A home-built type of design can be for RC modeling as well as for piloted aircraft. This one has most of the characteristics of the latter, but it is the author's own creation (with a little help from our friends). It's for three-channel controls and a .20 engine. ■ Paul F. Denson

Cricket

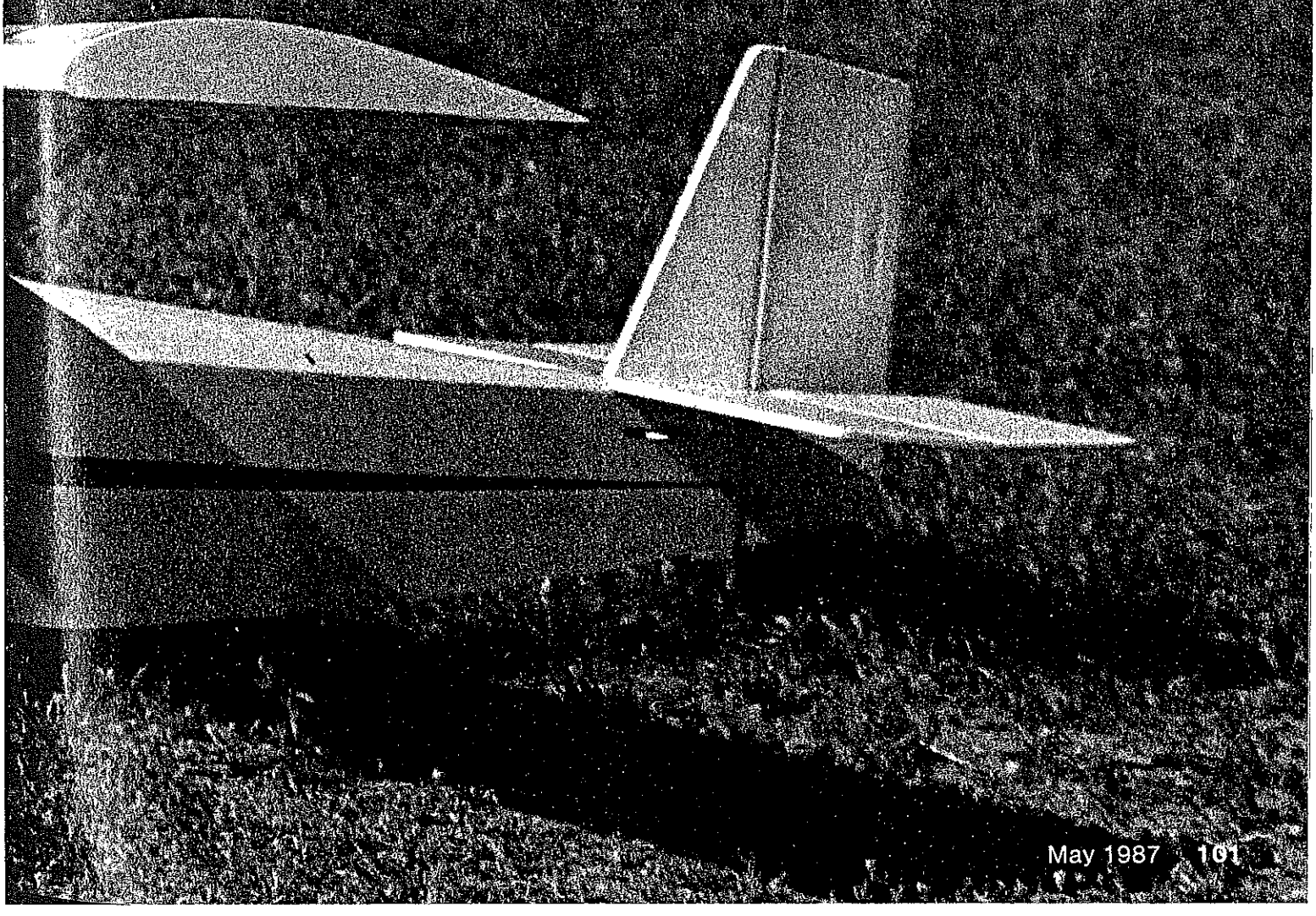
With cockpit door closed, functional struts holding the wing in place, and large Trexler balloon wheels firmly planted on the grass runway, Cricket is ready to go up for the next flight.

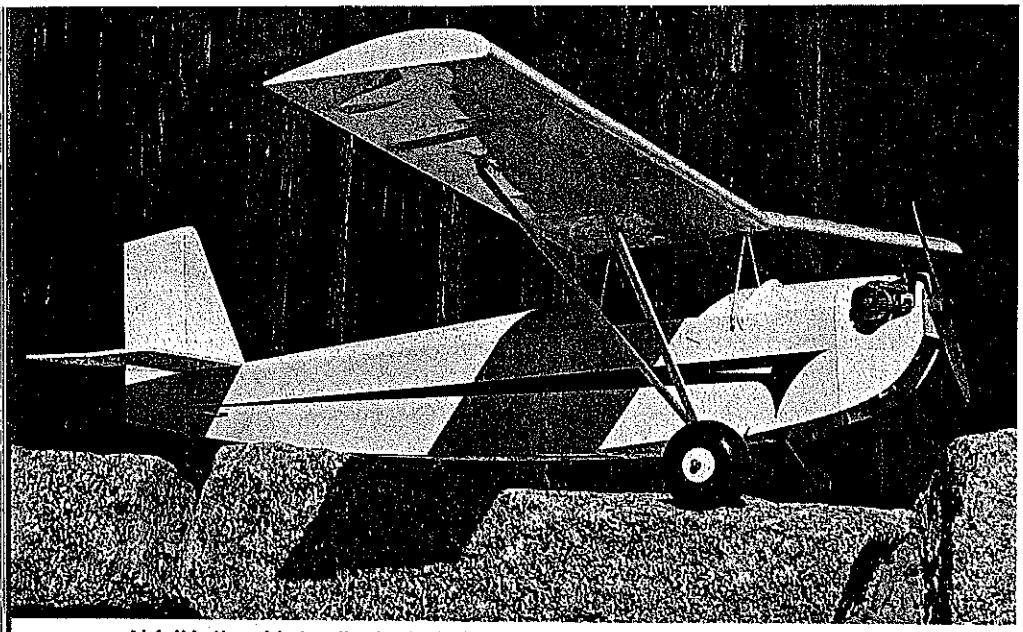
WITH MANY OF US, construction of miniature home-built aircraft is an obsession. The majority of our models have wound up being Stand-Off Scale versions of someone else's dream plane. We have done a number of home-builts: Woods' Woody Pusher, Stits SA8, Stewart's Headwind, and Hovey's Whing Ding II. Each time we felt it would have been more fun had we been the designer of the plane.

While looking through a 1956 copy of *Air Progress Homebuilt Aircraft Annual*, we saw a picture of a Model B Fike which appeared to be hanging from the ceiling of the Experimental Aircraft Assn. (EAA) Museum. The plane was pictured completely without covering—no cowl around the engine, great big doughnut tires, and no wing visible anywhere. It was hanging there dripping appeal all over the place. Every detail was highly exposed. It was readily apparent how longerons, cross braces, and formers were assembled to make a fuselage complete with the tail surfaces.

