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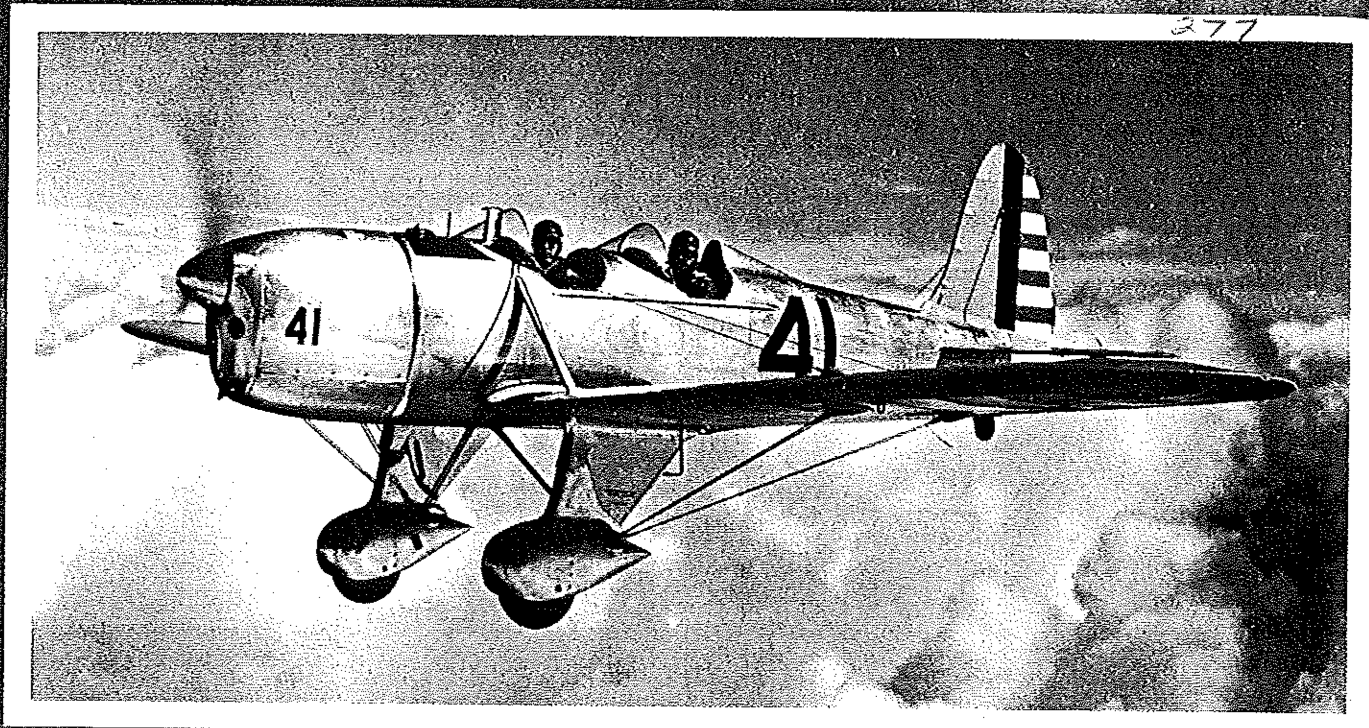
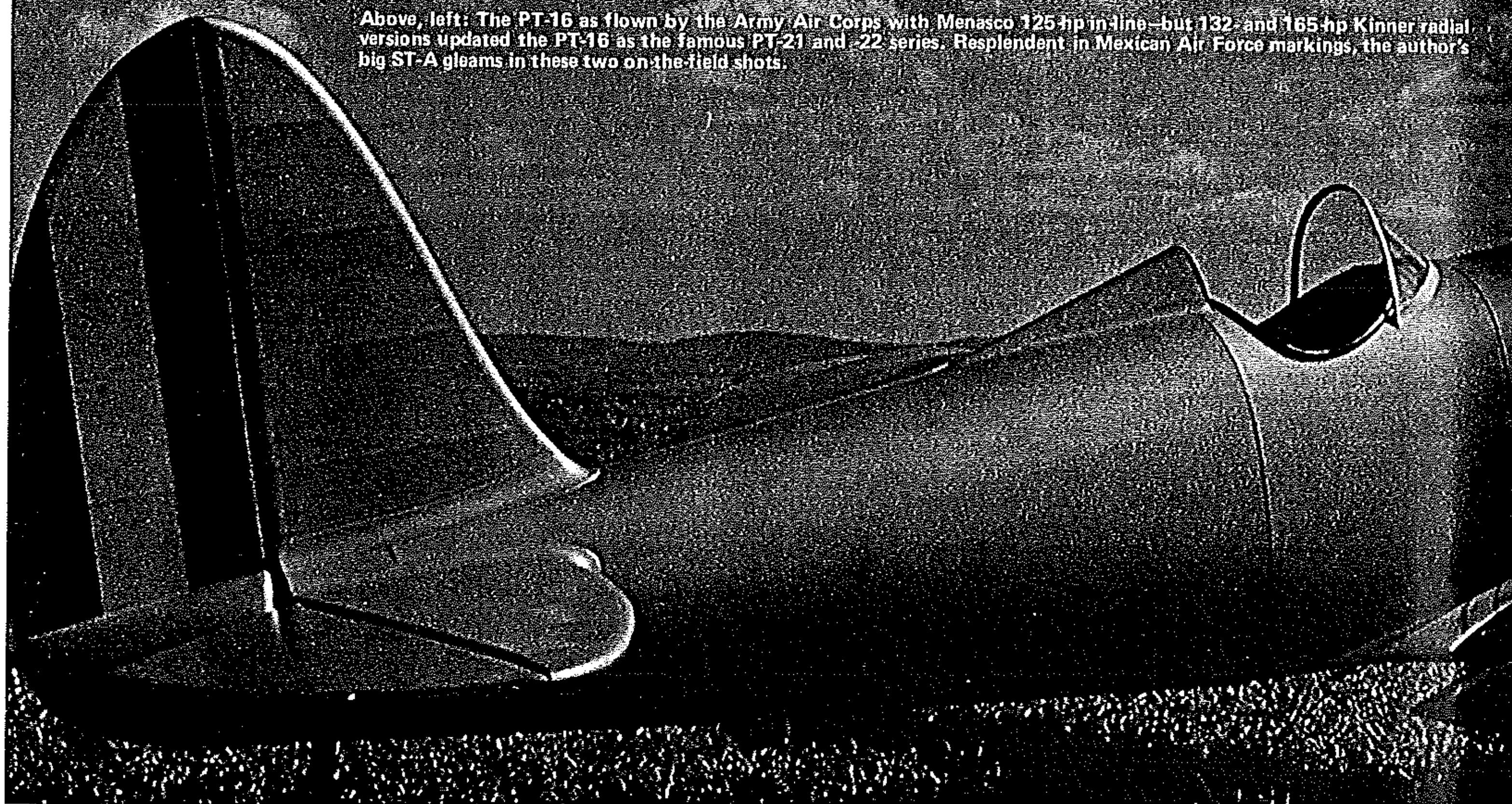


