontal Stabilizers, Rudder, and Elevator

From here on, sit the fuselage on its wheels on a level board. Your building board should do. Fix the wheels to the board so it's secure. At the tail end, just forward of where the horizontal stabilizer will be installed, block up the tail so the top rear fuselage longerons are parallel to the baseboard and secure the tail end with rubber bands or tape. Now, the fuselage is fixed to the board. Next, check to see if the top of the fuselage, transversely, is parallel to the building board. It should be, but if not, and you have a little twist in the fuselage, you may want to adjust the height of a wheel a bit. Remember, when you finally mount the model on a board, you will need to add a little shim under one wheel. When the top of the fuselage is parallel to the building board, you can commence to install the stabilizers and wings. All will be measured from the building board. (*See Figure 7-2*)

**Installing the horizontal stabilizer (Figure 7-3):** Set the horizontal stabilizer, which already has the vertical stabilizer and elevators attached, to top of the fuselage at the tail. Block up each end of the horizontal stabilizer so it's an equal distance above the building board on each side. Glue the horizontal stabilizer to the top longerons of the fuselage. On the real aircraft, the stabilizer is bolted with U bolts to the fuselage, which can be faked using brass wire. These fasteners go through the blocks and pads you already have on the horizontal stabilizer. Or, you could omit the U bolts altogether.

Below the horizontal stabilizer there are two wooden struts on each side from the stabilizer to the fuselage. Add these now. You should have already made these when you built the stabilizer. Sheet 4 illustrates all the mounting details for the tail surfaces.

The brace wires from the horizontal to vertical stabilizer were added when you assembled these, so no further rigging is required (unless you forgot, of course).

**Installing the rudder (Figure 7-4):** The rudder, which has already been fitted with the control horns, can now be installed. The fake hinges (brass strip) fit into slots cut into the vertical stabilizer, the fuselage tailpost, and the rudder leading edge.

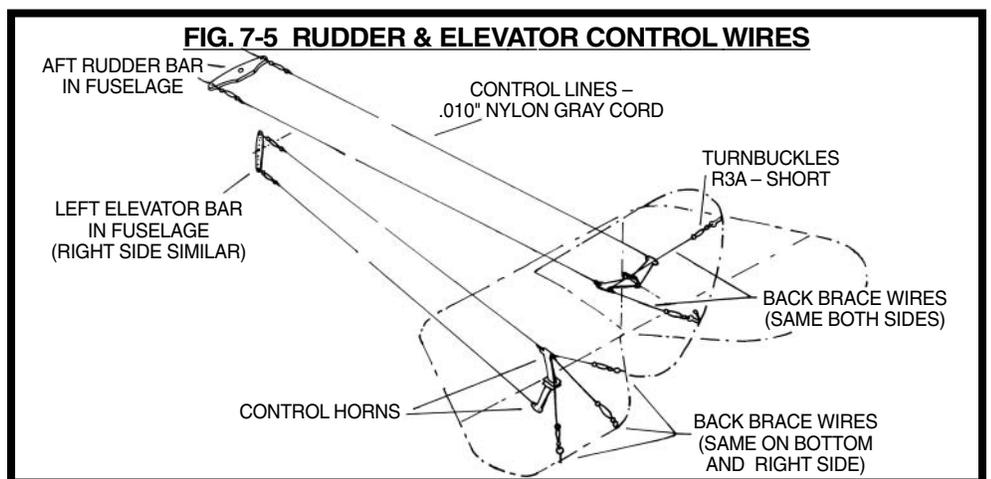
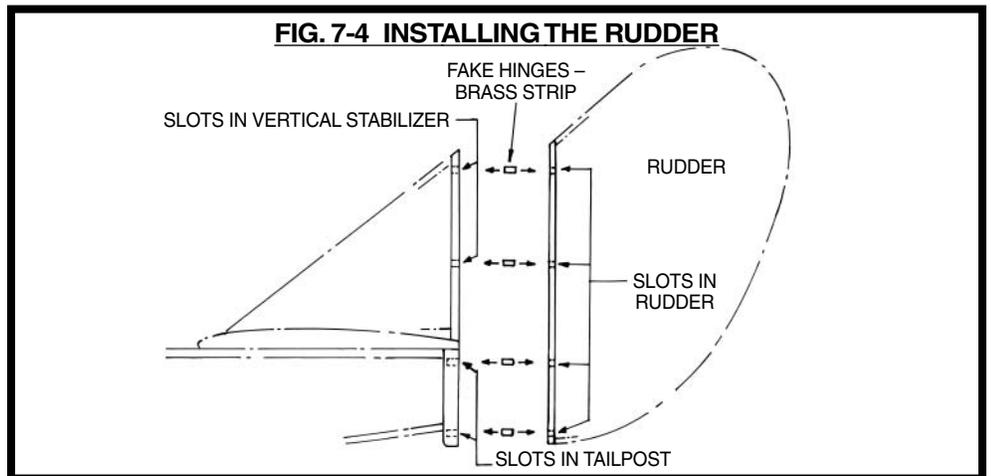
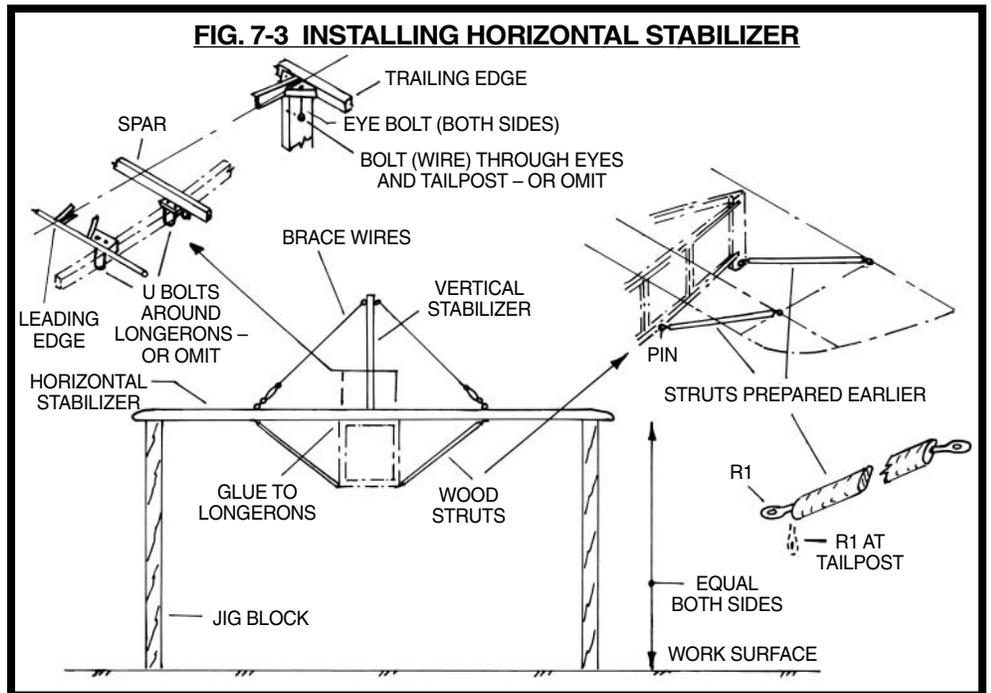
### 3. Rigging the Rudder and Elevator Control Wires

