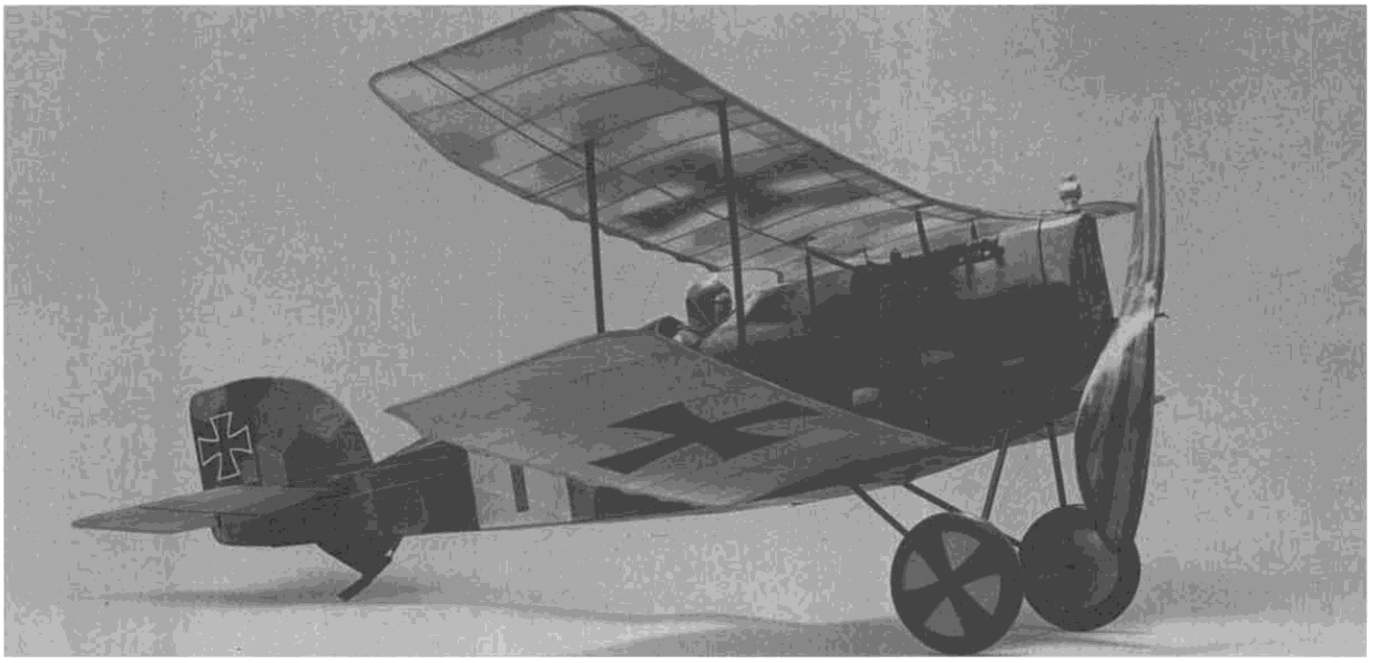


# AVIATIK D-1

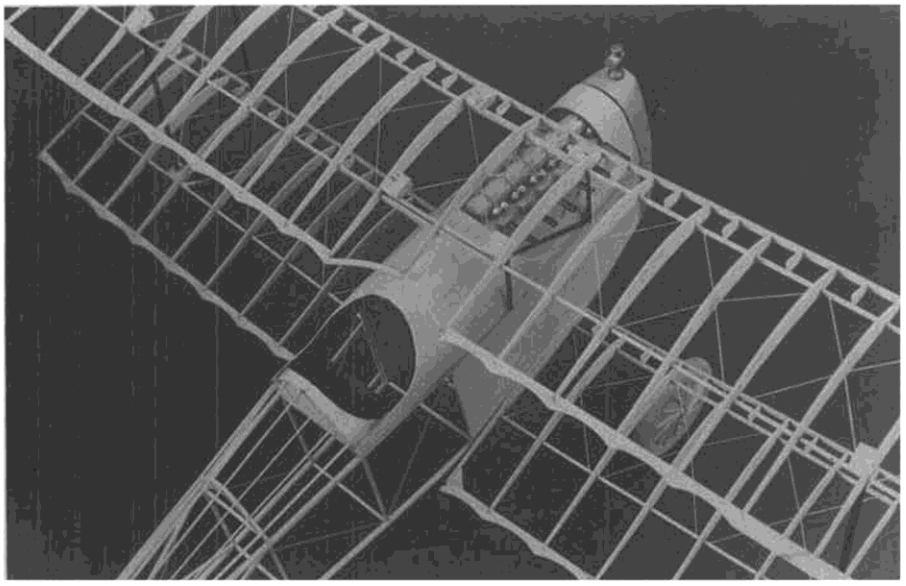
**By BILL NOONAN . . . Another lesson in the fine points of outstanding free flight scale construction, by one of the recognized experts. Even if you don't plan to build this model, you can learn a lot by reading about it.**

• The Aviatik D-I, sometimes called the Berg D-1, after its designer, was of Austro-Hungarian origin, and was used on the Italian front in considerable numbers between autumn, 1917, and the armistice in 1918. It was a compact, single-seat fighter with a wingspan a little over 26 feet. The hatchet-like fueslage provided relatively good protection and accommodation for the pilot. The D-I's robust appearance belied a somewhat fragile structure, which was subject to constant modification during its short-lived production by no less than five manufacturers.

The Austro-Hungarian army assigned a complex numbering system to its aircraft. The system identified the aircraft constructor, model type, and aircraft number in the series. As an example, our reproduction is of Aviatik D-I, 138.43. The number identifies the 43rd plane produced by Aviatik in the second production order (Aviatik was assigned 38, 138, 238, and 338 prefixes). The source for all of our information in preparation of the model is Profile Publication number 151. You may wish to consult it for color schemes, etc.

The Aviatik company, and its chief designer, Julius von Berg, were the orginators of the D-I, but the design was always being changed during production by other contractors. This accounts for the varied appearance, particularly in the radiator area and placement of armament. Pilots found the D-I responsive and pleasant to fly, but the cooling was its Achilles Heel; hence the fiddling around with the radiator design.