Above, left: The PT-16 as flown by the Army Air Corps with Menasco 125 hp in-line—but 132- and 165-hp Kinner radial versions updated the PT-16 as the famous PT-21 and -22 series. Resplendent in Mexican Air Force markings, the author's big ST-A gleams in these two on-the-field shots.



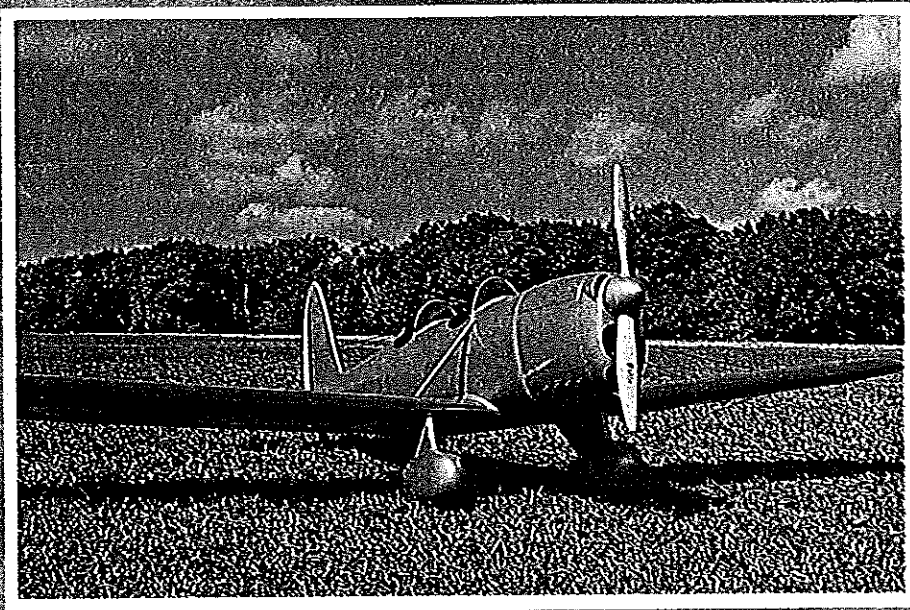
The RYAN

For those that like 'em big, a dream model of a dream airplane—the Air Force's
For the Du-Bro Prop Drive, it is a project for advanced builders only but its docile

IN 1933, T. Claude Ryan formed the second airplane company bearing his name, in San Diego, in order to design and produce a new sport and trainer type aircraft. On June 8, 1934, the Ryan ST (Sport Trainer) first flew, and in remarkably short time (on 6-29-34) received ATC number 541.

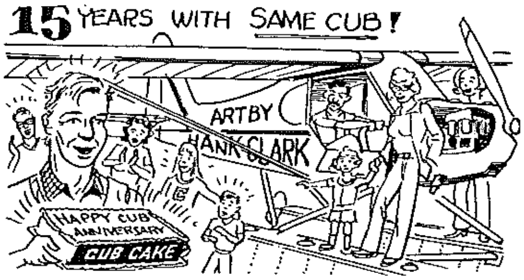
The Ryan ST was a slender, wire-braced monoplane using the Menasco B-4 95 hp engine. Fuselage construction was a monocoque structure built up of rather heavy gauge sheet aluminum. The two open cockpits were small and chummy, but well-protected by large, curved windshields. The wing had wood spars and metal ribs and was fabric covered. It was wire braced to the fuselage and landing gear structure. As a trainer, performance was considered "hot" so that flaps extending to one half the wing span were employed to reduce landing speeds.

In 1935, Ryan brought the more powerful ST-A "Super Sport" using the Menasco C-4 of 125 hp. Tex Rankin, a