See Figure 7-5. Now that the stabilizers, rudder and elevator are installed, rig the control wires for these (gray nylon cord on the model). The rudder has two control horn back brace wires, from the control horn to the fittings on the trailing edge of the rudder on both sides. Turnbuckles (R3A short) are located at the rudder trailing edge. On the real aircraft, the wires are fitted to a shackle on the control horn. For this model, just tie off the wires at the horn.

The wires forward of the control horns go directly to the rudder bar in the after cockpit. If you did not install these when you installed the rudder bars, do so now. A connecting wire is between the forward and after cockpit rudder bars. Fit turnbuckles (R3A short) just behind each rudder bar. Refer back to the rudder bar installation, Stage 4, Figure 4-3.

Three back brace wires (top and bottom) for each of the elevator halves are fitted in a similar manner. The turnbuckles (R3A short), like the rudder, are at the trailing edge. The forward wires go directly to the elevator beams in the fuselage. For these wires, locate the turnbuckles (R3A short) at the beam end of the wires if you have not done so. Refer back to Stage 4, Figure 4-5 relating to the elevator bar assembly.

*Note:* On the real aircraft, as the control wires pass through the fuselage there is a leather or fiber fairlead stitched into the covering fabric of the fuselage. However, since the model is uncovered, these fairings are not present. Nevertheless, make sure both the rudder and elevator control wires have a clear run from the cockpit to the rudder and elevator without hitting any structure.



### 4. Installing and Rigging the Upper Wing Center Section and Struts

The basic struts have already been assembled when you constructed the wings. Insert the four center section struts into the holes through the W22 fittings, in the underside of the wing center section. Check the side angles of the struts and bend to correct position if nec-

essary. Looking forward or aft, the struts are perfectly vertical. When the struts are aligned, glue in place with super glue. Set the assembly on top of the longerons, inside the upper clip fittings (F20) formed as a socket at Stations 4 and 5. Check the alignment of the center section and when level, glue the struts to the longerons and the clip fittings (Figure 7-6). The center section unit is not very strong at

this point, so it is best to install the fore and aft brace wires. The *Jenny* had several arrangements for the strut wiring. The one we selected is most common. First, rig the forward cross wires from the top of the struts across the fuselage to the R1 fitting on the inside top of Station 3 struts. Turnbuckles (R3A, short) are at the top. These wires act as sort of a combined cross brace wire and drag wire, since they are angled forward.

The aft drag wires do not cross and are quite unusual. With turnbuckles (R3A, short) at top, feed the wires inside the rear cockpit against the cockpit rubber edging and seize to the rigging eye used for the side cross brace wires at Station 7. On the inside of the cockpit, the wires are covered with a padded or rubber block attached to the longeron. Add these blocks; you could paint them brown to look like pads. The center section drag wires are shown on *Figure 7-7*.

*Note:* Some *Jenny's* fed the wires through holes in the cowl and seized the wire at the lower clip at Station 6.

### 5. Installing the Lower Wings

Double check the fuselage to make sure it is secure and sitting square. This is important, since the wings will be set by blocks measured above the working surface.

