Flapper Facts

Newsletter of the Ornithopter Modelers' Society

Fall 1998

Editor/Publisher: Nathan Chronister, PO Box 376
Arkville, NY 12406 USA

Membership dues, payable to the editor:
New members: $14 for one year ($21 outside USA)
Renewal: $9 per year ($14 outside USA)

Member Directory

It's long overdue — a directory of all the people working on ornithopters and flapping flight. It should include contact information, past accomplishments, and current projects. It should be available to all who request it, for the price of a self-addressed, stamped envelope. It doesn't yet exist, but if you volunteer your time, I will work with you on this major project that will benefit all of us and help to advance flapping flight! Contact the editor if you would like to help. I can't do it without you.

Earn Money for Plans

Do you want to make more money? Sure, we all do. But most of us don't have well-drawn plans of ornithopters that can be sold to the hundreds of modelers out there who would eagerly give flapping flight a try if they could find some decent plans! I want to put together a plans package for such modelers, including a variety of designs, to forever fill the flapping plans vacuum we live in. I'll buy your plans so I can include them in this package. Contact the editor for more information.

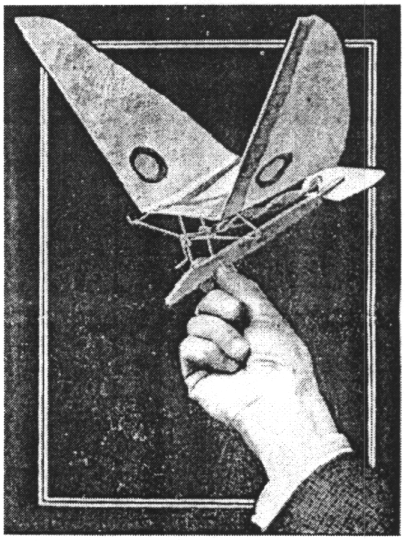
Get Ready

For 14 years, Flapper Facts has been the premier source of information about ornithopters. In 1999, things are about to change. The newsletter will have a new look, maybe even a new name. There will be a new ornithopter web site, www.catskill.net/evolution/flight. And I will be taking more aggressive measures to promote ornithopters. Only if our hobby expands can we move forward to more advanced forms of flapping flight.

A Flapping-Wing Model

From *The Model Aircraft Book* by F.J. Camm, 1936.

Here is something new for the aero modellist — a simple yet very successful flapping-wing model which really does fly. It is of the Slinn pattern such as is popular in America. This little model flies most steadily and realistically; its duration is not large — from 12 to 15 seconds — but it flies most spectacularly, and it is fascinating to watch it in the air. The mechanism is of the simplest character, and is made entirely of bent wire of which full constructional details are given in the illustrations. It is of 17 in. span, and the length of the motor rod is 8 5/8 in., the motive power being provided by 4 strands of 3/16 in. x 1/32 in. elastic. The mainplane is of paper and the motor rod of spruce. I have made the drawings so complete that I do not think a lengthy description is necessary in order to enable the reader to make it. The wire should be piano wire of 18-gauge throughout. It will be noticed that the crank has a winding handle formed on it, the bearings being provided by two washers soldered to the wing supports.



The Articulating Rods

These are attached in the manner shown in detail 4, whilst the bearings are shown in detail 3. Detail 5 is, of course, the rear hook for the elastic, whilst detail I shows how the wing supports are attached to the tin-plate wing mounting. The two limbs marked L, which are, of course, made of wire, form the hinge to the wing, whilst J indicates the wire leading edges to which the wing is attached; the paper wing is stitched over this, the rear or trailing edges of the wing being quite flexible. I should be glad to receive details and photographs of any successful flapping-wing model which has been built by readers.

PLANS >

One of the chief difficulties encountered with this type of model is to get the model to climb. Usually, they fly at the height at which they are launched, but this one does climb, and the best length of flight obtained at the present (with the model illustrated) is 80 yards. Generally speaking, a flapping wing model requires a stronger down-stroke than up-stroke, and a rate of wing articulation of 80 strokes a minute at least.

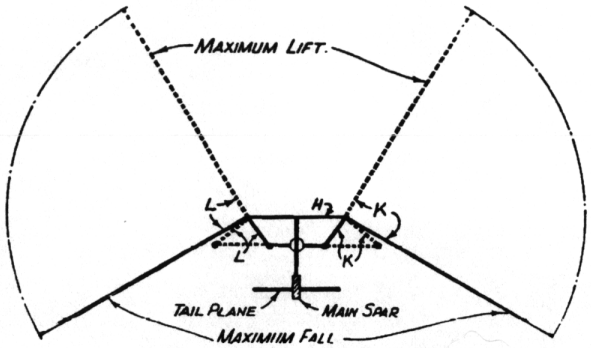


FIG. 234.—Detail of the articulating mechanism.

