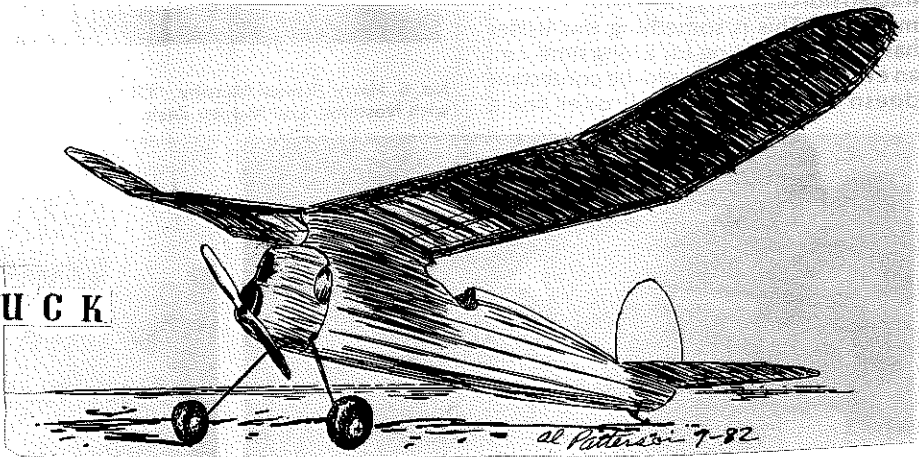


# NEW RULER

BY HENRY STRUCK



## FUSELAGE CONSTRUCTION

The fuselage is built up around an inner frame of  $\frac{1}{4}$ " square balsa to simplify alignment. Lay out the side view in full size. The longerons are  $2\frac{1}{2}$ " apart and parallel. Determine the location of the uprights by consulting the dimension chart given on Plate I. Build both sides at the same time—one atop the other—to assure their being alike. Note that the dimensions are given from the inside of each longeron to the center line to aid in laying out accurate top and bottom views. Therefore the full length of each cross piece is twice the dimension given. Join the sides from Station 1 to 5. Pull the longerons together at the rear, install the stern post and set the frame on the top view. Fit the required cross pieces and complete the bottom in a similar manner. See Fig. 1.

Trace the formers and bulkheads from the full-size patterns given on Plate II onto the stock specified. Lay the  $\frac{1}{8}$ " sheet pylon floor and cement the top formers in position. Insert the turtleback stringers of  $\frac{1}{16} \times \frac{1}{4}$ ". Fill in between T 2 and T 3 with  $\frac{1}{16}$ " sheet to form the "box" which is the backbone of the pylon. Add Formers 13 and 14 and the top of  $\frac{3}{16}$ " sheet to complete the outline of the pylon structure. Attach the side stringers and the  $\frac{1}{16} \times \frac{1}{8}$ " beading strips that

prevent the covering from sticking to the inner frame. Cement the cockpit cowl of  $\frac{1}{8}$ " sheet to the top longeron. Moisten the outside of the wood slightly to avoid splitting and bend it over the formers. Glue the nose bulkhead of  $\frac{1}{16}$ " plywood in place and mount the bottom formers. Insert the stringers of  $\frac{1}{8} \times \frac{1}{4}$ ", sighting frequently along their length to keep them free of "hooks" and "bellies." Cut the headrest sides from  $\frac{3}{16}$ " sheet balsa. Join the sides to a  $\frac{1}{4}$ " sheet top piece, first cementing the front section between the two small bulkheads. When dry pull the rear together and there will be no danger of the pieces springing apart. Shape the headrest to the cross section indicated on Plate I. After the headrest has been sanded smooth, cement it to the turtleback. Fit a  $\frac{1}{8}$ " square fillet stringer at the bottom corner, to provide a surface to which the covering can be attached. Cement reinforcements of  $\frac{1}{4}$ " sheet balsa inside the nose of the fuselage to support the motor retainers formed of bicycle spokes. Use several coats of cement to anchor them solidly.