Since there was no wing present, we felt it was our prerogative to choose one. We liked the square-tipped wing of the Pietenpol, so that is the way it came out. We could see enough of the Fike B empennage to duplicate it; the fact that it was also square-tipped like our planned wing made it a natural to use. Furthermore, we used Chuck Cunningham's design parameters to ensure that it would really be airworthy. If what we did could be called pirating, we are guilty. However, as far as we know there isn't anything that looks exactly like our plane. Consequently, we feel it is our design, so we decided to name it the Cricket.

The hardest part of the whole

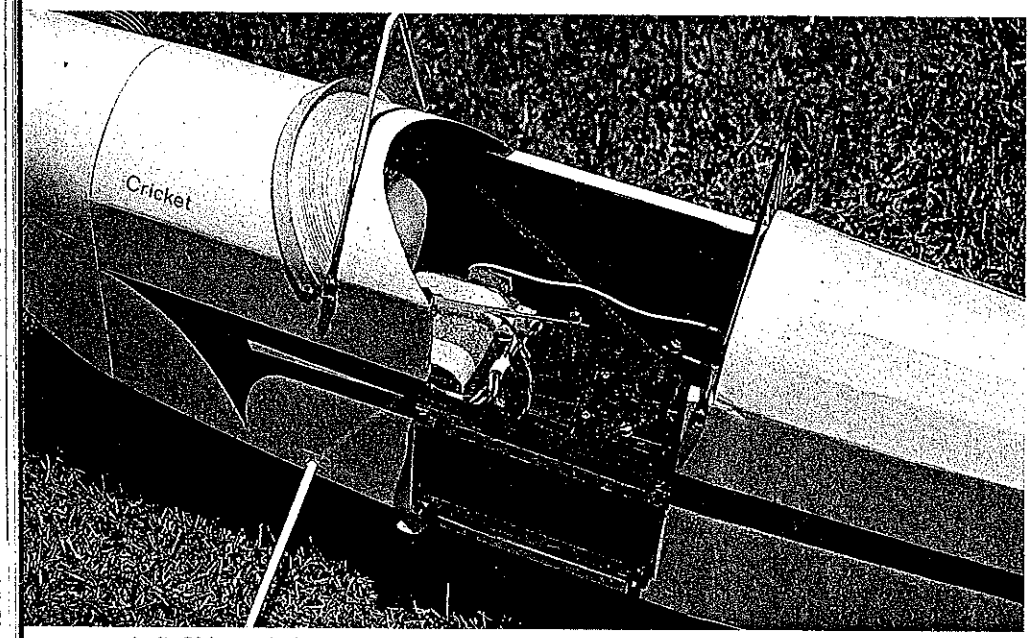


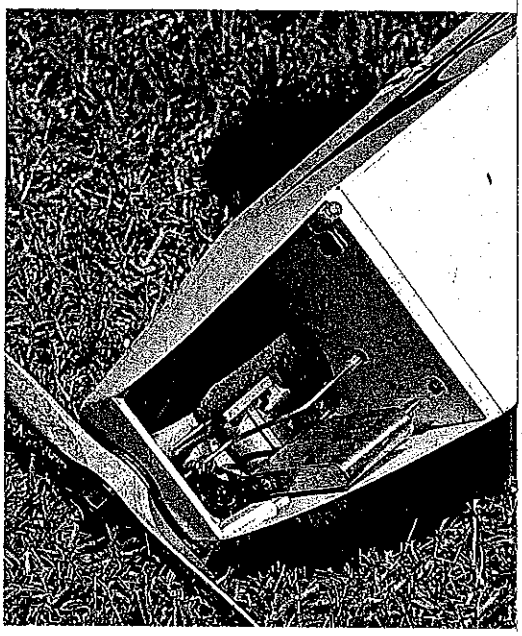


Airfoil is the old standby 15% Clark Y, and the 8-in. chord with 48-in. span means it has an aspect ratio of 6:1. At the prototype's 48-oz. weight, the wing loading is 18 oz./sq. ft. Engine installed is an O.S. .20 two-stroke. By moving the cowl ring forward slightly, a .20 four-stroke engine would be an excellent choice for the power plant. All photographs by the author.

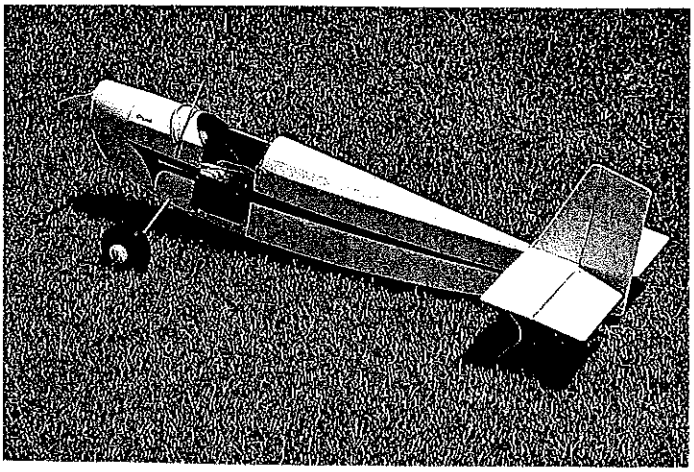
model was how to design the cowl. Those old-timers with their small opposed-cylinder engines were mounted high on the firewall; cowling with this situation is fairly easy. The engine in the Fike B is a Harlequin; this has two Harley Davidson motorcycle cylinders on a crankcase designed by Les Long. To duplicate this high location on the firewall, the model engine has to be mounted upside down or at 90° to upright. We have seen many problems with inverted model engines, so we avoid this configuration like the plague. Our choice was to mount the engine horizontally. Many standard mufflers will not work with this; Du-Bro, Slimline, and similar will.

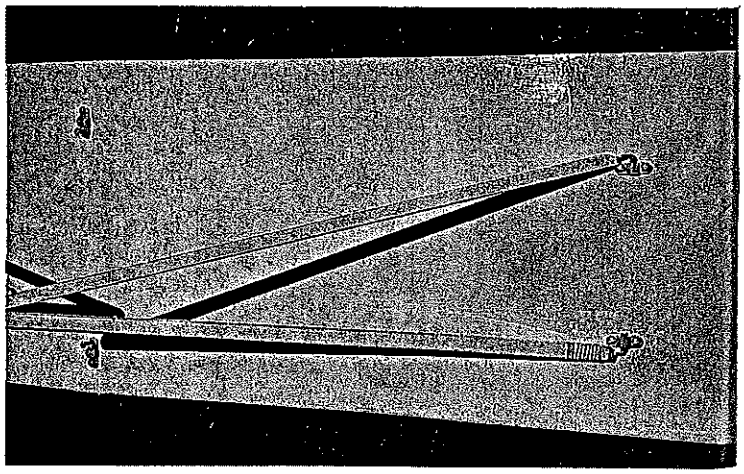
We learned a neat trick when working with Lou Proctor: two firewalls are better than one. The model is built with the front former acting as one firewall, then the whole cowl, engine, and muffler are arranged on another firewall which attaches to the first one with 4-40 machine screws. This decision was a blessing in disguise. The first cowl was discarded because we