Production documentation in Austro-Hungary was a bit careless in 1917, so it is not known exactly how many D-I aircraft were built by the five contractors, but it is thought to number about 700 to 800.



**Closeup of Aviatik structure reveals Bill's close attention to detail. Note especially the detail on the engine. Odd-looking gizmo on top of the engine cowl is an air pump.**

## CONSTRUCTION

Fueslage construction follows the time-honored method of building the sides over the plan. Hold the main (top and bottom) 3/32 sq. longerons on the wax-paper-covered plans by using plastic "pin-downs" (available through Peck Polymers). These handy little gizmos secure the balsa in place without the hazard of splitting the wood. The upright and diagonal components are hard 1/16 square balsa, with the exception of the nose and tail uprights, which are 3/32 square. Use of 1/16 stock allows the 1/32 sheeting to be inset into the fuselage, forming flush sides. Be sure to make a right side and a left side, one built over the other, separated with Saran Wrap or wax paper to prevent surplus glue from causing problems.

When thoroughly dry, remove the sides from plan and cement them together at the tail post, holding with a weak clamp. Set the fuselage on bottom longerons and cement in the 3/32 cross braces at the widest point in the fuselage, forward of the cockpit. Check the fuselage for alignment by sighting from

the front. When these cross-pieces are dry, add the rest, confirming taper width at former stations. This is important, as the formers won't fit if there is a discrepancy here.

Laminate two pieces of 1/32 medium balsa sheet at 90-degree angles to make former material. This is a little more trouble than using 1/16 sheet, but it provides stronger parts which resist splitting when being notched for stringers.