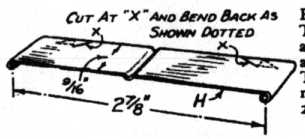


FIG. 235.—The wing anchorage and hinges. They are made from 22-gauge tinplate.

There are, of course, other means of articulating the wings, and in larger models it may be necessary to use reduction gearing in order to obtain sufficiently powerful wing strokes. Although very little experiment has been conducted with wing-flapping models a few experimenters have obtained successful results, although I cannot trace that any such models have been built powered with a petrol or a compressed-air engine. Some very neat flapping-wing models were sold in this country (of French manufacture) before the War. No full-size machine on flapping wing lines has yet made a successful flight. I shall be interested to hear from any readers of this book who have built successful models of this type, and to publish details of their machines in "Practical Mechanics."

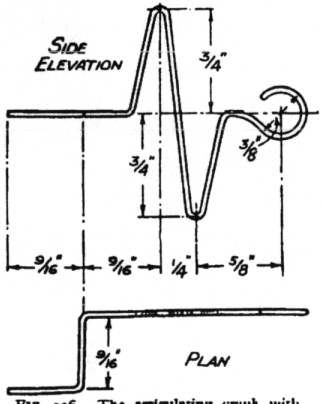


FIG. 236.—The articulating crank with combined winding handle.

MODEL AIRCRAFT

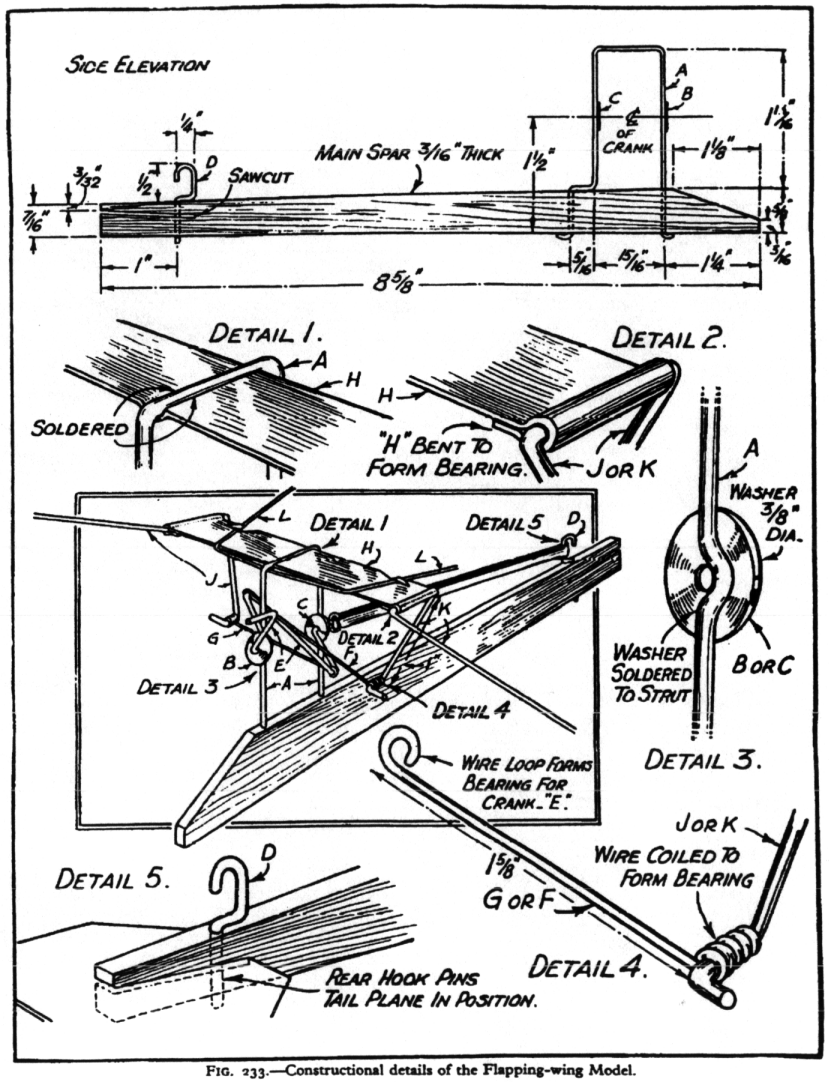


FIG. 233.—Constructional details of the Flapping-wing Model.