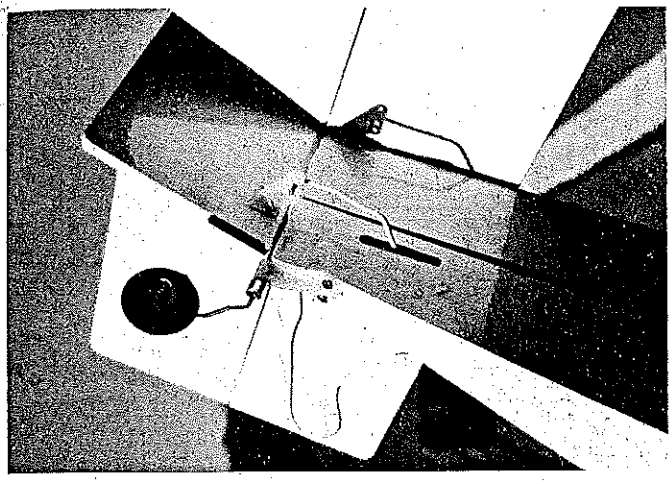


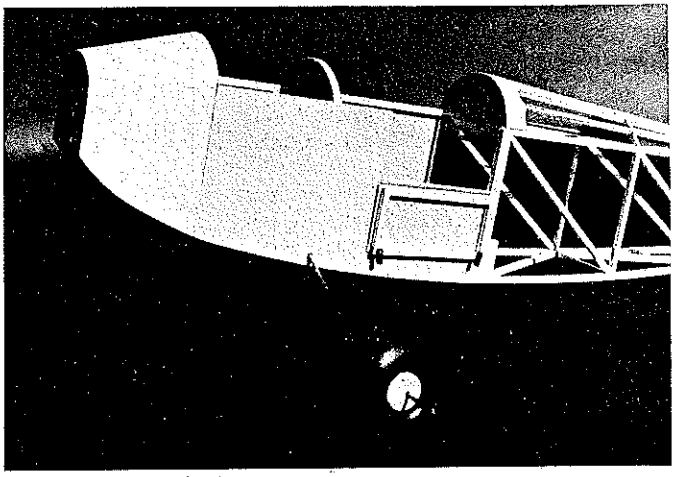
Left: Side cockpit door allows easy access to the radio gear. The rear curve of the fuel tank is exposed, allowing observation while filling. Bezels on the instrument panel are cross sections cut from various sizes of brass tubing. Right: A Slimline muffler fits neatly alongside the cowl. The throttle pushrod, for convenience, passes under the fuel tank, so it has a large Z-bend for connecting to the throttle arm.



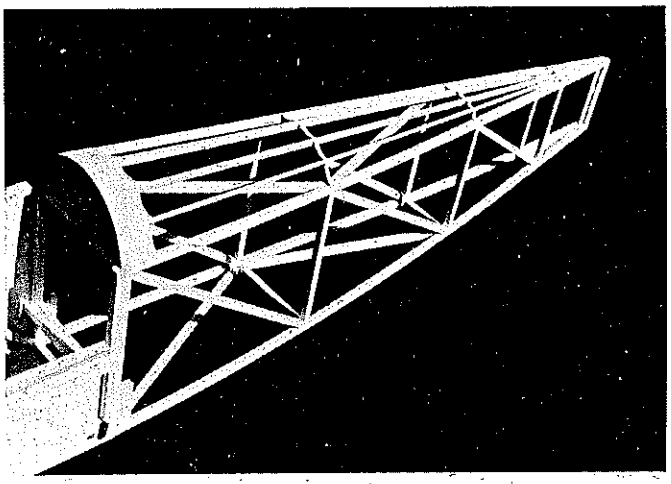


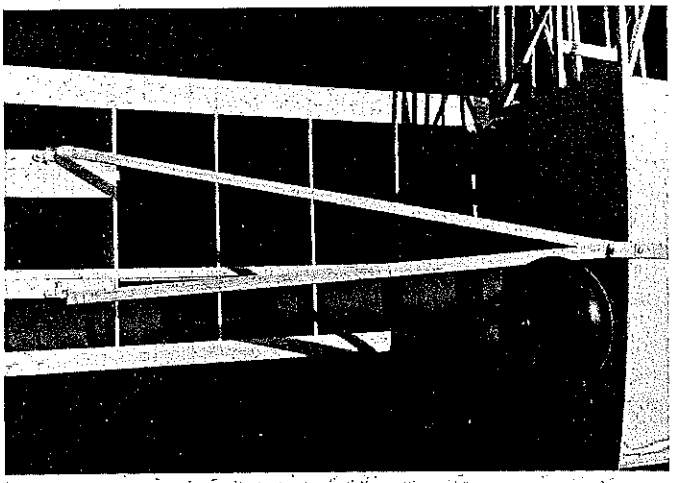
Left: Trexler wheels resemble the wheels used on the old Model B Fike, the inspiration for the Cricket. The landing gear wire on the plans will fit both the 3- and 3½-in. Trexlers (the hubs are different, so cut your landing gear to the size needed). Right: The Ls which are screwed into the outer ends of the wing struts must be doubled in size with small pieces of inner pushrod material so they will fit securely under the nylon landing gear clamps. Before painting, the ends of each strut were wrapped with heavy thread, then sealed with 5-min. epoxy.





Left: A standard nylon tail wheel bracket, attached to a triangular ⅛-in. plywood platform on the fuselage bottom, carries a 1-in. Ace tail wheel. The radio antenna is allowed to dangle when the plane is in flight. Going through the fuselage, the antenna wire is inside a plastic tube from an old roll-up window shade. Right: Latches on the cockpit door are small pieces of plastic screwed in place; they latch when turned. The engine cowl shown here was the first one which the author discarded for aesthetic reasons. Drill the wheel hubs with a 5/32 bit, and insert 5/32 brass tubing for a bearing surface. Add ⅛-in. wheel locks, and remove the excess length of the gear wire.





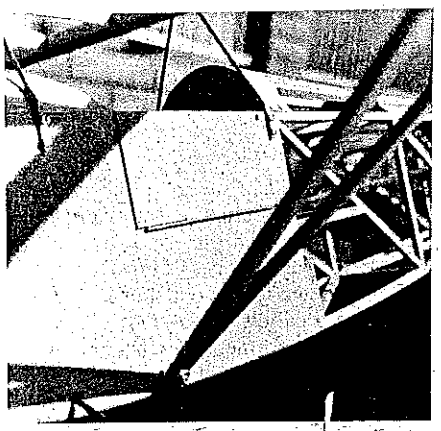
Left: Spaces between the stringers on the aft deck were filled with 3/16 soft balsa before rounding the deck. Formers were scalloped between stringers to prevent the covering from bulging. Note the crossed diagonals at the top and bottom. Right: You can see the method used for attaching the struts to both the wing and fuselage. Heavy thread was wrapped around the ends of the strut to prevent splitting.

just didn't like the lines. All we had to do was make a new firewall, move the engine up ¼ in., and add a new cowl. Without this two-firewall situation, we would have had to build a whole new fuselage. The remainder of the model is of standard construction except for the doubled ⅛-in. ply center wing rib.