Do not notch the formers when cutting them out. Cement them in place at their respective stations. When the formers are dry, establish the center stringer line by holding a straightedge along the center line of the fuselage. Mark them with a soft pencil or fine marker. File stringer slots to accept 1/32 x 3/32 basswood stringers. Repeat the same procedure for the adjacent stringers. Cement the stringers in place, noting 1/32-inch reduction in the stringers depth forward of bulkhead F5. This is to accommodate the 1/32 sheet balsa covering which forms the cockpit and cowl. Carefully bend the sheet covering over the area described. It is well to start at the center stringer and work your way around to the right top longeron, then repeat on the left side. This operation will require patience and judicious use of pins and cement.

Cut the 1/32 sheet balsa nose and tail sides and inset them into the fuselage sides, cementing to the longerons and 1/16 square uprights. Sand carefully when dry, to make the best base for a neat covering job.

Cut two paper patterns, one for the engine cowling cut-out, the other for the cockpit. Position each in the correct place and trace with a soft pencil. Remove the 1/32 sheet, including the surplus stringers underneath. This can be done with both a sharp modeling knife and fine-tooth saw. A Dremel tool circular saw is handy for cutting the stringers. Sand the edges when complete, noting that the engine cut-out is "coved" in the corners.

**The author and the completed model, ready for winding . Note the trim tab on the upper port wing. Model has a very realistic rustic appearance.**

Laminate the nose block from three pieces of medium 1/4-inch sheet balsa, the center lamination set 90 degrees from the others. Rough-form with a knife and sanding disc. Spot-glue to the fuselage with Hot Stuff, Zap, or similar. Finish contouring to conform to the fuselage shape, finishing with progressively finer grades of garnet paper. Carefully cut the nose block from the fuselage and drill a hole for the thrust button, providing for about 2 degrees down-thrust. The radiator is cut from brass filter screen. It is cemented in place later, after the model is doped.

The simulated Daimler-Benz engine is made of balsa. The major components are separate pieces: 1) base, 2) exhaust manifold, 3) intake manifolds, 4) valve cover, and 5) rocker arm-valve spring assemblies. The exhaust pipes are cocktail straws. The assembled engine sits on a 1/32 sheet balsa "floor" between former F1 and former F3. Valve springs may be simulated by wrapping coarse thread around 1/16-inch diameter dowels. Finish the engine with three coats of sanding sealer. Paint it dark gray. A worn metallic appearance may be had by buffing the engine with powdered graphite, available from locksmiths.

Going from the nose to the tail, the rubber motor anchor is made of 3/16-inch O.D. aluminum tube, held by friction fit between two laminated uprights. See side view.

The tail skid assembly was a rather ingenious affair, not the usual sterile, characterless appendage. The conical base (part TS on our model) was a handsomely conceived plywood veneer support which provided a fulcrum for the pivoting hardwood skid. Landing shock was taken by a sort of bungee cord attached to the longerons. There is no record of any Austro-Hungarian pilot ever complaining about the tail skid.

