

The Flapper

from Model Airplane News, July 1943



Junior and Senior Record Holder Ornithopter

by ROBERT HORAK

AFTER designing and building several ornithopters following the general indoor trend of design, I reached the conclusion that indoor types were not adaptable for outdoor flying. I then set about trying to develop an ornithopter which would turn in successful outdoor flights. After trying various ideas and different aerodynamic setups I finally arrived at the following conclusions:

1. It must have a large stationary surface with a high lift airfoil set at a high angle of incidence.
2. It must be extremely light but strong in the right places.
3. It must be streamlined in order to permit fast flights. Speed is essential since lift increases with the square of the velocity. In other words, a model producing 5 oz. of lift at 5 mph. will produce 25 oz. of lift at only 10 mph.
4. It must have sufficient flap area to obtain the very necessary forward speed.

I designed the model presented here with these ideas in mind. The model presently holds both Junior and Senior National Records.

Read the article carefully, studying plans until all details of construction are clear. Lightness should be paramount throughout the entire model. Select materials indicated. Original model only weighed 1-1/2 oz.

FUSELAGE—Select four pieces of 3/32 sq. medium hard balsa for the longerons. Pin longerons in position placing pins on either side of the wood and not through it as this weakens the structure. Next select a length of soft 3/32 sq. stock. This is to be used for the crossbraces and uprights. Finish one side of the body and let it dry thoroughly; then place a piece of wax paper over it and build the

second side directly over the first. After both halves are dry, remove them from the plan. Cement the rear of the fuselage together and insert the crossbraces starting with Station No. 6. Stations No. 7 and No. 8 are cut from 3/32 medium sheet. Do not glue No. 7 in place until the crank arm is bent. Bend the crank arm from .050 wire to the shape shown, being sure to put the tubing in place. Before bending the hook, solder the washer in position and insert the wire through Former No. 7. After this is done the hook may be bent and the Former cemented in place. Fill in the nose with 1/16 sheet, carve the noseblock to shape and re-cement the body joints from Station No. 7 forward. The original model used "quarter grained" wood exclusively due to its superior strength/weight ratio.

WING—The wing is built in one piece and the dihedral is "cracked" in later. The first step is to cut 9 ribs from soft 1/20 sheet. After they are cut out, select a length of soft 1/8 x 3/8 for the trailing edge and a piece of 3/32 sq. for the leading edge. Place them in position and (Turn to page 52)



Here's one for your "Believe It or Not" collection: a flapping wing design that really works, as evidenced by the above record



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apply cement. When the wing is dry remove the structure from the plan. Next cement the 1/4 lengths of aluminum tubing for the hinges in the places indicated.

The moving flaps are made next. Select a length of 1/16 wire and bend to proper shape. Then construct the small wooden triangles. Install them with cement and bind with wire. Then bend fitting "A," cement and bind into place. Note the differences in dimensions and be sure to make one right- and one left-hand flap. Next bind and glue tubing as indicated on the plan. Cut out the paper outline and cement it to the wire. The connecting rods are 9-3/16 long and made from 1/8 x 1/4 sanded to a streamlined section.

STABILIZER—To build the stabilizer select a length of 1/8 x 1/4 soft stock for the trailing edge, taper it and pin in place. Then obtain a length of 3/32 sq. and some 1/20 sheet. Cut the ribs and place on plan, locate the leading edge, assemble and cement entire structure at once. When dry remove it from the plan and sand smooth. Pinpoint the rudder outline on 1/32 sheet. Cut and sand smooth. Two are required.