Wing. Since we like to build fuselages, we usually start with the wing and save the best until last. First, decide whether you will want ailerons or if you will have a three-channel ship. Then cut out a "kit" of parts.

Cut out all the wing ribs. Get some Sig pre-shaped ¾ x ⅜-in. leading edge (LE) stock from your local hobby shop. There is no pre-shaped trailing edge (TE) stock, so use two ⅜ x 1-in. pieces of light balsa. If you have a power saw, the TE pieces can be ripped out in just minutes; otherwise, a plane and sandpaper will do a fine job. The spars are relatively hard ¼-in.-sq. balsa. Chances are you have enough ⅛-in. ply in your scrap box for the center rib and the doublers on each side. (This strong center rib will be the anchor point for attaching the wing to the fuselage.) You will need enough 1/16 aircraft plywood to make the two dihedral braces.

When you are finished shaping the TE stock, cut indentations for the rib ends. We taped three thicknesses of hacksaw blades together to saw the notches in conjunction with a depth gauge. Notches made this way will take a 3/32 rib very snugly so that a small drop of cyanoacrylate glue (CyA) will anchor it firmly.



This view shows how the ends of the cabane struts were fabricated. Former F-3 must be set back to allow the rear cabane to clear. The cockpit door hinge is a piece of brass or copper tubing epoxied to the bottom edge with music wire passing through the tubing.

The rib positions for a wing with or without ailerons are the same. If you use ailerons, the outboard ribs have to be modified accordingly. In either case the bottom spar is fastened to the workbench so that the trailing edges of the ribs will fit snugly into the TE notches. CyA the ribs and spar in place. Glue in the top spar with CyA. Do not glue the center rib at this time. Pin the LE tight against the rib fronts; add a drop of CyA at each joint, and most of the wing is finished.

The following is for the three-channel wing without ailerons. If you are building the aileron wing, read this over and then proceed to a finished wing in your own manner. Cut the strut anchors from ⅛-in. Lite Ply, and glue the forward ones in place with epoxy. The aft short spars will have to be notched into the bottom of the outboard wing ribs as indicated on the plans, then the anchor is epoxied between the two ribs and tight against the short spar. (In one of the pictures, note that the strut anchor blocks

are on each side of the short spar. This was an accident. The front block was epoxied to the wrong side. It was too late to remove it when the discovery was made, so there it stays. Don't be as careless as we were.)

Use a sanding block to bevel the ends of all the spars, LE, and TE so the two halves will fit together exactly with each tip blocked up 2 in. (block up 1¼ in. for a wing with ailerons). With a Zona Saw remove the first 1/16 in. just behind the spar of the first rib outboard the center one. Slip the dihedral brace into this space; epoxy-glue it using clamps to hold it tight against the spar. When cured, remove 1/16 in. vertically from the same two ribs just forward of the spars, and epoxy-glue another dihedral brace in the slot. Add 1/16 webbing on the forward side of the spars out to the wing tips.

Double the center rib with ⅛-in. ply as shown on the plans. Cut it to length, and epoxy in the center of the wing. The tip ribs are made of 1/16 balsa. Put the diagonal braces in the corners. Sand everything carefully. The wing is now ready for the covering.

The tail assembly construction is completely standard. Everything is built from 1/16 stock in the widths as per the plans. The joiner between the two elevator halves is made from 1/64 piano wire which is epoxied into grooves cut in the forward edge of each elevator.

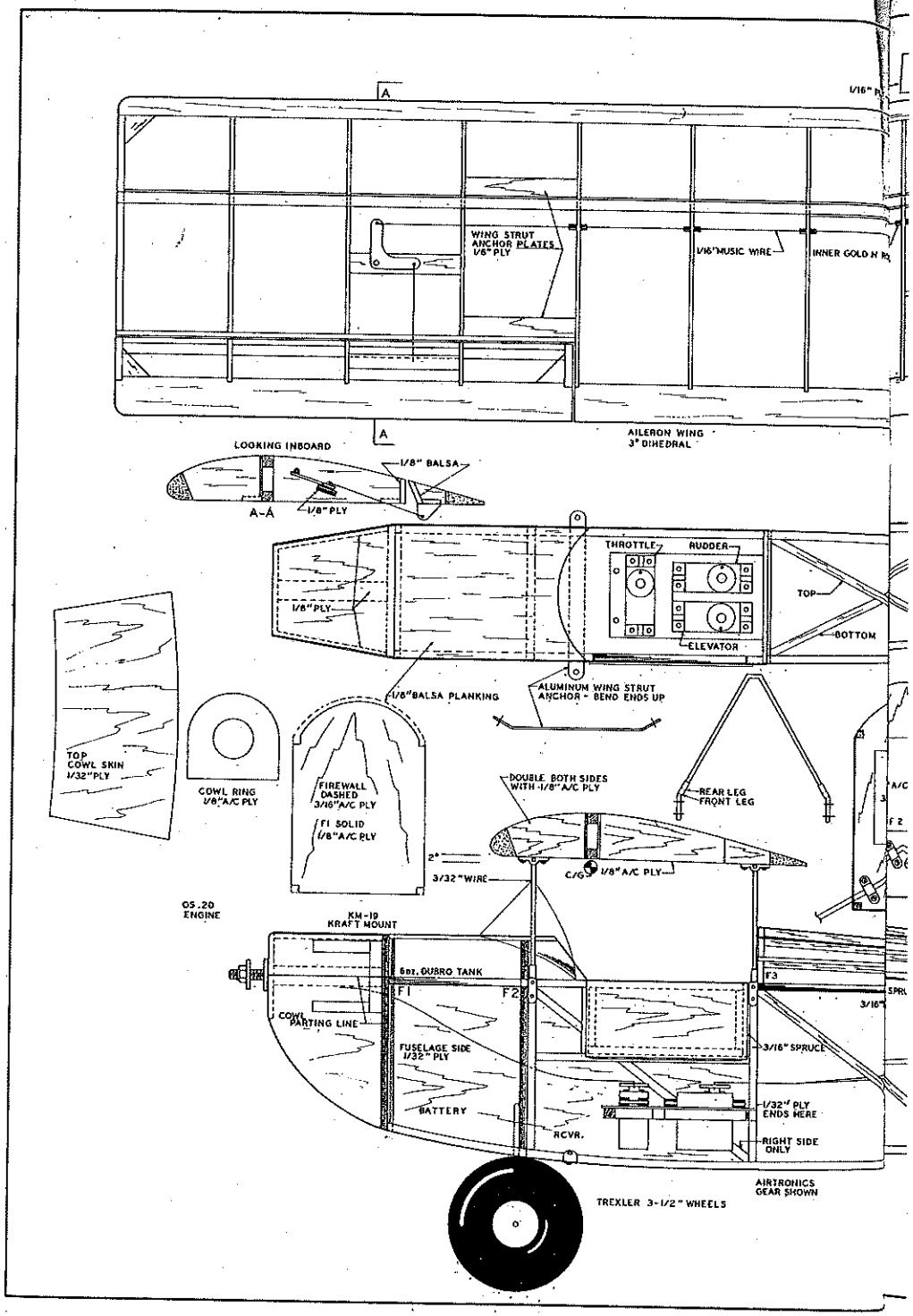
Fuselage. Cut the formers from ply as per the plans. The No. 1 former is ⅛-in aircraft ply. The second former, to which the landing gear is attached, is 1/16 aircraft ply, as are the firewalls. Bend the landing gear from ⅛-in. piano wire, and affix it to former No. 2 with four nylon landing gear clamps.