Insert the lower wings steel fake hinge pins in the fuselage holes at Stations 4 and 5. Place a temporary 3/32"-thick wood strip at each end of the wing to gauge the gap between the fuselage and wing. This gap is where the actual hinge pin is located on the real aircraft, so the outer wing panels do not actually touch the center wing section or fuselage. However, if you have already added a spacer on the fake hinge pins as shown on the plans, the temporary spacer is unnecessary. Temporarily block up the ends of the lower wings.

Shape two other wood blocks to the wing angle next to the fuselage. Move the blocks out near the wing tips just beyond the outer wing strut locations, and shim them up until you have the correct dihedral angle for the wings. The dihedral is only 1 degree. At the outer wing strut the wing is about 3/16" higher than at the fuselage. Make the blocks long enough to install some nails or eyebolts in top, for attaching a rubber band to hold the wings to the block. Glue or nail the block to the board.

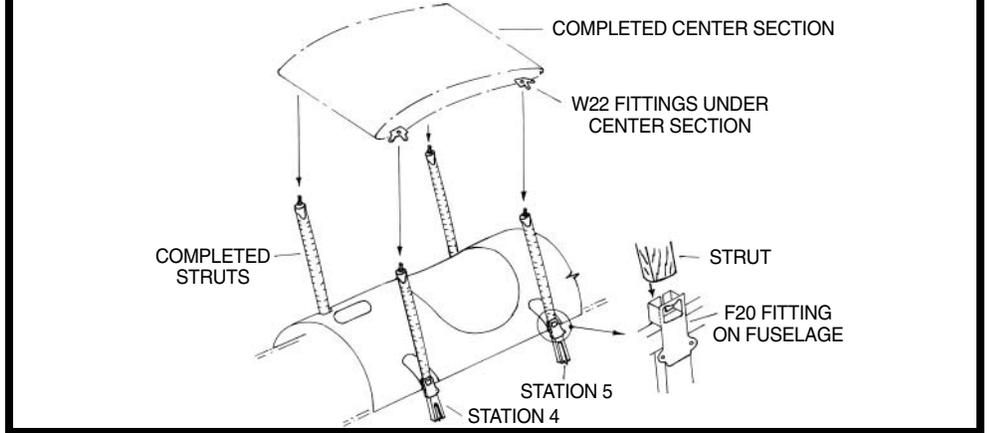
Check that the leading edge of the right and left wing panels are perpendicular to the fuselage and are in a straight line. You don't want any sweep back or up with the wings. When all is correct and secured to the blocks, glue the fake hinge pins in the fuselage.

Make sure the lower wings are rigidly held down before attempting to install the upper wing panels. See *Figure 7-8* for lower wing installation.

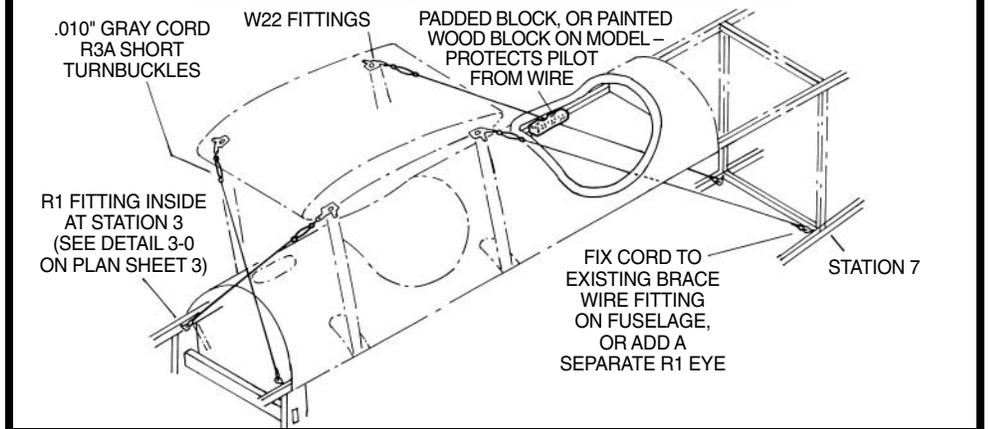
### 6. Installing the Interplane Wing Struts and Upper Wings

First, fit the interplane struts into the lower wing holes through the W22 fittings at the

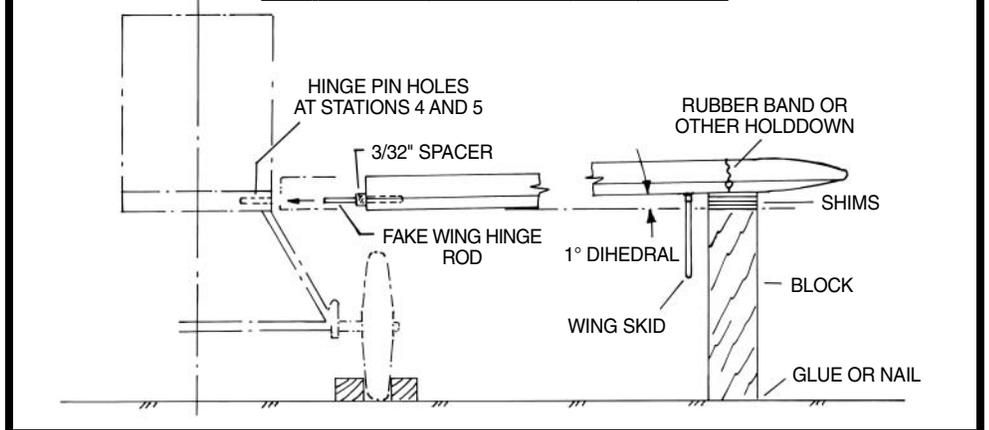
**FIG. 7-6 INSTALLING THE UPPER WING CENTER SECTION**