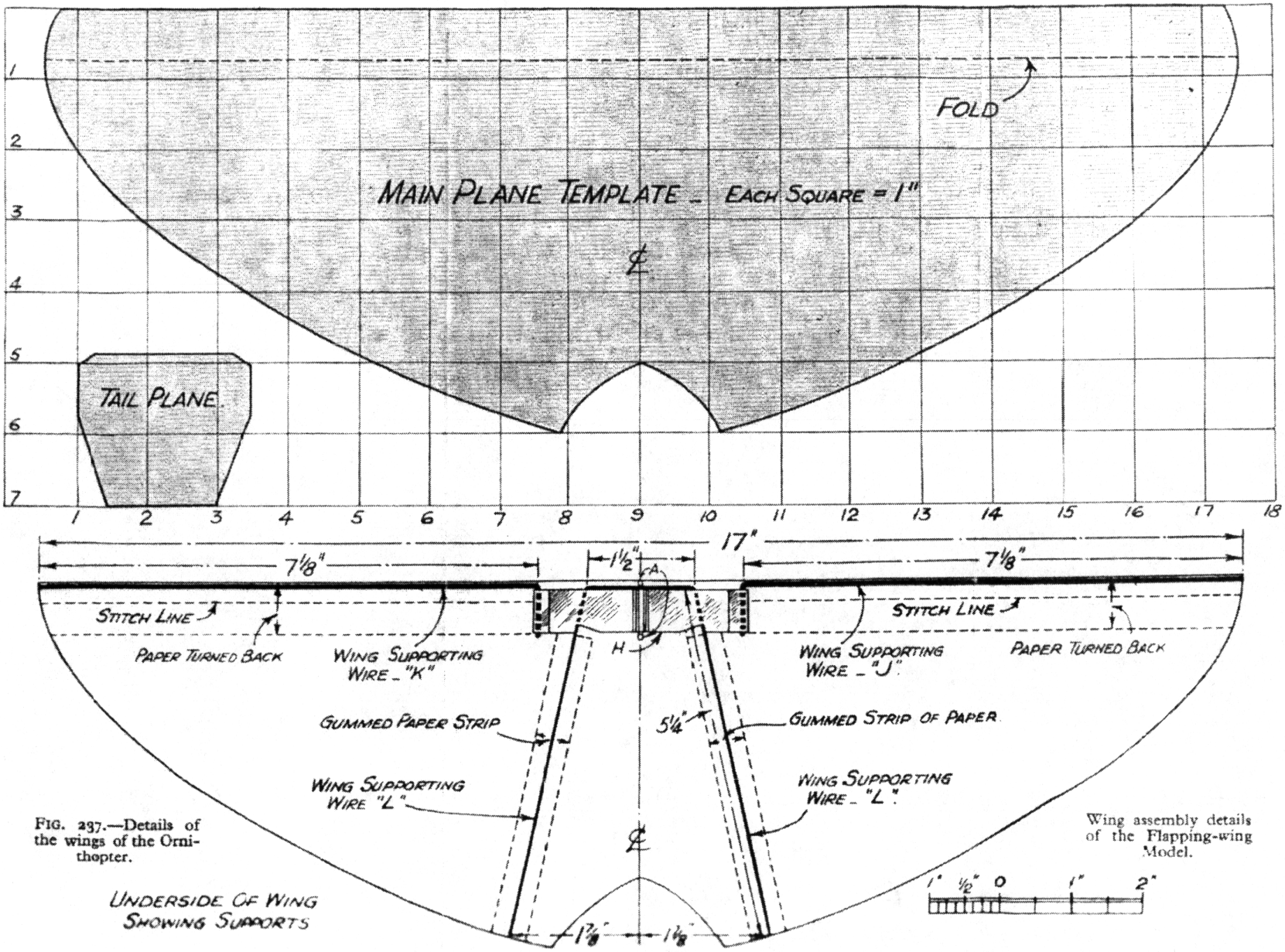
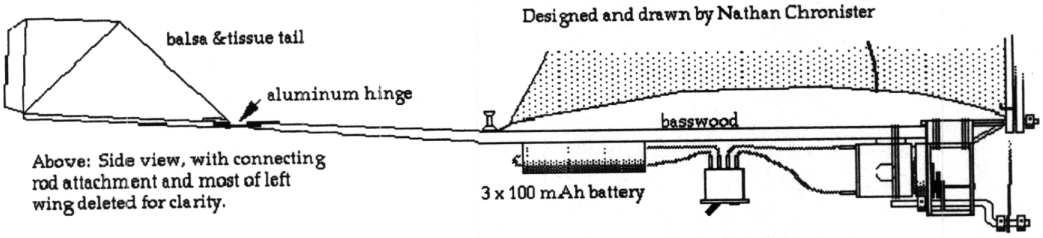


FIG. 237.—Details of the wings of the Ornithopter.