Cover the plans with wax paper, and construct the left side of the fuselage. The longerons are 1/16-sq. spruce, as is the frame for the cockpit door. Station No. 3 just aft of the cockpit is also spruce. All other vertical and diagonal members are 1/16-sq. balsa.

When the glue has completely set up, remove the pins and apply the 1/32 ply skin from the firewall aft to the former just behind the cockpit. Duplicate this for the right side (except for the cockpit door), and please make sure you have a *left* and *right* for the fuselage.

Drill holes in the 1/32 ply skin for the landing gear. Slide each side over the landing gear wires until they are flush against former No. 2. Add glue, then erect upside down over the top view of the plans. Pin in place, making sure everything is vertical. Quickly, add former No. 1; glue and tape it in place. Allow the glue to dry thoroughly.

Add the two cross braces at station No. 3. The bottom one is in line with the vertical components. The top one is its own width to the rear of station No. 3. This will allow the cabane strut to fasten directly to the side of the fuselage at station No. 3 and be braced at the rear by the first turtledeck former. Bend the two sides together at the tail end.



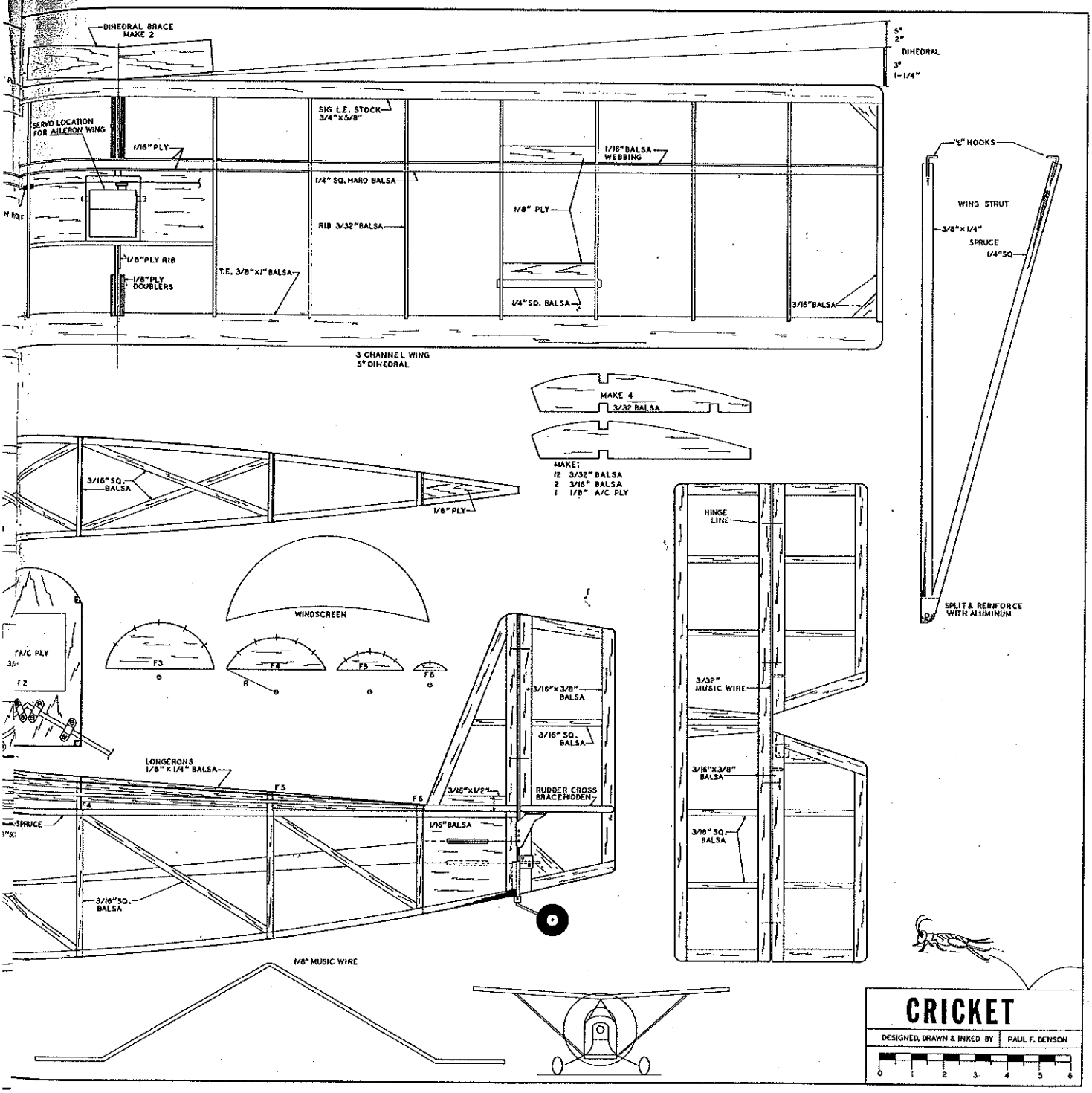
Taper the wood and glue together.

Install all top and bottom cross braces, then all diagonals. Cut the turtledeck formers from ⅛-in. medium balsa. Transfer the location marks for the longerons to the edges of the balsa formers. Glue the formers in place. When the glue is thoroughly dry, check the location marks with a straightedge. If each former does not touch the straightedge, a little sanding will have to be done.

If all the notch lines are in a straight line, cut the notches. Slip the longerons into place, checking for straightness by eye; glue in place. At the rear end of the turtledeck, some of the longerons will have to be notched on the bottom side so they will fair into place. The fillers between the longerons of the turtledeck are individually cut and fitted pieces of ⅛-in. soft balsa.

Build a platform of ⅛-in. sheet balsa between formers No. 1 and No. 2 upon which the tank will rest. Put the tank in position, then run the silicone tubing to extend about 4 in. beyond former No. 1. The holes for the tubing must be above and to each side of the engine mount. When you are sure of the tank location, check to see if it can be removed through the cutout in former No. 2.

If everything is OK, pad the tank with foam, then plank the cowl in front of the cockpit. We used ⅜-in.-wide strips of ⅛-in. sheet balsa for the planking. Start at the



spruce longerons and work to top center from each side; the center strip is fitted last. If it makes you feel better, the cowl can be rough-sanded now, but hold off final sanding until the cowl, etc., are in position so everything is faired together.