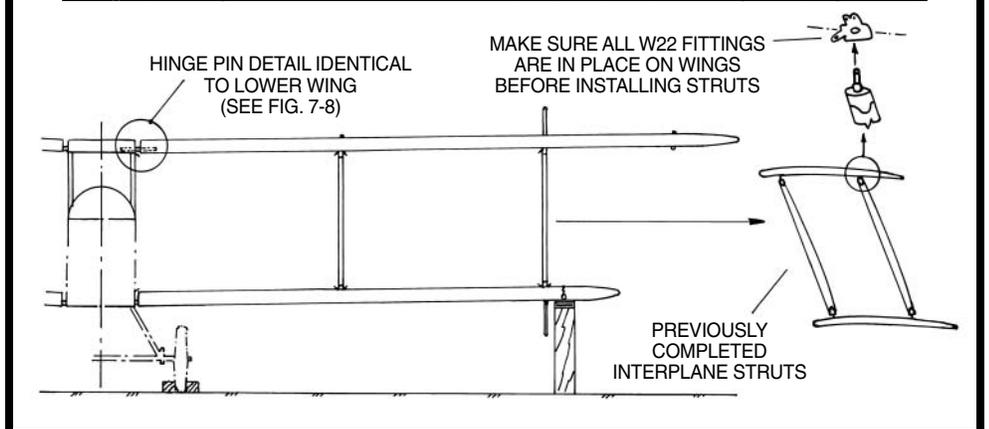
**FIG. 7-7 CENTER WING SECTION BRACE WIRES**



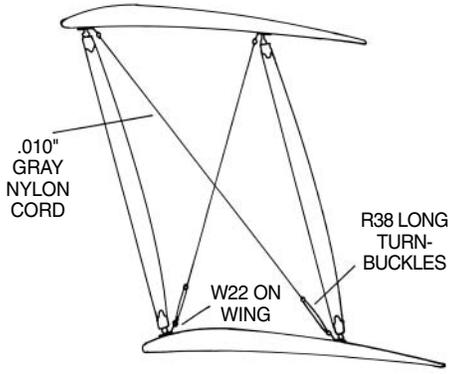
**FIG. 7-8 INSTALLING LOWER WINGS**



**FIG. 7-9 INSTALLING INTERPLANE STRUTS & UPPER WING PANELS**



**FIG. 7-10 INTERPLANE STRUT BRACE WIRES**



correct angle. Then, fit the upper wing panel fake hinge pins in the holes in the center section just as you did the lower wing, and the wing onto the interplane struts (Figure 7-9). Like before, check all the angles, and when correct, glue the hinge pins and the interplane strut pins. You will probably need several jig blocks to hold the wing panels until you glue them in place.

Leave the lower wings secured to the blocks until all the wing rigging is completed.

**7. Rigging the Interplane Strut Cross Brace Wires, Flying Wires, Landing Wires, Drag Wires, and Kingpost Wires**

On a real aircraft, flying wires are tension wires to prevent the wings from folding up when flying. Since these wires may have quite a bit of tension, they are double wires. The landing wires are the opposite, preventing the wings from folding down when landing. These are single wires. Drag wires are fore and aft wires preventing the wings from folding forward or back.

**Brace wires between interplane struts (Figure 7-10):** The fore and aft cross brace wires between the interplane struts are single wires. Rig them first. Turnbuckles (R3B, long) are at the lower ends.

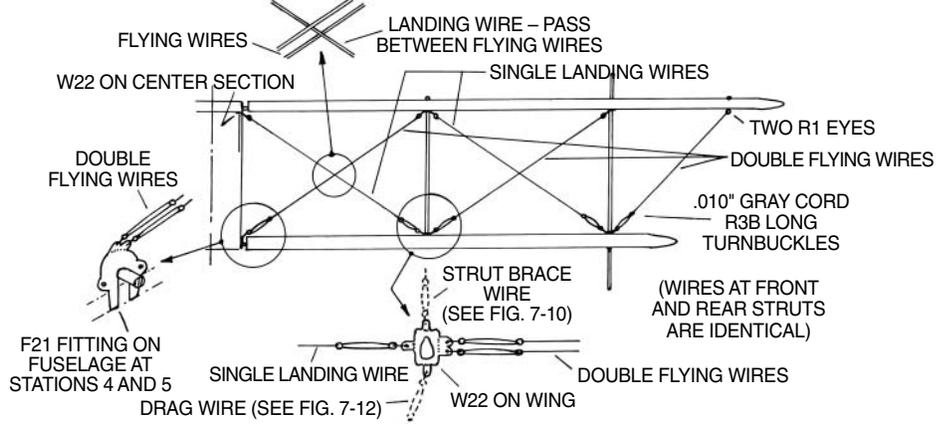
**Flying and landing wires (Figure 7-11):** The double flying wire turnbuckles (R3B, long) are at the lower wing end. Note that the inboard flying wires attach to the lower clip fittings on the fuselage struts at Stations 4 and 5. The single landing wires have turnbuckles (R3B, long) at the lower ends.