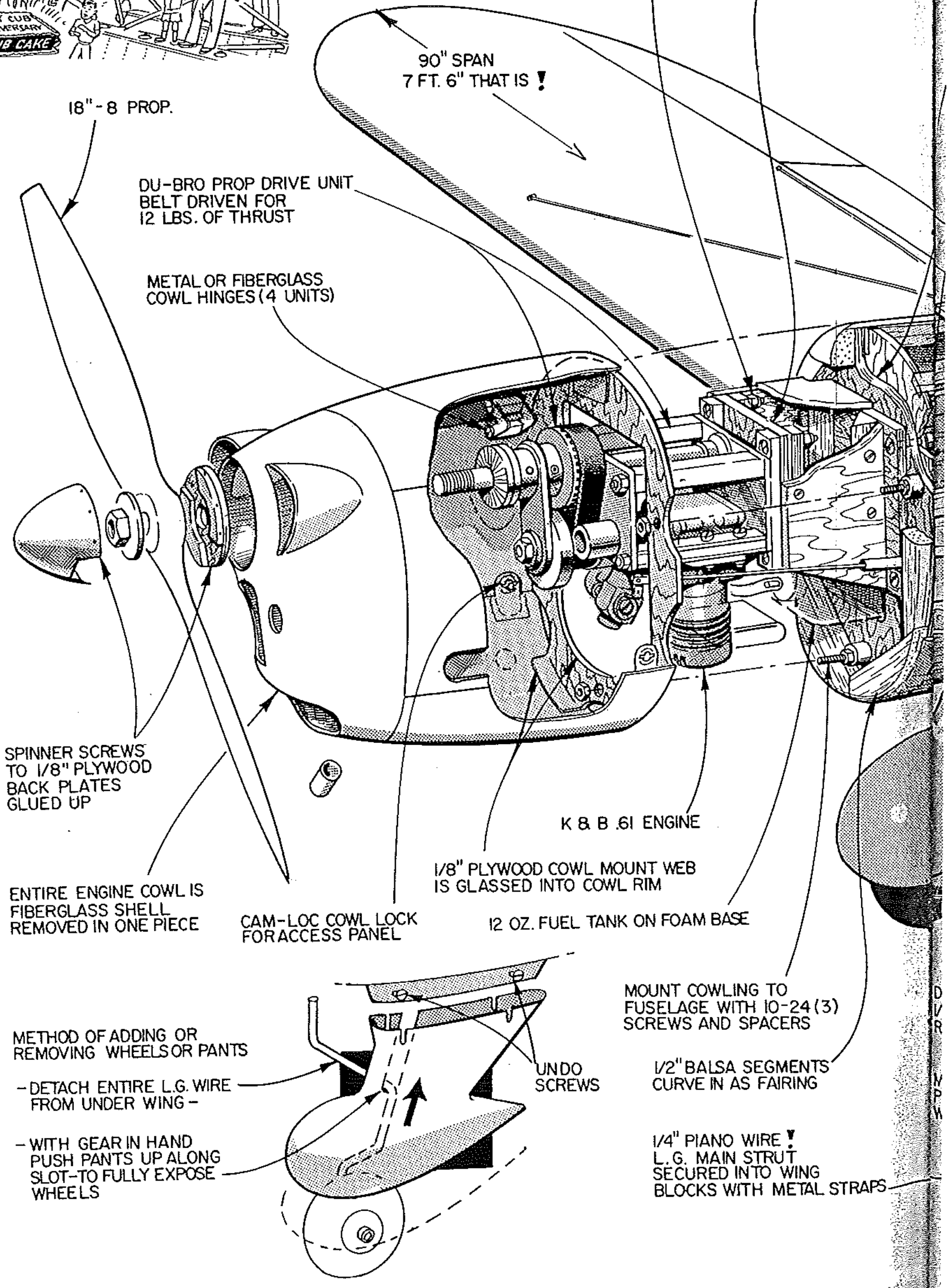


ST-A

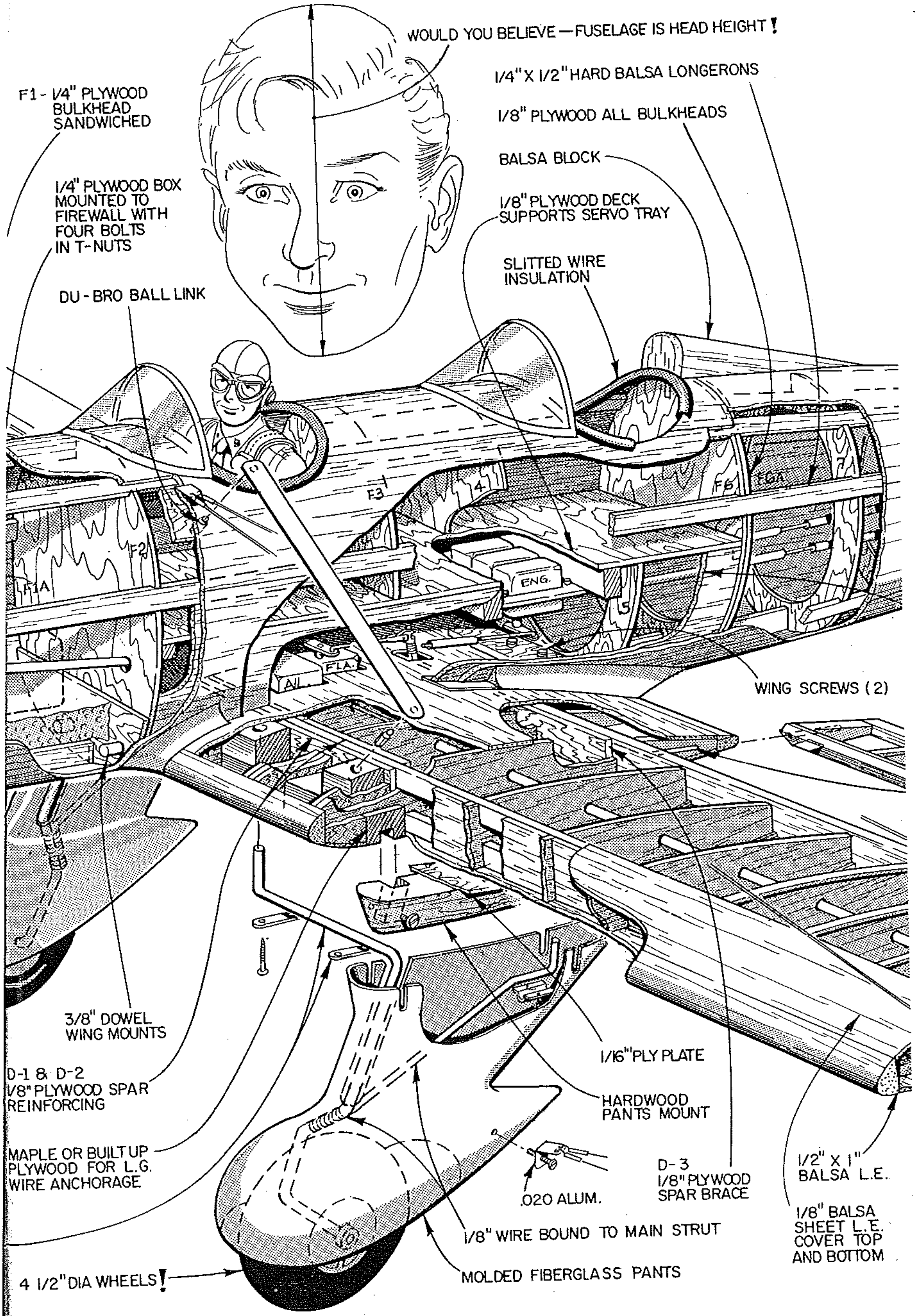
PT-16 trainer and winner of the International Aerobatic Championship in 1937. flight is equivalent to that of a pattern trainer. ■ Hank Farrell