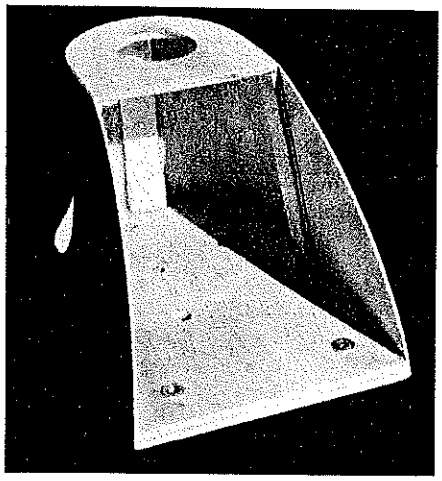
It's time to build the separate firewall for mounting the engine and building the cowl around it. Attach the engine and mount to the firewall with 4-40 machine screws and blind mounting nuts. As soon as the blind nuts are set in the back of the firewall, reverse the screws so they stick out the back side about 1/32 in., then locate the firewall against former No. 1. Make sure they are in register, then squeeze them together; the machine screws will leave indentations in the face of former No. 1.

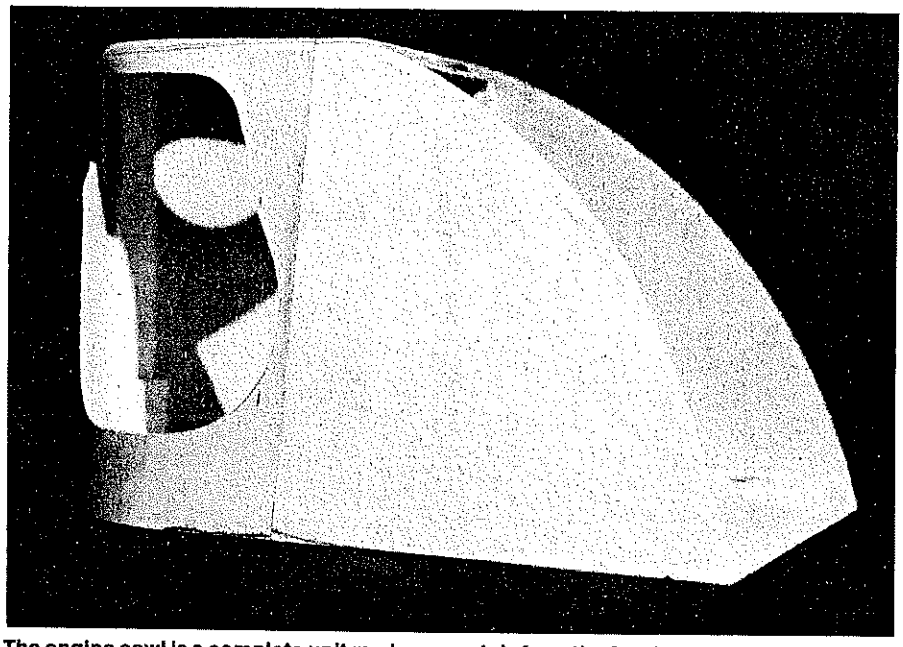
Enlarge these indentations to about 3/8 in. diameter and 1/16 in. deep. A Dremel cutter does a fine job of this. These indentations will receive the blind nuts so the two surfaces will fit together flat. Put the two surfaces back in register, and check to see that the firewall is 1/32 in. smaller all around than former No. 1. While the two surfaces are together, drill the holes in the firewall for the fuel tubing. Also drill four holes for the blind nuts and screws which will hold the two surfaces in contact. Put the blind nuts on the rear side of the No. 1 former through the bottom. Add the bottom skin from former No. 1 aft to station No. 3.

Build the cowl ring from 1/8-in. aircraft plywood, then fasten your choice of engine to the engine mount. Screw down the mount tight to the firewall. Cut two pieces of 1/8-in. Lite Ply 1/2 in. wide and about 3 in. long. Place the firewall on your workbench, and erect these strips at the top curve and at the flat bottom in such a manner that they will support the cowl ring. The prop drive washer should stick out through the hole in the cowl ring about 1/8 to 5/32 in. When everything is level and square, epoxy the cowl ring and supports in place.

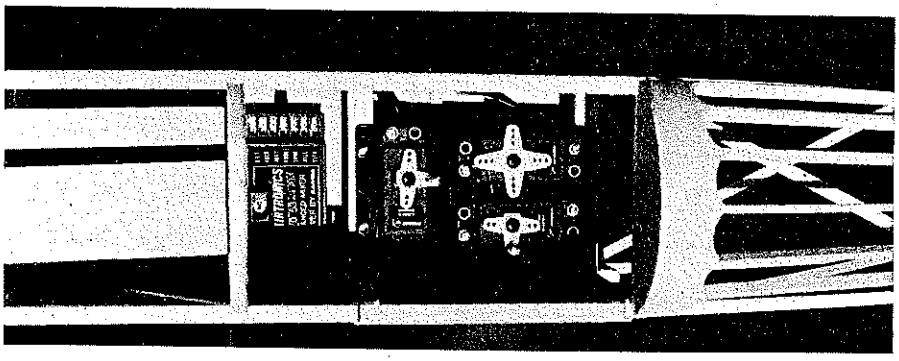
When the epoxy has hardened, erect two more support strips on each side, making sure they are equally spaced on each side of the cowl parting line. Once these two are set up, the one attached to the bottom edge of

the cowl ring should be removed for ease of engine installation and removal. Take off the engine's prop washer and needle valve while building the model. The engine is going to be in and out a great number of times, so make it easy on yourself. As the engine becomes more and more closed in, we discovered that it has to be removed from the engine mount and reinstalled many times; have patience.

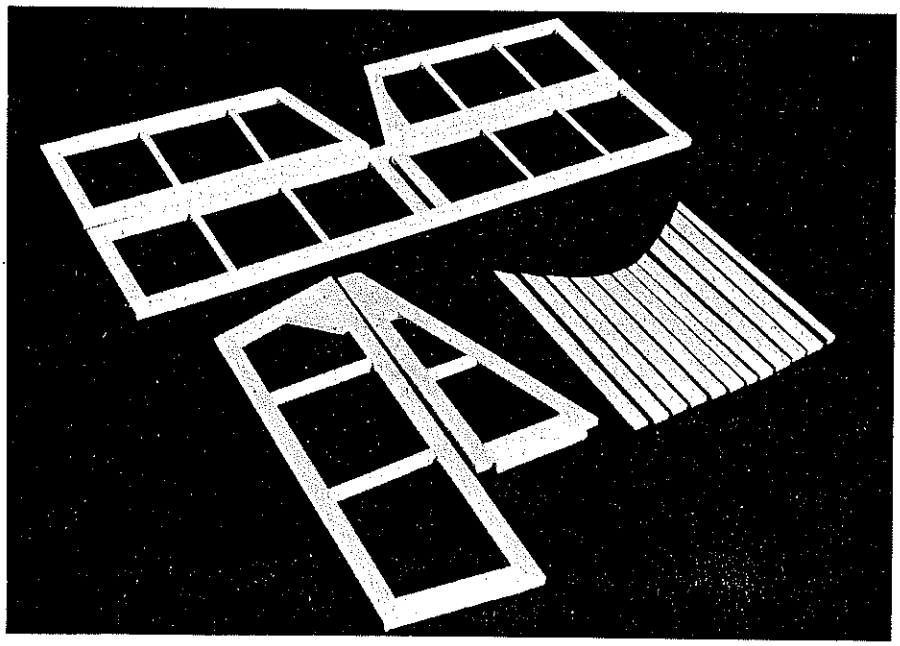




The engine cowl is a complete unit made separately from the fuselage. It is attached to the firewall with four Allen-head machine screws and blind mounting nuts. The cowl exterior is 1/32 aircraft plywood assembled in three pieces. Doublers back up the ply at the parting lines. The cutout in the side should be made to match your particular choice of engine.