Since the double flying wires lay side by side, not one on top of the other, when rigging a single landing wire, run it between the two flying wires.

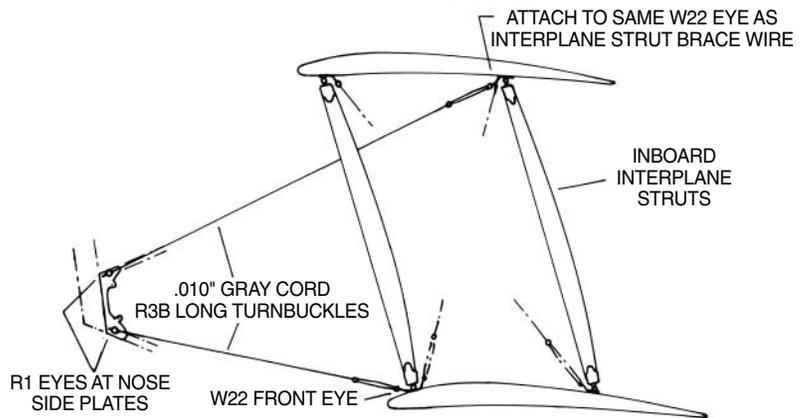
**Drag wires (Figure 7-12):** There are two drag wires on each side. One goes from the top of the rear inboard interplane wing strut to the top of the nose plate rig eye fitting. The other goes from the bottom of the front inboard interplane strut to the bottom of the nose plate rig eye fitting. The turnbuckles (R3B, long) for both the drag wires are located at the wing ends.

**Kingpost wires (Figure 7-13):** If you did not rig the kingpost wires when you con-

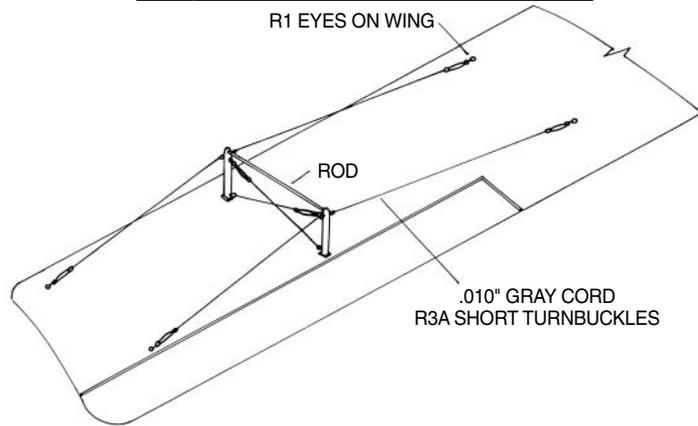
**FIG. 7-11 FLYING & LANDING WIRES**



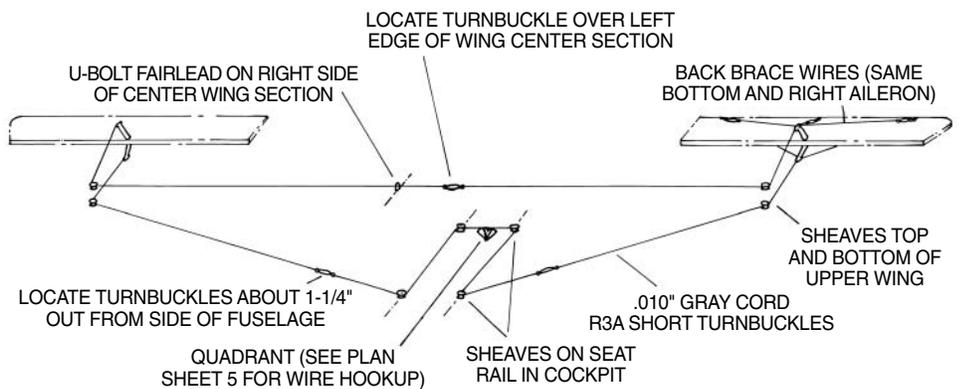
**FIG. 7-12 DRAG WIRES**



**FIG. 7-13 KINGPOST BRACE WIRES**



**FIG. 7-14 AILERON CONTROL WIRES**



structed the upper wing, do it now. With the wing rigging completed, you can remove the support blocks under the lower wings, or leave them in place for now in the fuselage holes at Stations 4 and 5. Place a temporary 3/32"-thick wood strip at each end of the wing to gauge the gap between the fuselage and wing. This gap is where the actual hinge pin is located on the real aircraft, so the outer wing panels do not actually touch the center wing section or fuselage. However, if you have already added a spacer on the fake hinge pins as shown on the plans, the temporary spacer is unnecessary. Temporarily block up the ends of the lower wings.