See Motor Retainer Detail, Plate I. The fuselage has now reached the stage shown in Fig. II.

Fill in the nose section of the fuselage with  $\frac{3}{16}$ " sheet and carve to fit the contour of the nose bulkhead. See Fuselage Section A-A. Install the battery track guide bulkhead II of  $\frac{1}{16}$ " plywood. See Fuselage Section B-B. Smooth the entire frame with successively finer grades of sandpaper to remove any bumps that may spoil the appearance of the finished job. Form the wing hooks of .049 piano wire and cement them solidly to the pylon formers. The fuselage is now ready for covering. Silk is recommended both for ease of application and durability. The entire bottom and both sides can be quickly covered with one piece of silk. Cut a strip about 20" wide and  $1\frac{1}{2}$  yards long. Wet the silk thoroughly and spread it over the bottom of the fuselage. The wet material will stick to the frame and make it a simple matter to work up each side, pulling out the wrinkles. When most of the wrinkles have been smoothed out, apply heavy dope over the silk along

the center stringer, the edge of the nose bulkhead and the top beading, to stick it in place. Before the dope is dry pull out any small wrinkles.

Then apply two more coats of dope when the fabric dries, because the dope does not stick too well to wet wood. Cover the headrest and turtleback in the same way, sticking the silk carefully to the fillet stringer at the bottom corner of the headrest. Now to cover the pylon with silk. Cut a piece of silk of ample size, wet it and lay it in place, spreading it roughly into position. Apply dope over the frame between T-2 and T-3. Pull the silk taut vertically, using pins to hold it if necessary. Then draw in each end, pulling lengthwise, and dope and pin the silk to the outline in a similar manner. When the fabric and wood are quite dry apply several more coats of dope to prevent

the silk from springing loose, and remove the pins. Try to pull the silk as evenly as possible on each side to assure a symmetrical cross section. But if one side does have less "hollow" than the other, a band of extra coats of dope brushed on lengthwise will increase the curvature. Do not permit the silk to stick to any of the pylon formers or the contour of the fillet will be spoiled. Apply three or four coats of clear dope to the fabric, polishing between each with 10 nought sandpaper to smooth the "fuzz." The completed fuselage will appear as shown in Fig. III.

## MOTOR UNIT CONSTRUCTION

The motor bulkhead is a 3" square of  $\frac{1}{8}$ " plywood. Cement and brad the motor bulkhead keys of  $\frac{1}{4} \times \frac{3}{8}$ " bass to the bulkhead.

Trace the full-size motor mount blank onto  $\frac{1}{16}$ " sheet aluminum and cut out with a jig, or jeweler's saw. Clamp the blanks in a vise and file them to exact shape. Bend the blanks over the rounded corner of a hardwood block, by tapping with a mallet, or a hardwood block and a

hammer. Be sure to make one right and one left. Drill all the holes with the exception of the motor bolt holes. Cut five 1 1/4" long blanks from .020 x 1/2" sheet brass and bend fittings 'A' around a length of 1/8" wire. See Fitting 'A' Detail, Plate III. Form the landing gear from 1/8" diameter steel wire, measuring each bend to assure regularity.

Slide the fittings onto the landing gear. Attach the landing gear and the motor mounts to the bulkheads by 3/32" bolts. Form the coupling of .049 piano wire and clamp it to the bottom pair of bolts by a couple of extra nuts. Use a flat washer and a lock washer under each nut to prevent them from loosening due to vibration.

Lash the battery track to the coupling with plenty of thread and cement a block of balsa, hollowed out to fit the coil, on top of the joint. This unit is extremely flexible and absorbs shock and vibration well. Clamp the timer to the battery track by the remaining pair of fittings 'A.' Construct a battery box of 1/8" sheet and mount .034" piano-wire springs at each end. See Battery Box Detail, Plate III. A pair of 3 1/2" air wheels are held on the axles by washers soldered on either side.