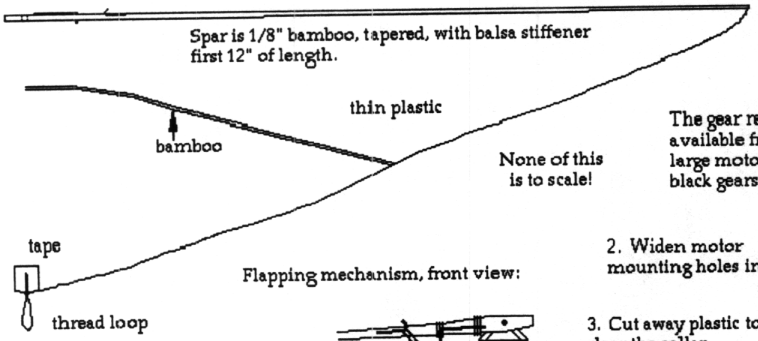
Wing assembly details of the Flapping-wing Model.

Electric Dawn ornithopter

Designed and drawn by Nathan Chronister



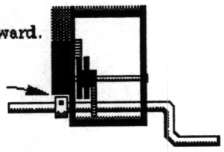
Above: Side view, with connecting rod attachment and most of left wing deleted for clarity.



Motor: M-25 motor from VL Products. Request one without the prop adaptor (bare shaft).

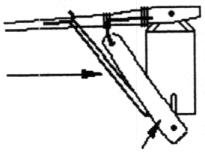
The gear reduction unit in this model is available from Hobby Lobby: HLH731 large motor geartrain using two of the black gears, with the following changes:

1. Remove screw mounts.
2. Widen motor mounting holes inward.
3. Cut away plastic to clear the collar.



4. Cut away the integral spacer which keeps the second black gear away from the metal gear. Replace it with a new washer made from plywood.

Flapping mechanism, front view:

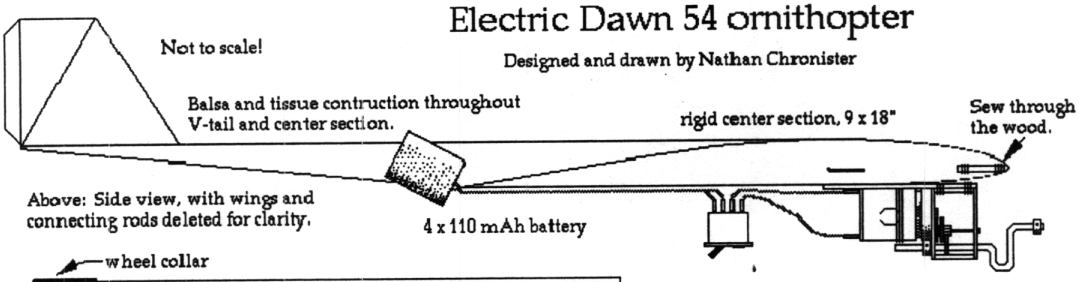


Rubber bands are used to balance the force of lift on the wings.

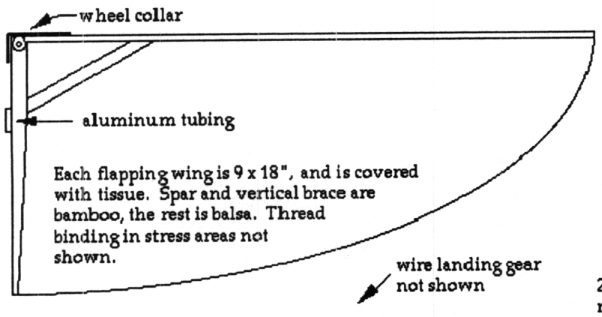
‖ = thread wrapping

Electric Dawn 54 ornithopter

Designed and drawn by Nathan Chronister



Above: Side view, with wings and connecting rods deleted for clarity.



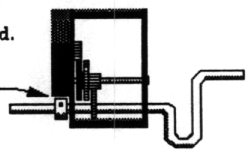
Each flapping wing is 9 x 18", and is covered with tissue. Spar and vertical brace are bamboo, the rest is balsa. Thread binding in stress areas not shown.

wire landing gear not shown

Motor: M-25 motor from VL Products. Request one without the prop adaptor (bare shaft).

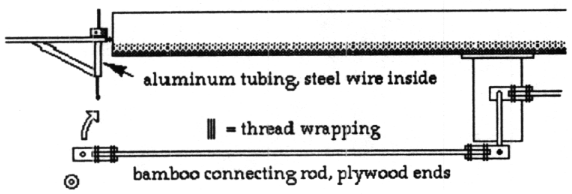
The gear reduction unit in this model is available from Hobby Lobby: HLH731 large motor geartrain using two of the black gears, with the following changes:

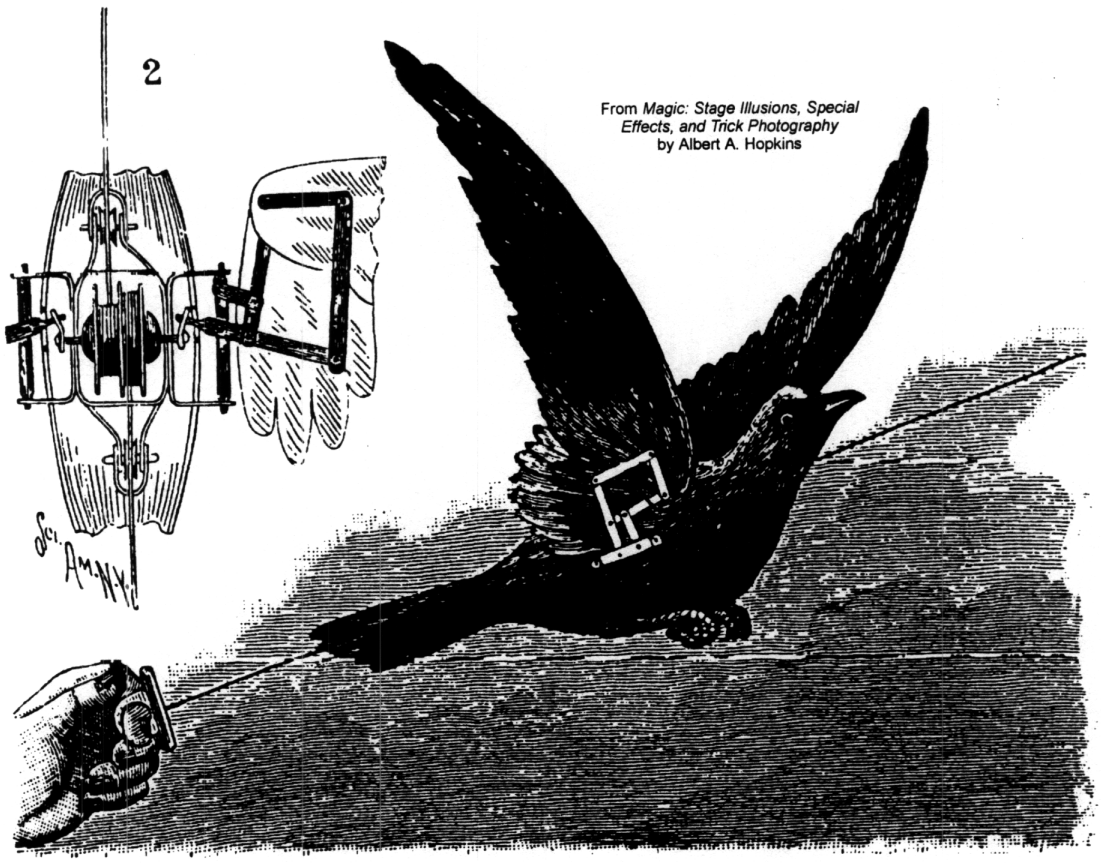
1. Remove screw mounts.
2. Widen motor mounting holes inward.
3. Cut away plastic to clear the collar.



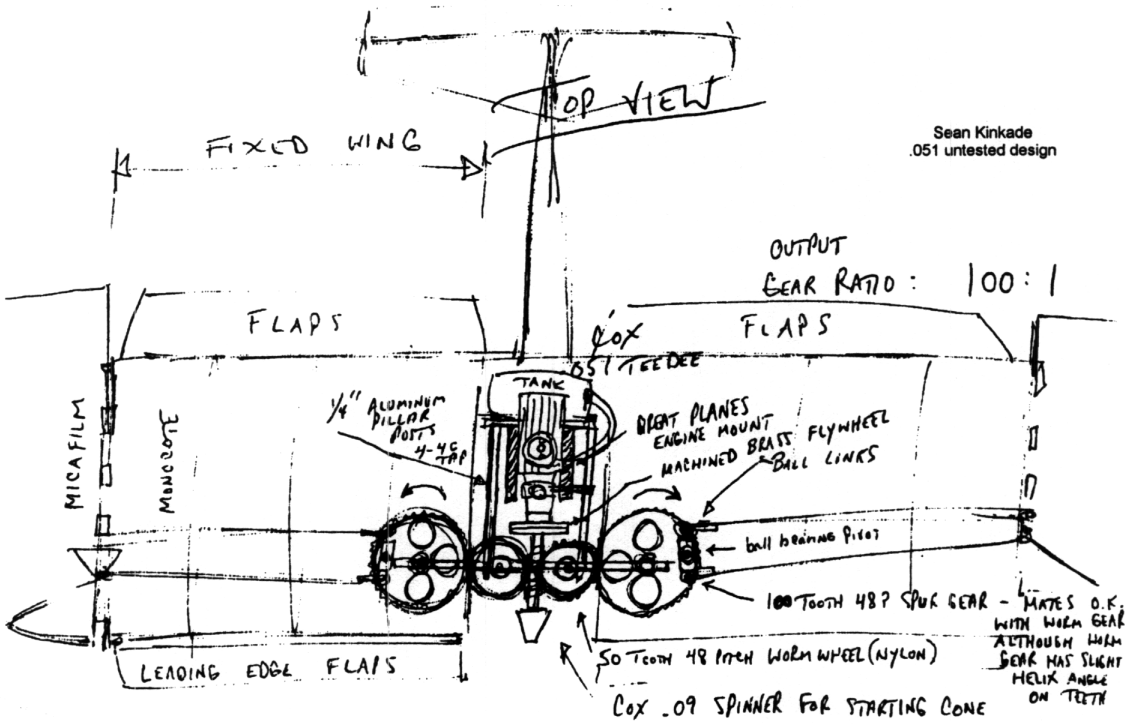
4. Replace second black gear with a stronger one.
5. Cut away the integral spacer which keeps the second black gear away from the metal gear. Replace it with a new washer made from plywood.