Shape two other wood blocks to the wing angle next to the fuselage. Move the blocks out near the wing tips just beyond the outer wing strut locations, and shim them up until you have the correct dihedral angle for the wings. The dihedral is only 1 degree. At the outer wing strut, the wing is about 3/16" higher than at the fuselage. Make the blocks long enough to install some nails or eyebolts in top for attaching a rubber band to hold the wings to the block. Glue or nail the block to the board. Check that the leading edge of the right and left wing panels are perpendicular to the fuse-

lage and are in a straight line. You don't want any sweep back or up with the wings. When all is correct and secured to the blocks, glue the fake hinge pins in the fuselage.

Make sure the lower wings are rigidly held down before attempting to install the upper wing panels. You don't want anything moving. See *Figure 7-8* for lower wing installation.

### 8. Rigging the Aileron Control Wires

See *Figure 7-14*. First, rig the back brace wires for the aileron control horns. Use the short turnbuckles (R3A) for these, which are located at the trailing edge of the ailerons. Start the control wire at the quadrant in the rear cockpit. Feed the wire around the aft sheaves on the seat rails, then around the forward sheave and out the fuselage. About 1-1/4" out from the fuselage on both sides, add a turnbuckle (R3A short) in the cord. Continue the cord through the sheave under the upper wing and to the control horn.

For the upper control horn wire add a turnbuckle (R3A short) in the cord. Locate the turnbuckle over the left edge of the center wing section, then feed the ends through the sheaves on top of the wings to the con-



*Aileron control horn on a restored Jenny*

trol horns. Finally, add a U-shaped brass rod as a fairlead for the wire, inserting it into the center section right rib (you probably already installed this when building the center wing section).

Double check all the rigging to make sure it is still fairly tight – no drooping of the nylon cords.

## FINISHING TOUCHES

Check the entire model over, and touch up any remaining stain or paint. Check all rigging cords to make sure they are tight. Stand back and take a picture.

***Congratulations*** – the *Jenny* is finished! Take a moment to revel in your accomplishment. You've persevered when the going

became rough, and your effort has produced results. You've developed skills you never knew you had, increased your vocabulary, and become a time traveler.

We hope you've enjoyed your voyage and look forward to flying with you on your next aircraft modeling project.

As this is a delicate model, it is suggested that it be mounted on a suitable baseboard and housed in a protective glass or plastic display case – or at least keep it away from your cat.

## BIBLIOGRAPHY

**Resurrection of a Jenny** by Chester Peek. Three Peaks Publishing, Norman, OK, 1995. Interesting text on the history and restoration of a *Jenny*. Some fascinating photographs of the aircraft under construction and in flight.

**Scale Aircraft Drawings, Volume 1** Air Age, Inc. Wilton, CT (Publishers of *Model Airplane News*) 1986.

This book contains history, photos, and plans of the *Jenny* drawn by Joseph Nieto.

**WWI Aero: The Journal of the Early Airplane** A quarterly journal published by Leonard E. Opdycke, Poughkeepsie, NY. Many issues of this journal have articles about the *Jenny* with photos of the aircraft in flight and under restoration. Vol. 119, April 1998 includes a plan of the OX-5 engine, and Vol. 152, May 1996 has excellent photos of a restoration with many details of the uncovered structure.

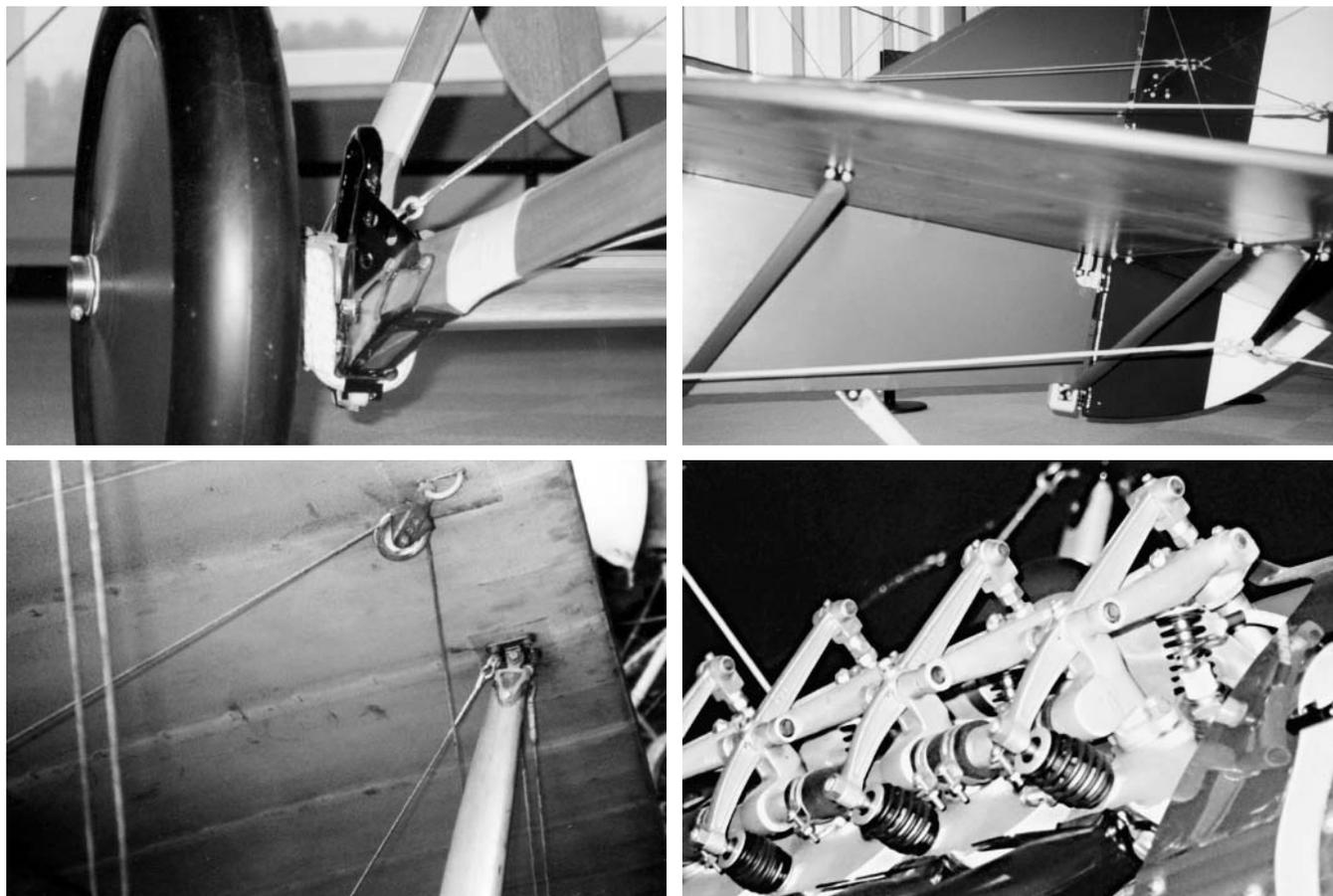
**Jenny Was No Lady: The Story of the JN-4D** by Jack R. Lincke. W.W. Norton & Company, New York, 1970.