Slip the motor unit into the fuselage and clamp it in place by tighten-

ing down a pair of bicycle spoke nipples on the projecting spokes. An upright Brown B engine was mounted in the original but any other similar-size motor may be used by drilling the mounting holes to suit. Drill one hole and set the engine in place, adjusting the thrust line until it is not offset in any way. Then drill the remaining holes and complete installation.

Remove the motor unit and install the wiring. The ignition system shown on Plate III will operate on boosters even when the timer is switched off. One booster lead is clipped to a terminal extended from the coil and the other grounded. The motor and nose bulkheads should be either doped generously or varnished to protect them from the effects of oil and gas.

Next month the wing and tail construction will be detailed. Until then don't get so impatient that you start the motor and enter the fuselage in a midget auto race!

#### BILL OF MATERIALS

(For fuselage and motor unit)

*All strip balsa should be hard and straight grained. All sheet balsa should be light and quarter grained.*

- 6 1/4" sq. x 48" longerons
- 7 3/8 x 1/4 x 48" stringers
- 6 1/16 x 1/4 x 36" stringers

- 2 1/8" sq. x 36" stringers
- 6 1/16 x 1/8 x 36" beading
- 3 1/8 x 3 x 36" bulkheads, pylon floor
- 1 3/16 x 3 x 36" pylon top, headrest
- 1 1/4 x 3 x 36" pylon formers, headrest, sternpost

- 1 1/16 x 9 x 6" plywood nose bulkhead and battery track guide
- 1 3/32 x 1 x 16" plywood battery track
- 1 1/8 x 3 x 3" plywood motor bulkhead
- 1 1/4 x 3/8 x 6" bass-motor bulkhead keys
- 1 1/16 x 3 x 6" sheet aluminum motor mounts
- 1 .020 x 1/2 x 8" strip brass fittings
- 1 1/8" diam. x 30" steel wire landing gear
- 1 .049" diam. x 12" piano wire wing hooks and coupling
- 1 .034" diam. x 18" piano wire battery springs and tail wheel fork
- 12 3/32" bolts, 12 lock washers, 18 brass washers
- 2 bicycle spokes motor retainers
- 1 1/2 yards silk
- 1/2 pint each of cement and dope
- 1 pair of airwheels, engine, coil, condenser, timer

**L**AST month we described the construction of the fuselage and motor unit. Probably by now you have cleared your workbench and are waiting to build the wings and tail, and inflict new razor scars, pin holes, and cement blotches on its long-suffering face. If you wish to begin this Class C gas model now, we suggest you first acquire a copy of last month's Air Trails and catch up with the job. For those who are ready to continue the first step is to collect the following materials, for wing, tail and cowl:

- 8 1/16 x 3 x 36" ribs, leading edge cover
- 3 1/4 x 3 x 36" trailing edges, wing and tail rests
- 4 1/8" sq. x 36" stabilizer spars
- 6 1/8 x 1/4 x 36" wing spars
- 12 1/16 x 3/16 x 36" cap strips
- 2 1/4" sq. x 36" wing leading edge
- 1 3/16" sq. x 36" stabilizer leading edge
- 2 ft. 1/4" O. D. aluminum tubing rudder outline
- 1 1 x 2 x 36" soft balsa for cowl
- 2 large-face bushings for attaching cowl
- 18 sheets tissue covering
- 3 in. 1/16" O. D. aluminum tubing
- 6 in. .040 piano wire cowl hinges
- 12 in. .014 piano wire cowl attachment clips
- 1/2 pint cement
- 1/2 pint dope

#### CONSTRUCTION OF WING AND TAIL

The wing and tail are constructed in identical manner and will be described together. Make full-size layouts on which to work. Consult the dimension chart on Plate IV to plot the outline. Connect the points established, by a strip of balsa held

in place with pins, or a ship curve.