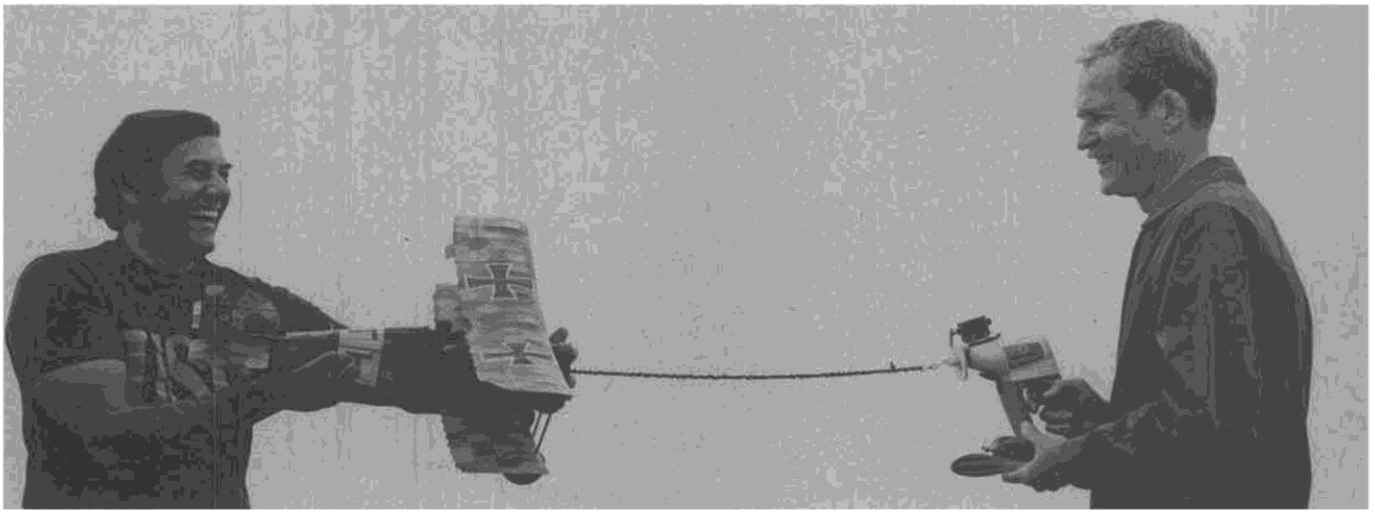
Bend the landing gear from 1/32-inch diameter music wire. Bind the front and rear legs to the fuselage cross-pieces with thread. Cement it well with epoxy. Solder the spreader bar in place after binding with fine brass wire. Wheels 2-1/2 inches in diameter are commercially available, however, we made ours of balsa, turning them on a drill press. Simulated spokes were incorporated on the outer sides, covered with tissue, and doped. The landing gear struts were covered with cocktail straws to bring them to a scale appearance. A balsa fairing would achieve the same illusion.

TAIL SURFACES

Both the vertical fin and the stabilizer have laminated outlines. Soak strips of 1/32 x 3/32 basswood overnight in water to which about 10% household (not detergent) ammonia has been added. Rinse them in fresh water and wipe before bending 2 pieces around cardboard or scrap balsa forms to make a 1/16 x 3/32 part. Titebond or any white glue may be used to hold the laminations together. Wipe away surplus glue before pinning (not through the wood) around the form.

While the outline is drying, cut rib and spar components for the fin and stab. The fin has a 3/32 square hard balsa spar, tapered toward the top. Fin ribs are 1/32 x 3/32. The stab spar is 3/32 square, and stab ribs are cut from 1/32 sheet. The stab trailing edge is 1/4 x 3/32, shaped

**Although it looks like a lot of work, the hexagonal camouflage pattern is not all that hard to do. The pattern is applied to white tissue paper using a template and "Ad Marker" pens.**



**Fernando Ramos seems to be saying, "Heh, heh, heh, can I let go now, Bill?" Bill's winder was adapted from a Black & Decker cordless drill and features a cam-operated stroke counter. Full details of the winder were covered in the July '78 MB.**

before assembly. Build both the fin and stab over the plans, securing the dry laminated outline in place. Cement ribs on the respective spars, position this assembly, and cement to the laminated 1/16 x 3/32 outline. Add gussets and provisions for control horns. These are made of 1/16 sheet balsa and prevent the tissue from sagging when the horns are cemented in place after covering.

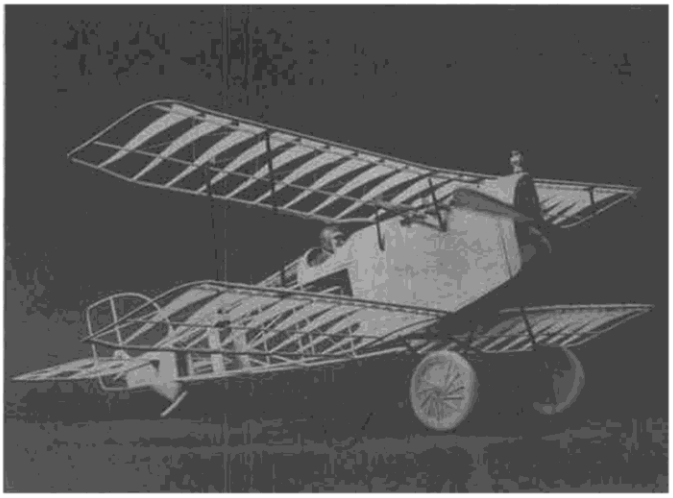
Incidence change is provided for by hinging the stab at the spar where it contacts the fuselage tail post. Note that the stab fits snugly to the fuselage sides. Note the 1/32 ply "ears" just behind the stabilizer leading edge on the underside. The function of these is to allow incremental changes in incidence (negative or positive) to effect trim adjustment during flight testing. Merely drill a small diameter hole in the plywood to allow a pin to be stuck into the fuselage sides, holding the stab in the desired position. When final trim has been established, the stabilizer may be permanently cemented in place and the brace struts added.