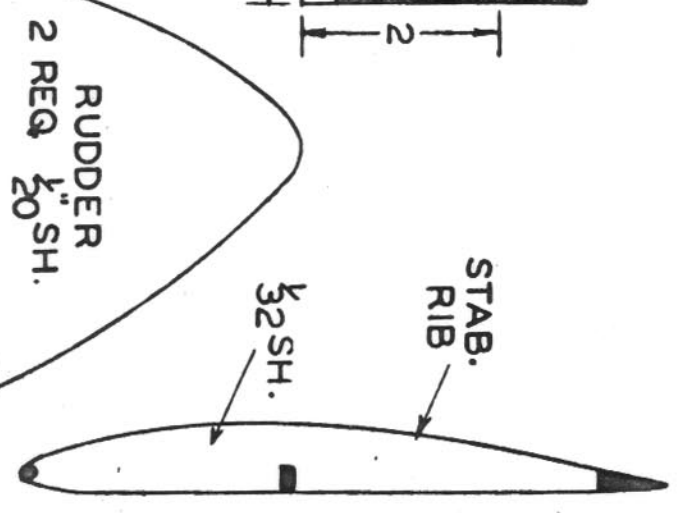
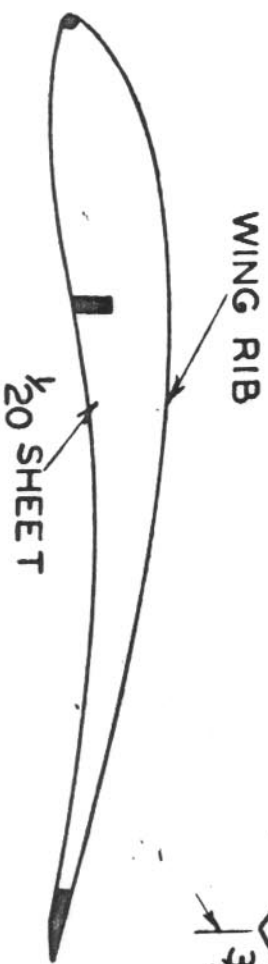
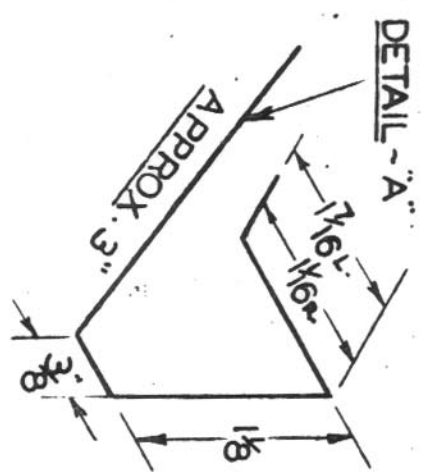
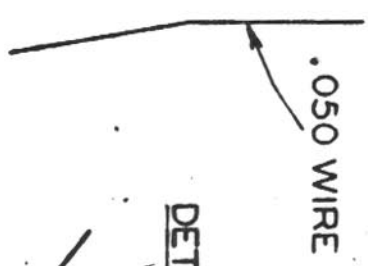
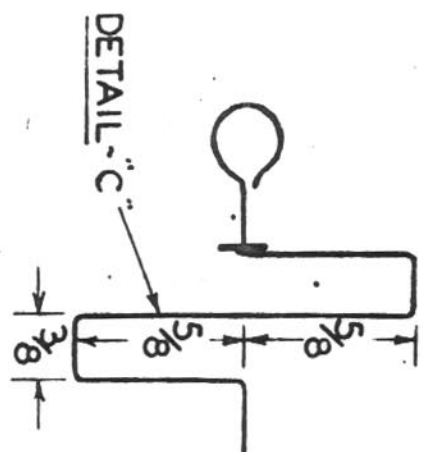
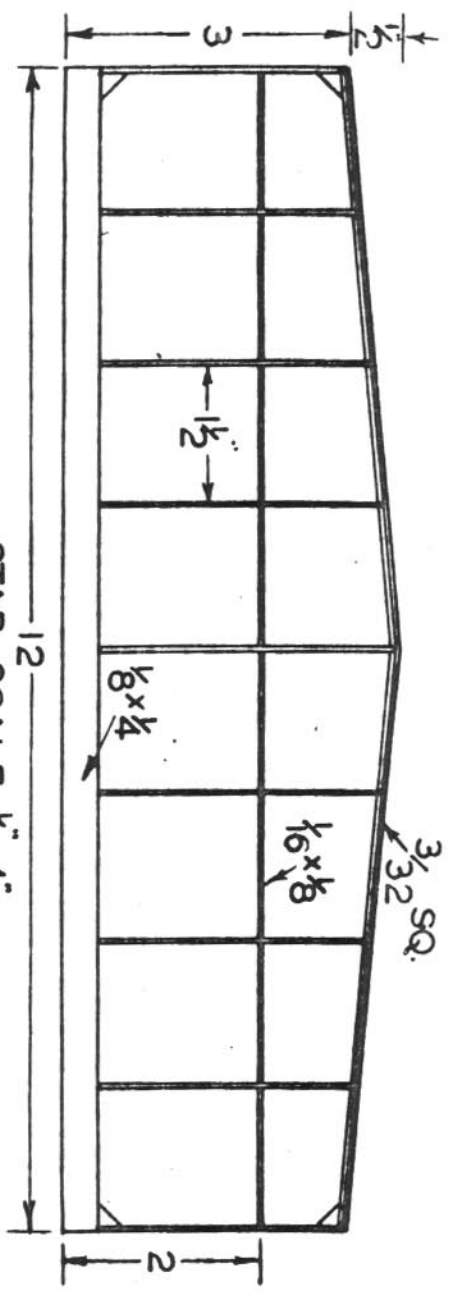
MOTOR—Power is supplied by four loops of well lubricated 3/16 flat brown rubber. Each loop is 11" long.

COVERING—The original model was covered with red tissue and given two coats of dope. Regarding the wing, cover the lower camber first, then the upper camber. Make certain the grain of the tissue runs spanwise. Cover the stabilizer same manner as the wing. The fuselage is covered with the grain running lengthwise. The rudders are not covered or doped as the latter will warp them.

FLYING—The model should balance 1/3 of the wing chord back from the leading edge. First glide the model and adjust for a slightly nose-heavy glide using the horizontal tail surfaces for adjustments. When the glide is satisfactory, wind up the motor (either way will work) and launch with a gentle push into the wind. If the model is built according to the plans presented, it should fly right off your building board. Incidentally, for a little fun try towhooks on the side of the fuselage; tow it up and then watch it really pile up time.

BILL OF MATERIALS

7 lengths 3/32 sq. medium hard
12"—1/8 x 1/4 soft
12"—1/8 x 1/16 medium
20"—1/8 x 3/8 soft
20"—1/16 x 1/4 hard
20"—1/8 x 1/4 medium
1/32 x 3 x 4 soft (2 required)
1/16 wire
.050 wire
1 1/2 sheets red tissue
White G. M. Silkspan
Aluminum tube 6 x 3/32



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PLATE 2