Trace the shape of the trailing edges and tips from your plan onto 1/4" sheet balsa. Cement the sections together and shape to a triangular cross section with knife and sandpaper. Cut 1/16"-deep notches in the trailing edges to receive the ribs.

Pin the trailing edges and then the leading edges on the layout to establish the outline. Trace the full-size ribs from Plate V onto 1/16" sheet balsa. Cement the ribs in place, leaving a 1/16" space at the top and bottom of the trailing edge into which the cap strips are to be fitted. Moisten the leading edge and install a number of temporary diagonals to keep the tips from springing out of shape.

When dry, remove the wing frame from the plans and rejoin the panels at the correct dihedral angles, reinforcing the corners with gussets of 1/4" sheet. Insert the spars of 1/8 x 1/4" hard balsa and strengthen the joints with gussets of 1/8" sheet.

Apply a liberal coating of cement to the top of the leading edge and pin the 1/16" sheet covering to it. Bend the wood over the ribs, moistening the upper surface slightly to facilitate bending, and glue it to the ribs and spar. Cover one panel at a time, straightening out any warps before the cement has set. Trim the protruding bottom corner of the square leading edge, flush with the ribs, and cover the bottom.

Cement the cap strips in place and trim excess material from the leading edge. Smooth the frame with successively finer grades of sandpaper to

eliminate bumps that will spoil the surface.

Trace the outline of the top of your pylon onto  $\frac{1}{4}$ " sheet balsa and cut out the wing rest. Set a number of auxiliary spars in the center section of the wing. Carve out the front of the wing rest to fit the curvature of the leading edge and taper the rear to fit the bottom of the trailing edge. Set the wing on the pylon and check the alignment, sanding with rough sandpaper to give a solid, true fit. See Wing Rest Detail, Plate IV.

The tail rest is constructed similarly and cemented to the balsa-covered center section of the stabilizer. A piece of  $\frac{1}{4}$ " sheet balsa is used to "key" the tail group on the fuselage.

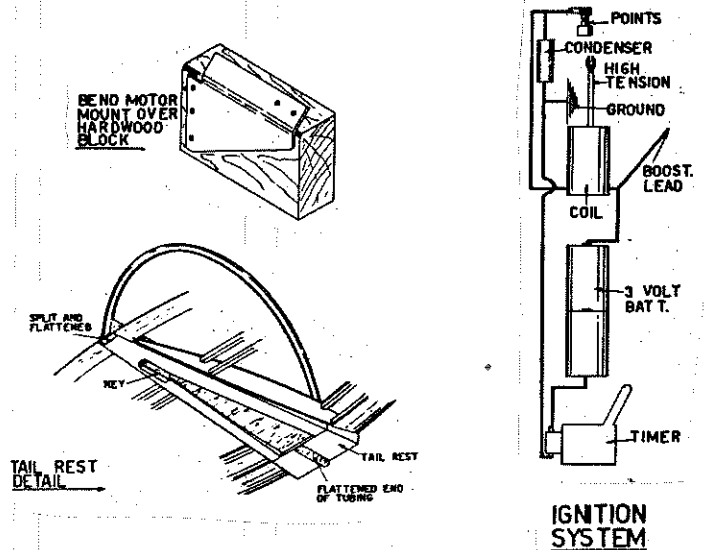
### COVERING AND RUDDER

The center section of the wing may be covered with silk to withstand rough handling. Cut a piece of ample size, wet it, and dope it to the frame. Apply extra coats of dope

to the undercamber of the ribs when the wood is dry. Use pins if necessary to make sure the fabric will not spring loose when it is doped. The rest of the surfaces are covered with red double tissue. In this way the ship is ideally colored for visibility without the weight and fuss of colored dope. Use fresh tissue to do a quick job and avoid wrinkles. Apply the first coat with the grain running chordwise. Cover the bottom of the wing first, being careful to stick the tissue to every rib to maintain the true airfoil. Elsewhere dope the tissue only to the edges of the frame. Spray the surfaces with water, and when dry apply the second coat of tissue with the grain running spanwise. Spray again with water and apply three coats of clear dope when thoroughly dry. Polish between each with 10/0 sandpaper.