WINGS

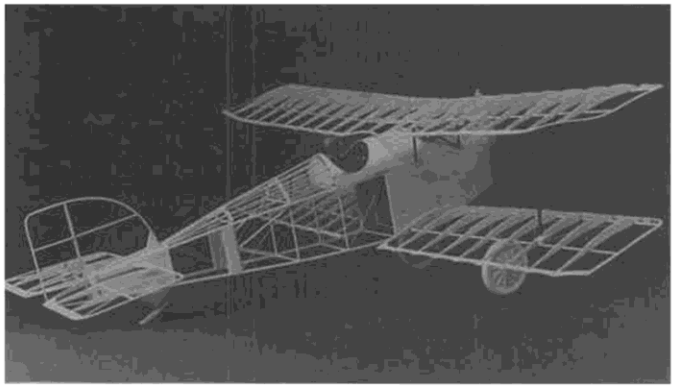
The most distinctive feature of the Aviatik is the washout on the tips of the upper wing. On the full-size aircraft, this feature was incorporated in the ailerons, which were found on the upper wing only.

Cut 30 R1 ribs from medium grade 1/32 sheet balsa. Cut two R2 ribs, one R3 rib. Exercise care when cutting the spar

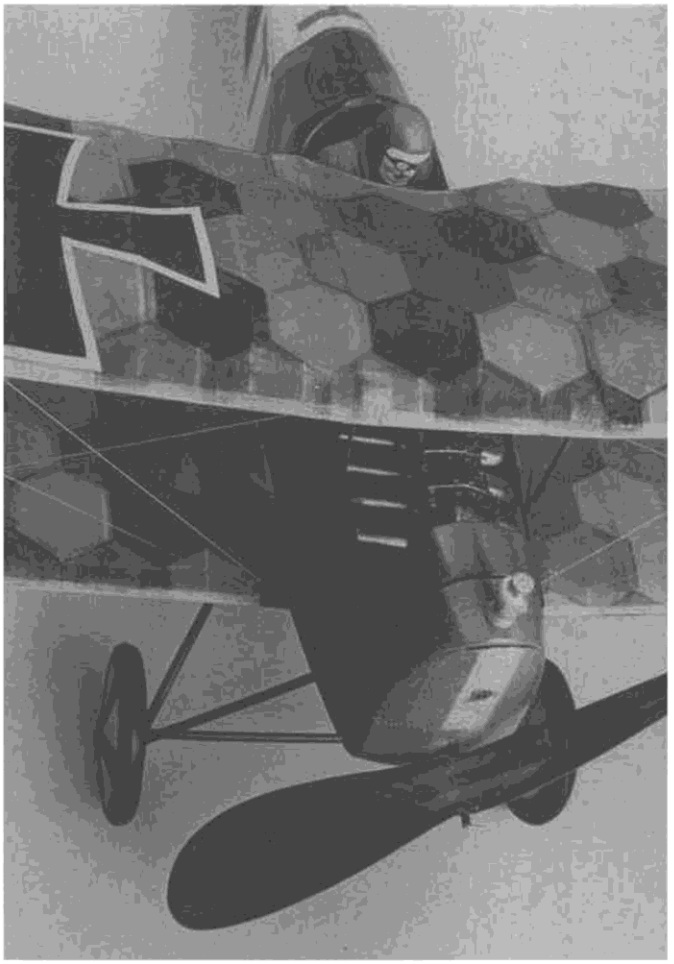
*Continued on page 98*



**Complete structure. Model is wearing the original prop, which was laminated from 1/64 plywood but had too much pitch.**