Flapping mechanism, front view:



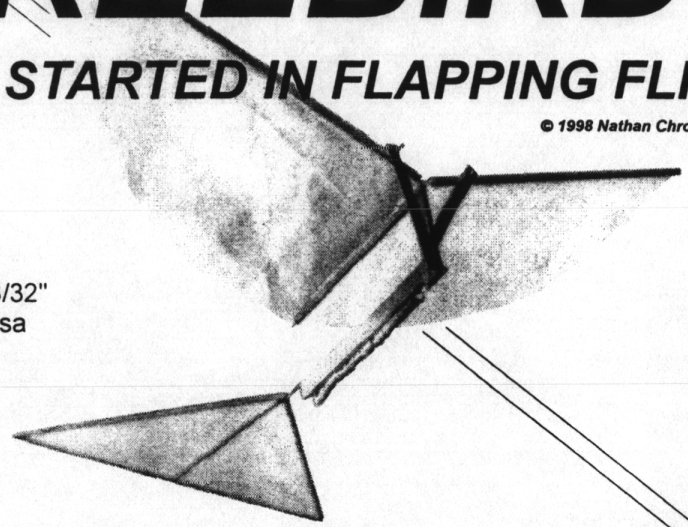


A TOY BIRD THAT EFFECTIVELY SIMULATES A BIRD FLYING.



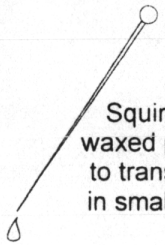
FREEBIRD 2

GET STARTED IN FLAPPING FLIGHT!