The radio compartment size is more than adequate for the flight gear. The battery is placed beneath the receiver. The slot in the tank compartment floor is for the throttle pushrod as it passes through on the way to the engine. The filler between the stringers of the rear deck are shaped with sandpaper wrapped around wooden dowels of various diameters.



Note the extension on the bottom of the vertical fin (this does not show on the plans). The leading edge of the stabilizer was rounded, and the elevators were taper-sanded from the LE to TE. All the front deck pieces were cut from 1/8 x 1/2-in. balsa, each piece beveled. Build from the bottom up on each side, adding the center piece last. Sand to a round shape.

We beveled the cowl ring and the firewall with a sanding block so that the cowl covering (1/32 aircraft plywood) would glue flush to both. Cut a piece of heavy paper to the pattern on the plans for the top cowl skin. Drape it over the top of the cowl to see if it fits with a small amount sticking out fore and aft. The sides of the paper should exactly split the side cowl ring support braces. Using this paper as a pattern, cut a piece of 1/32 aircraft ply to match. We soaked the ply in hot water for a few minutes, then formed it around the top of the cowl. When everything fits well, glue it in place. We used clamps and protector strips to fasten the edges of the cowl skin to the cowl ring supports. This contact must be absolutely flat so it will match the bottom pieces of the cowl skin.

Three more pieces or sets must be made: the cabane struts, wing struts, and under-fuselage strut anchor. This strut anchor is a 3/8-in. strip of aluminum long enough to stick out 1/2 in. on each side of the fuselage. Drill holes in the ends of the strip and a couple of holes under the fuselage through which the anchor screws pass to hold it in place.

The cabane struts are a little more difficult. Cut four pieces of 1/8-in brass tubing 1 1/8 in. long. Also cut four pieces of 5/64 brass tubing 5/8 in. long. The shorter pieces are doublers to strengthen the outer ends of the longer pieces. Slide them in flush, then place the tubing 3/4 in. deep in a vise and squeeze flat. Bend two pieces of 5/64 piano wire to the shapes given on the plans. The legs of the front cabane are the longest.

Place the squeezed-flat end of the brass tubing back into the vise. Insert a leg of the piano wire in the open end of the tubing, and bend it until the lambda (an upside down V) is vertical. Remove that fitting from the vise, and insert another. Put the other leg

into the open end and bend until the lambda is vertical. Do the same for the rear cabane. The wire is then cleaned with fine sandpaper and soldered into the pieces of brass tubing.

Drill two holes into each flattened end large enough to pass a 2-56 machine screw. Erect the two cabane struts above the cockpit. If you are careful, the 2-56 screws will pass through spruce; add a washer and nut, and pull up tight.

The wing struts are made from 1/16-in.-thick spruce strips that are 1/4 and 3/8 in. wide. In the bottom end, saw a slot with a fine saw. Insert a piece of sheet aluminum in this slot. File off the surplus around the edges, and epoxy in place. The outer ends are drilled for small L-shaped cup hooks (from your local hardware store). We cut short pieces of inner Gold-N-Rod and squeezed them on the outer end of the L-hook to bring the diameter up to 1/8 in. A hole is drilled into the lower end of the wing struts to match the hole in the under-fuselage anchor. A 2-56 machine screw with lock washer and nut holds them in position. The upper ends are inserted in landing gear clamps which are screwed to the anchor blocks in the outer portion of the wing.

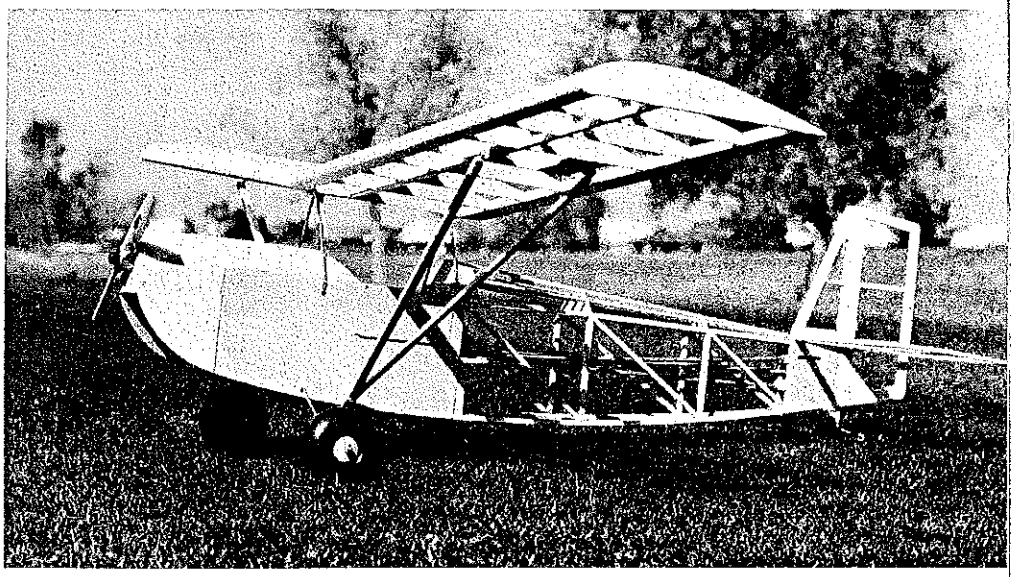
It is a good idea to fully assemble the skeleton plane at this point. It will make things easier when the covering is on. The screw holes will already be in place.

Note the location of the two landing gear clamps called out on the plans which are located on the underside of the wing. Drill holes in the bottom of the doubled 1/8-in. wing rib for these two clamps. Insert a screw into one of the holes, and tighten the clamp almost to the bottom of the wing rib. Do the same for the other one. Turn the wing upside down and turn the fuselage sideways across the wing. The clamps are looped over the sides of the cabane struts. Insert the second screws, and pull the clamps up tight. Since the clamps are for 1/8-in. wire, the 5/64 wire will slide through the clamp and turn the corner so the wing is sitting atop the cabanes. Turn everything over, and sit the plane on its landing gear.

Add the wing struts. Fasten them to the fuselage anchor, then tuck the L-hooks into the landing gear clamps you added to the anchors built into the outer portion of the wing.

Wing alignment. The two front struts will determine the dihedral. The two back struts will determine the washout. Sit the plane on your workbench without the wheels and with the tail propped up so the fuselage is level. Even if you were able to get the L-hooks in the landing gear clamps, undoubtedly there will be a difference in the distance from the workbench up to the wing tip on each side.

Measuring from the workbench up to the front corner of the wing tips, adjust by turning in or out the L-hooks so the distance is the same to each wing tip. We measured the distance at the leading edge and the trailing edge of the root rib. The difference in this measurement is taken to the wing tip where the trailing edge corner is that much lower than the leading edge corner. This will assure that there is no warp in the wing. Leave the wing flat until it is covered. At this time you will put in the washout. Then the rear wing spar will be lengthened to take this washout into consideration.