Great, comprehensive history of the *Jenny*. Many good photographs. Unfortunately out of print, but worth looking for a used copy.

**World Encyclopedia of Aero Engines** by Bill Gunston. Patrick Stevens Limited, Sparkford, England, 1996.

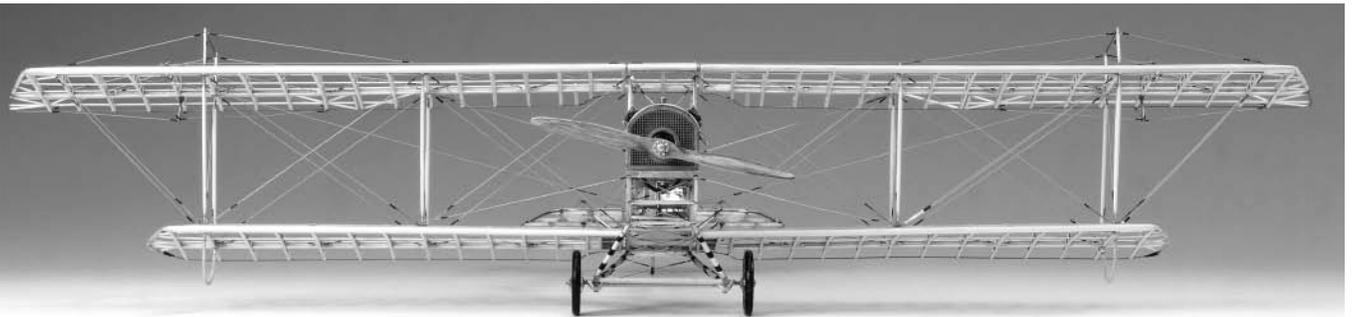
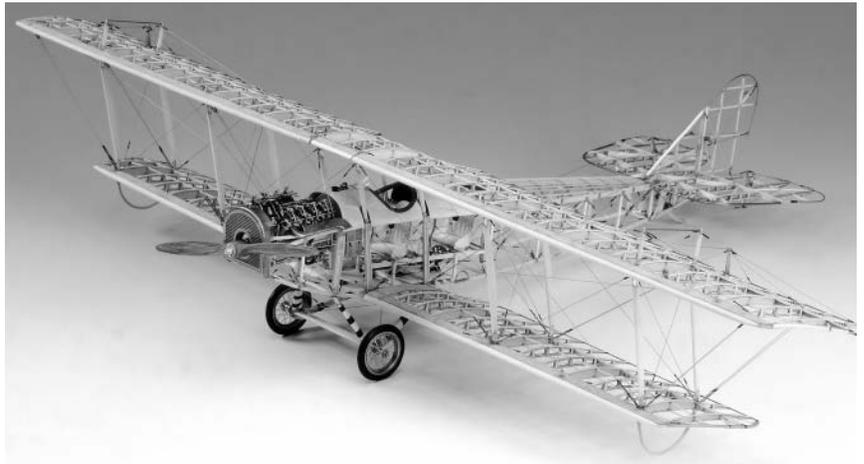
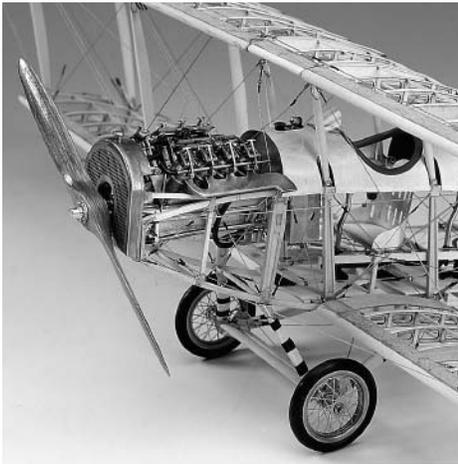
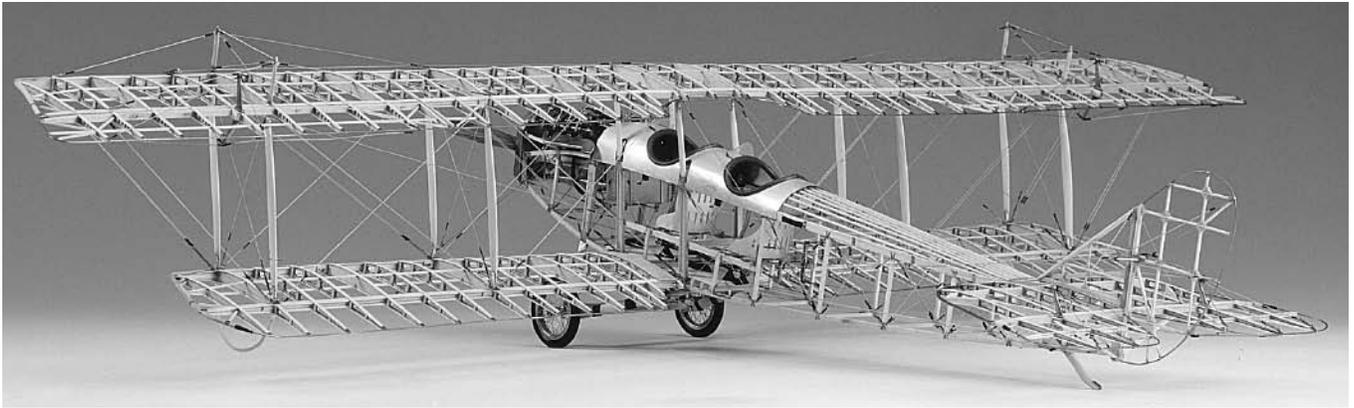
Contains a discussion and photo of the Curtiss OX-5 engine.