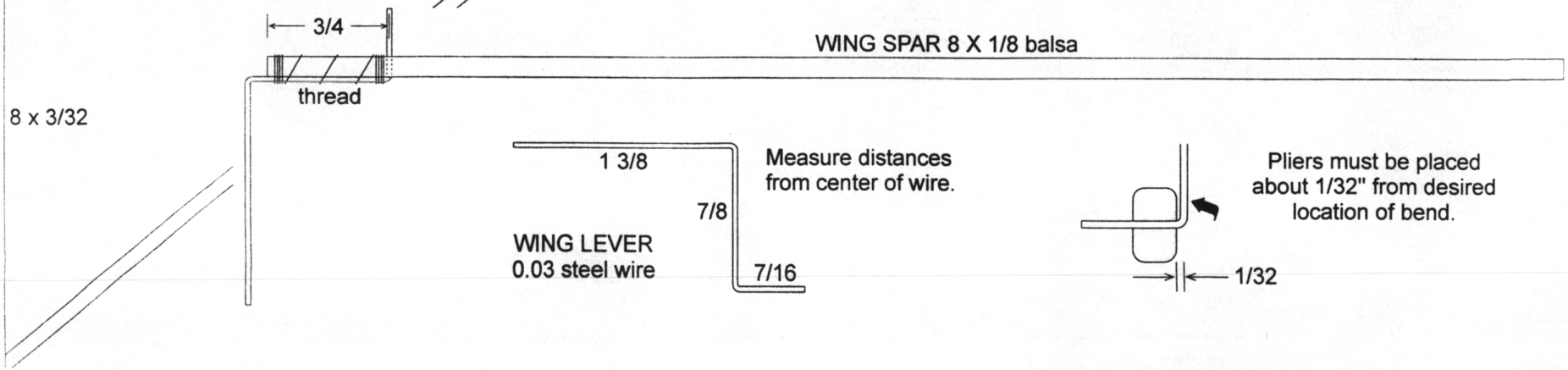


TAIL
made from 3/32"
square balsa

5 x 3/32



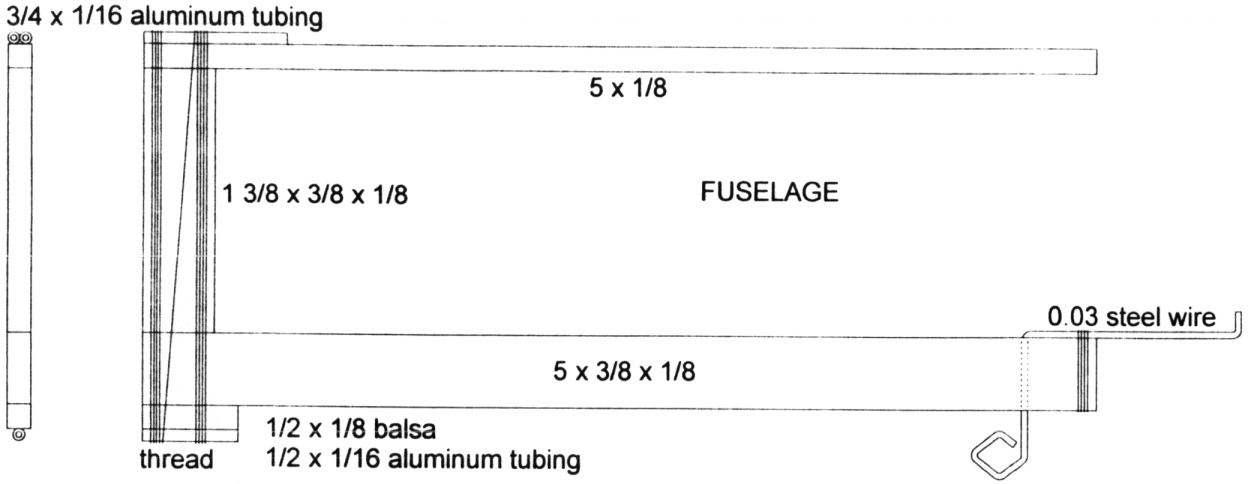
Squirt a drop of glue onto waxed paper. Then use a pin to transfer glue to the model in small, controlled amounts.

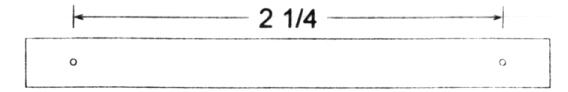


IT TOOK FOUR BILLION YEARS for flight to evolve in nature. You can build this simple flapping-wing model in a single evening! Designed specifically for first-time builders of ornithopters, Freebird 2 is just about the easiest-to-build ornithopter there is. It will give you the greatest chance of success in this challenging field. Despite its simplicity, Freebird 2 is innovative. Like real birds, it uses its wings, not tail, for directional control. Freebird 2 is also a good subject for experiments, because it is rugged and can be modified quickly. With Freebird 2, you can try more ideas in less time!

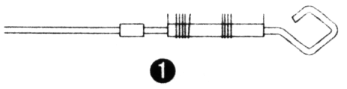
START WITH THE TAIL. Work on cardboard or another surface you can cut on. Work right on the plan, but cover it with waxed paper so the glue doesn't stick. First cut the center and trailing edge pieces to length, then glue them together on the plan. Glue is applied to the joint while holding the parts together motionless. Next cut the tail side pieces by referring to the plan. Angles at the ends must be cut accurately or the glue won't hold. Set the tail aside for later.

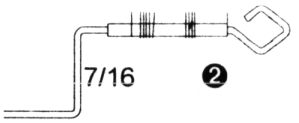
WINGS. Bend the wing lever wires as accurately as possible. Both bends are in the same plane, so the completed part should lay flat. After you cut the wing spars, make a hole in each spar for the wing lever wire. Start the hole with a pin and then drill it through by hand with a sharp piece of plier-cut wire. Make sure the hole is straight. Wrap with thread as shown; don't use too much thread. Saturate the thread with glue, just enough to do the job, and rub it in with a small piece of waxed paper.

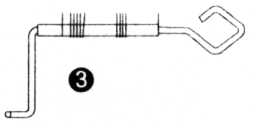


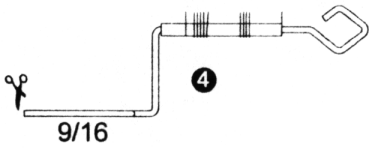


CONNECTING ROD 2 3/4 x 1/4 x 1/32 plywood







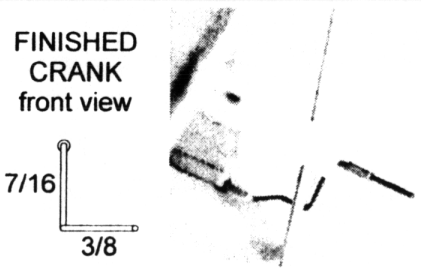


FUSELAGE. Assemble wooden parts first. Then glue aluminum tubing in place. Make sure the tubing is parallel to the fuselage and that it is not recessed behind the front of the balsa structure. Make the tail hook, which holds the rear end of the rubber motor, from a long piece of wire: Use a pin to make a hole through the fuselage, form the tail hook, and insert the remaining wire through the hole. Bend the wire 90° so it lays back along the end of the stick as shown. Finish by making an upward bend. Make sure wire is straight up and down when viewed from behind. Cut off the excess wire. Wind with thread as shown.