**Another view of the ready-to-cover structure. Washout in top wing ailerons is evident, as is Bill's outstanding workmanship.**



**Good detail shot of the nose and pilot. Peck-Polymers prop is painted to look like a full-size laminated prop.**

**Aviatik** . . . . . *Continued from page 79*

slots in the ribs, particularly the rear spar, as the little beggars are pretty skinny back there.

Here is the construction procedure we followed (upper starboard wing): Mark the rib stations on the 1/8 x 1/16 hard balsa front spar, as well as on the 1/16 square basswood rear spar. Cement ribs along the front spar, but do not pin the assembly over the plan. Without dallying, cement the rear spar in place. Before the cement is set, position this structure over the plans and rapidly confirm parallel rib alignment and perpendicularity. After you are satisfied that all is *OK*, pin down this assembly and cement the leading and trailing edges in place. The trailing edge should be shaped, but not scalloped, before cementing it in place. Repeat this procedure with the three other wing panels.

The funny wing tip is the most unorthodox part of the upper wing, and calls for a somewhat unusual form for lamination lay-up. It will be necessary to make two of these, one for the right wing and one for the left. They may be made of 3/8-inch balsa, or carefully bent from cardboard, reinforced with contour ribs. This form serves a dual function by providing a "platform" for the tip form as viewed from the top, and as an airfoil contour form when viewed from the side. The basic side configuration closely follows the undercamber of the wing until about 2/3 the way back on the chord, where it swoops up. It should work in coincidence with rib R2. The sketch shows form relation to the wing. The laminated tips are laid up independently of the wing, of course. The bottom wings require different forms.

Cement the tips in place after letting them dry overnight on the form. Add false ribs to all panels. Join the right and left upper wing panels, using plywood spar braces, so that each tip has a 1/2 inch of dihedral. Add the curved (laminated) piece at the t.e. of the upper wing center section.

Cement the 1/4-inch thick balsa strut mounts in place for both cabane and interplane struts. The strut mounts for the cabane struts should have a piece of 1/32-inch I.D. aluminum tubing fitted in them. These are to receive the 1/32-inch diameter wire struts which are bent in the shape of a flat-bottomed "U" and epoxied in the correct position on the fuselage cross bracing. A diagonal wire soldered in place provides the necessary rigidity to keep the assembly from swaying fore and aft. See sketch for typical cabane arrangement. Struts should be brought to the approximate scale width with 1/16 x 1/8 balsa fairings, cut to a streamline cross-section. Cement these to the wire and apply sanding sealer.

The interplane struts were made from cocktail straws, slightly flattened and plugged at each end with 1-inch hard balsa which is allowed to protrude about 1/4-inch. This protrusion fits into the 1/4-inch. This protrusion fits into the appropriate hole drilled in the balsa strut mount in the wings. You may wish to substitute 1/8 x 3/32 balsa for struts.

COLOR SCHEME AND COVERING

The Aviatik D-I's sported no less than five different paint and camouflage schemes, reflecting progress from the prototype through squadron assignments on the Italian front. The hexagonal motif used on our model was most frequently seen.

To achieve the hexagonal design, we simply cut an appropriate-size hex aperture in a piece of thin cardboard, and used "permanent" Ad Markers, available at artist's supply stores, moving the hex template across white tissue which had been taped down to a firm support. A piece of tissue about 14 x 11 inches is a convenient size would be sufficient to cover the tops of two wing panels.

Although it sounds laborious, the process goes rather rapidly if you make simple preparations. Determine approximately how much tissue you will need to cover the camouflaged portions of the model. These include all surfaces except the undersides of the wings and stab, and the fuselage. The wing and stab undersides are cream color; the fuselage, which was plywood covered, was natural wood color, or medium brown.