Only the covering remains to do. In the prototype's case it was white MonoKote with dark blue Trim MonoKote. Engine cowl was painted white to match. Windshield fabricating tip: Cut a 3/8-in. white strip from the top of an oleo or butter container. With RC 56 Wilhold glue, affix this strip over the bottom of the windshield. When dry, trim to shape. This strip will hold the windshield in a gentle curve. The author used three small pins to attach this combination on the forward deck and applied a drop of cyanoacrylate at each pin location.

Pin the tail surfaces into place and fit the pushrods from the servos to them. This way the elevator and rudder horns will be easier to locate when the tail assembly is covered.

Covering. If built for three channels without ailerons, washout in the wing is necessary. If the center section of the wing should stall, with washout the tips will still be lifting. When the wing stalls without washout, the whole wing stalls; a very dangerous maneuver called a tip stall will occur. This is disastrous if it happens while the plane is close to the ground (when landing, for example).

Washout is put in after the wing has been covered with the film of your choice. Do this by first putting a 1/2-in. block under the outboard trailing edge corner while holding the center of the wing flat on the workbench. This will cause diagonal wrinkles to form in the plastic material. Iron out these wrinkles, and shrink the covering to the wing. Hold the wing in this position until the covering cools. The bottom covering should be ironed flat without trying for a warp. The top covering will hold the washout in position. Final washout for this plane should be approximately 3/8 in.

There is no special covering advice for the tail surfaces. They are standard.

The fuselage is longer than the width of most plastic covering films. Cover it in pieces. First, cover the turtledeck on top of the fuselage. Cover the cowl with what you cut off from this piece. Cover the bottom with two pieces. Start at the end of the ply skin, overlap 3/16 in., and cover to the tail. Come back with another piece and cover

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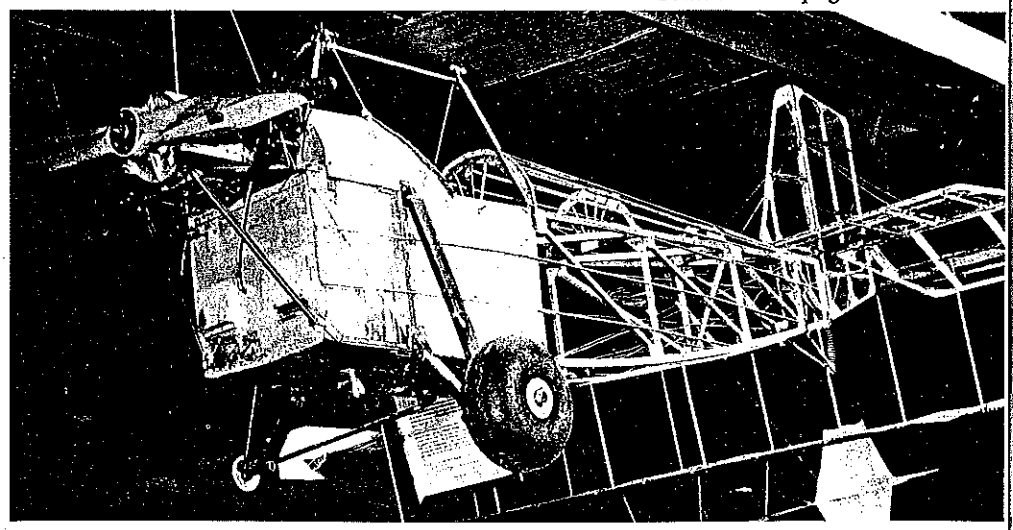

This is the Model B Fike of 1936 with Long-Harlequin engine that provided inspiration for the Cricket model. It's easy to see the similarities. Picture was taken in the old EAA Museum.

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Cricket/Denson

Continued from page 107

the bottom forward. The sides are done exactly the same way. Allow the covering to bend around the front of former No. 1 about ⅛ in., and seal it there. Coat the whole front of the former with epoxy.

The cowl of our Cricket was painted with white enamel. We gave it two coats of primer, then two coats of gloss white. Finally, we applied one coat of clear.

Don't forget the back of the firewall. It needs fuel-proofing just as much as the rest of the plane. While you are at it, paint the struts, rear ends of the pushrods, landing gear, cabane struts, and hubs of your Trexler wheels. We painted the inside of the cockpit with two coats of flat black paint.

Should you decide to include the cockpit hatch, it will go a long way toward dressing up your plane. The hatch cover overlaps ⅛ in. on each side and is flush at the top. It is cut from 1/32 aircraft plywood. The frame on the inside is made of ¼-in.-sq. balsa which will make it flush with the inside of the fuselage. We found a length of 1/16 O.D. copper tubing at our hobby shop through which we ran a piece of music wire. We

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bent the wire at right angles where it comes out of the tubing, then clipped the wire to leave about ½ in. on each end. We epoxied the copper tubing to the bottom edge of the hatch cover and punched holes through the skin into the 3/16-sq. spruce hatch frames. The ½-in. ends of the wire were inserted into these holes. The tubing rotates on the wire and acts as a hinge. We made hatch locks from small scraps of plastic and small machine screws.

At first we planned to use 3-in. Trexler wheels. When the plane was finished, assembled, and placed on the workbench with the 3-in. wheels, they just didn't look right. We took the wheels back and traded them for 3½-in. wheels. The larger wheels seemed "to push the right buttons," but we can see no reason why the smaller wheels will not work as well.

The windscreen was made from clear plastic, the lower edge of which was bonded to a ⅜-in. strip of white plastic. The whole thing was bent to shape and pinned in place with ½-in. straight pins. A drop of CyA was put on each pin to lock it in place.

We covered the prototype Cricket with white MonoKote and trimmed it in dark blue Trim MonoKote. Paints were Krylon undercoat, gloss white, and clear.

The Airtronics Championship Series CS7P flight pack we used fitted in the bottom of the cockpit with plenty of room to spare. The battery went under the tank. The antenna was routed down through the fuselage inside a long piece of plastic tubing that originally was on a roll-up window shade. It exits through the tail just in front of the rudder.

Flying. The Cricket balanced exactly at the center of gravity (CG) shown on the plans; no weights were necessary. Power is by an O.S. .20; we wouldn't recommend anything smaller. The new O.S. .20 FP would be great, as would the O.S. .20 four-cycle. We have flown our .20 four-cycle in comparable planes and have no doubt whatsoever that it can handle the Cricket.

We took the Cricket to a nearby air base where we were allowed to use a large concrete tie-down area as our runway. It was thought that a runway with a very smooth surface would be best for the first flight with the soft Trexler wheels. We were not disappointed. The plane putt-putted down that concrete strip just as proud as could be and almost jumped into the air as if that was where it belonged.

There were no idiosyncrasies in any way—just a smooth, even flight. We have done a loop, split-S, Immelmann, and even a great big barrel roll (it takes a great big barrel to do a roll without ailerons). Do your rolls with quite a bit of altitude because the plane almost always winds up pointing at the ground when the rolls are finished.

Those big, soft wheels make the sloppiest landing look fantastic. All in all, we are extremely proud of our Cricket. We hope, should you build one, that you will have all the fun we have enjoyed.