The rudder outline is formed by hand, moving the stock constantly and backing up the inside of the bend with the thumbs to prevent kinking. Lay the outline on the bench and flatten the trailing edge to a thinner section by placing a hardwood block over it, tapping lightly on the block. Flatten one end of the tubing, bend it over, and glue it into the tail rest. Split the other end and cement the ears under the trailing edge of the stabilizer. Reinforce the corners with gussets of  $\frac{1}{8}$ " sheet and fill in around the stabilizer with  $\frac{1}{16}$ " sheet, using the top of the center rib as a pattern. See Tail Rest Detail, Plate IV. Cover the rudder with silk or double tissue.

The rudder may be built on the stabilizer with the trailing edge offset about  $\frac{1}{8}$ " to the right—looking from the rear—as preliminary circling adjustment.



### COWL CONSTRUCTION

Cut a 36" length of 1 x 2" soft balsa into eight sections  $4\frac{1}{2}$ " long. Cement them together to form a block from which the cowl may be carved. See Cowl Block Assembly, Plate VI. Trace the outline of the nose bulkhead on the rear of the block and shape with knife and "rock" sandpaper. Split the block apart at a number of seams to facilitate hollowing. Leave the walls about  $\frac{1}{4}$ " thick. Reassemble the sections, finish the outside with fine sandpaper and cover with silk. Cut notches for the landing gear struts and fit cooling louvers of sheet celluloid. Cut out the door and install a hinge of aluminum, tubing and piano wire. A rubber band snaps the door shut after the engine has been adjusted. See Cowl Details, Plate VI.

Glue a pair of .014 piano wire clips in the cowl. These fit tightly into large-face bushings set in the nose bulkhead. See Clip Detail, Plate VI. Polish and color-dope the cowl inside and out.

### ADJUSTMENT AND FLYING

Attach the tail group by a loop of  $\frac{1}{4}$ " flat rubber and slip the motor unit in place. Balance the model by shifting the batteries till the center of gravity is located about  $6\frac{1}{2}$ " from the front of the pylon. Mount the wing with about eight to ten strands of  $\frac{1}{4}$ " rubber and glide the ship to get the "feel" of it. Very little push will be required, especially if there is a little wind, due to the slow gliding speed. Bend the rudder till the model either glides straight, or makes a gradual right circle, to avoid a desperate chase after the engine cuts.

When satisfied, start the engine and get it running smoothly. Set the timer for about ten seconds and hand-launch the models. The stability of this model will make the first flight scarcely more than a check. Of course, to get the finest adjustments fly the ship as often as possible, observing its actions carefully. Bend the rudder to make circles of about 200 feet in diameter, and perfect the glide by increasing the negative angle of the stabilizer if it seems a bit steep, decreasing the negative angle if it seems to "mush." Under power our ship responds ideally, always flying in right circles with scant regard for changes in rudder setting made for the glide, and climbs just as swiftly and steeply as the engine can pull it.

Glue a strip of balsa across the fuselage, inside the cockpit, so that the timer arm cannot be advanced beyond the twenty-second motor run permitted by the contest rules.

### SPECIFICATIONS

Engine—Brown, or Ohlsson 60 (displacement .60).

Required weight—3 lbs.

Area—5.8 sq. ft.

Wing loading—8.25 oz. per sq. ft.

Individual weights—

Fuselage .....	8 oz.
Wing .....	7 oz.
Tail .....	3 oz.
Cowl .....	1 oz.
Motor unit .....	.29 oz.

Complete .....

48 oz.