A common desk blotter placed under the tissue before taping the edges tends to prevent the marker ink from spreading to the adjacent color.

Rather than attempt to describe the complicated repeat pattern followed by the Austro-Hungarian air forces in WW-I, we shall only suggest colors that are appropriate and readily available in the felt-tipped markers. You may wish to consult the Profile Publication for an accurate scheme, reproduced in color.

Here are the colors: light gray, dark violet, dark green, light blue, ochre (yellow), olive, dark blue, and tan.

The markers which are identified as "permanent" are not water soluble, so you can water or alcohol spray the tissue to shrink it after applying it to the framework. Don't take the term "permanent" too literally, however. The colors tend to change when subjected to sunlight over a prolonged period of time.

After you have prepared the tissue with what may seem like a zillion hexagons, follow conventional covering practice in applying the tissue to the framework. The "T" insignia which appears on both sides and the turtledeck of the aircraft is cut from red tissue. A white tissue background band is applied first, but does not go on the underside of the fuselage, which is solid brown. The nose and cowling, which surrounds the engine back to former F3, is painted red.

Crosses may be cut from black tissue and applied after the model is clear doped. Some Aviatiks are shown in photographs with crosses without white outlines. We followed that arrangement, but it looked strange, so we added the white outline with bond paper, on the top wing and rudder crosses only.

MISCELLANEOUS

After covering and shrinking tissue, apply two coats of diluted clear dope, with plasticizer, to minimize warping.

The easiest way to assemble the model is to slip the finished top wing into the wire ends of the cabane strut assembly. Establish the incidence carefully as shown in the plans. Apply cement to root ribs of the bottom wing and cement them to the fuselage, taking particular care to observe alignment. The bottom wings should have the same incidence as the top, and the dihedral should be the same. When you are satisfied that the alignment is true, allow everything to dry thoroughly, then "spring" the wings slightly and insert the interplane struts, seating the strut ends in the proper holes. Hot Stuff in place. Apply Hot Stuff to the cabane mounts. The flying wires are simulated from 2-pound test fish leader. All struts are painted dark gray.

The odd projection coming out of the top of the cowling immediately above the radiator is an air pump, and presumably functioned somewhat as a supercharger. It can be fashioned from balsa, and painted silver. Aviatiks had all sorts of vents and inspection louvres scattered about the forward fuselage sides. The photographic reference we have shows them in all sorts of different places. They may be fabricated from thin aluminum or cut from scrap balsa. On the real plane, they hinged at the entering edge, and could be swung out for access to a hole about 4 inches in diameter in the plywood side of the fuselage. Details, like the bust of the pilot and machine gun muzzle (left side of model only) with streamline fairing, may be made of balsa.

The control horns projecting from the tail surfaces are cut from 1/32 plywood and painted black. Carefully cut tissue on the stabilizer and rudder where you have included the balsa supports. Cement the horns in place. Add control wires, which may be fashioned from silk thread or fish leader.

FLYING

The propeller we first tried was made by laminating two 1/64 plywood blades (to make a 1/32-inch thick blade) around a pine prop blank. It turned out to have excessive pitch, so we substituted an 8-inch Peck-Polymers plastic prop, which gave good results.

The model should balance a little forward of the center of the top wing. To achieve this, it is necessary to add about 12 to 14 grams of lead to the nose. Simply drill a little cavity inside the nose block and secure the weight. It can be held in place temporarily with clay until balance adjustment is confirmed.

The model flies well on six strands of 3/16 FAI rubber. The greatest number of winds tried so far has been about 1000, with lubed rubber. It is a good precaution to use a winding tube if you

intend to pack in maximum turns, as the camouflage tissue is difficult to patch in case of rubber breakage, to say nothing of all those balsa uprights!

The model is extremely stable in flight. The biggest difficulty we had was in getting it to fly in acceptably tight circles. Right thrust helped in this respect.

The Aviatik D-I is an unusual modeling subject, providing very good appearance and flying characteristics. Why not add it to your fleet? •