CRANK. The crank wire is the most difficult part of the ornithopter, but the tail hook was good practice. Even if you make a mistake, you can easily cut off the crank wire and make a new one. Begin by bending the motor hook. Then slide the wire through the bearing tube on the bottom of the fuselage. Cut a 1/8" long piece of aluminum tubing as a thrust washer and slide this onto the front end of the wire. In Figure 1, you are ready to bend the crank itself.

The crank consists of a series of 90° bends. Make the first bend by grasping with pliers, just ahead of the thrust washer, and bending the free end of the wire by hand. Carefully make the second bend so that it is in the same plane as the first. Notice that in Figure 2, the remaining wire is parallel to the bearing tube. The third bend rises directly "out of the page", as shown in Figure 3. The fourth and final bend leaves the wire parallel to the bearing tube once again, as shown in Figure 4 and the front view.

FINISHED CRANK front view

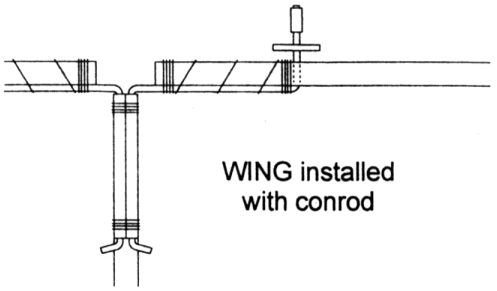


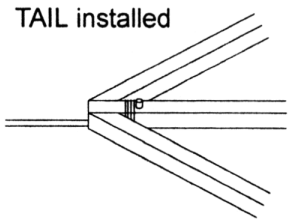
CONNECTING RODS. Make 2 conrods from plywood. Make holes by piercing the wood with a straight pin; enlarge with wire. Holes must be exactly 2 1/4" apart. Slide conrods onto crank, then onto wing lever wires; rear conrod goes to left wing. Turn the crank. Wing motion should be smooth and symmetrical.

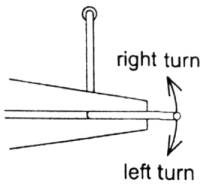
INSTALL TAIL. Make a perpendicular hole through the tail and fit the tail onto the wire extension of the tail hook. Make sure the tail is not crooked, then glue and bind with thread.

INSTALL WINGS. Insert wing lever wires through the wing hinge tubes. Bend the wires as close as possible to the hinge tubes to hold the wings on, bending more or less in the same plane as the wing lever. Cut off excess wire. Wings should swing freely and should be perpendicular to the fuselage.

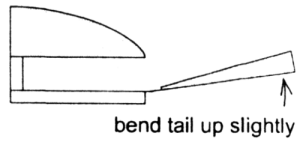
APPLY TISSUE COVERING. Cover the tail first, because it is easier. First apply a thin coat of white glue (mixed with 3 parts water for best results) to the upper surface of the frame. Then apply the model tissue and smooth out wrinkles before the glue dries. Let it sit until dry, then trim off the excess with a new, sharp razor blade. Do not shrink the tissue. Do not cover the bottom of the tail.







FLIGHT ADJUSTMENTS



How to tie together ends of rubber band:

For the wings, spread the tissue flat on your work surface. Coat the top of the wing spars and pylon with glue and lay the structure on top of the tissue, keeping both model and tissue flat on the work surface until the glue sets. Tissue grain should be perpendicular to wing spars.

RETAINERS. Reinstall conrods. Cut two aluminum tube retainers 3/32" long and put them on the wing lever wires. Leave space between conrods and retainers. Crimp each retainer with pliers and add a small drop of glue to the outer end. As the conrods loosen up, you may need a retainer on the crank as well.

POWER UP. Cut an 18" length of 1/8" model airplane rubber. Tie as shown. For best results, lubricate the entire motor with rubber lube. Double the rubber band, and install on the front and rear motor hooks with the knot in the back.

FLY IT! Before flying, bend the tail slightly upward. Start off with some lowpower indoor tests to get the model adjusted right. Wind the motor 40 times, launch gently. The ornithopter should slowly descend, weakly flapping its wings. If it makes a nose dive, bend the tail up slightly. If it stalls (tries to go up, but then drops sharply), bend the tail down a bit. Try to eliminate left or right turns. Fullpower flights (130 turns) may require further adjustments.