*Many historical notes and specifications of the Jenny can be found on the World Wide Web. Search the name Curtiss or Jenny.*



*Clockwise from upper left: Landing Gear Shock Cord, Horizontal Stabilizer, OX-5 Engine Cylinder Heads, and Aileron Control Wire Sheave, as they appear on restored Jenny's*

PHOTOS OF MODEL AIRWAYS' JENNY



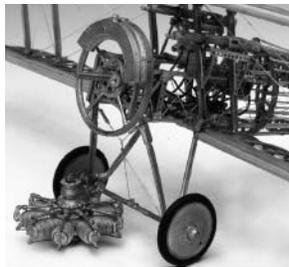
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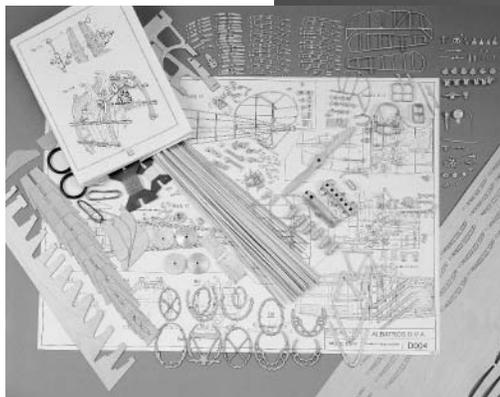
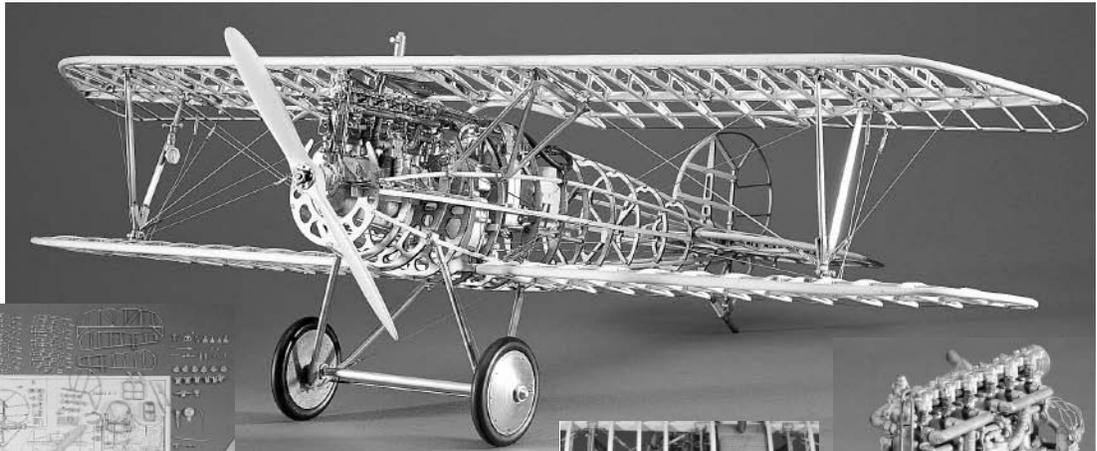


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