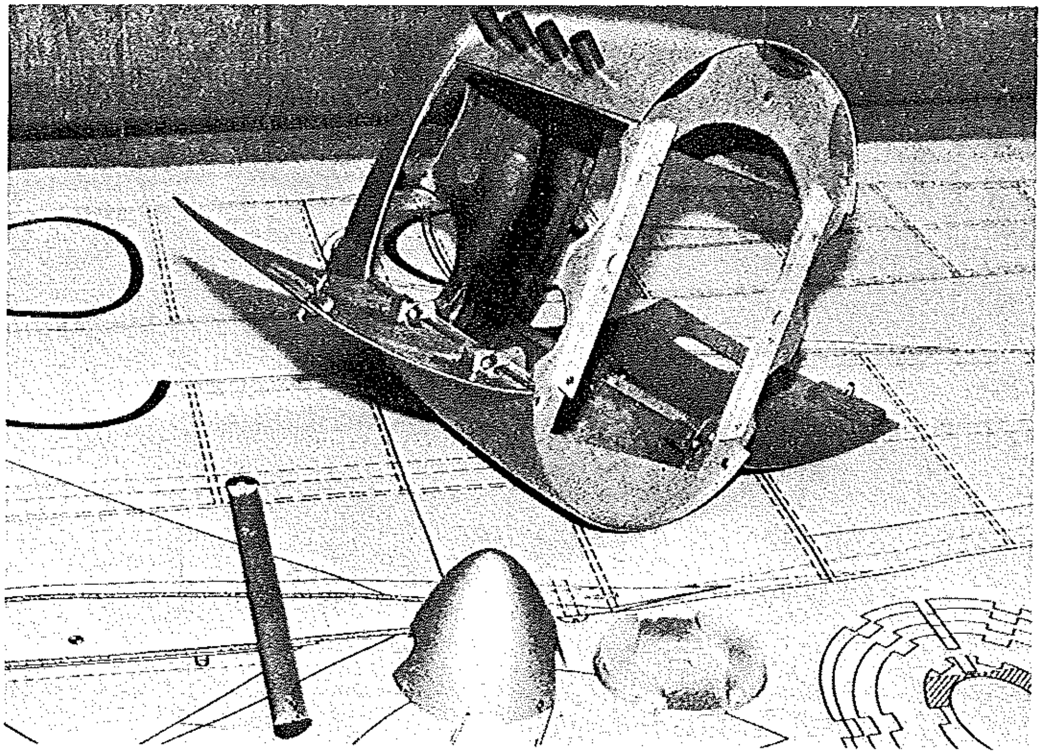
15 YEARS WITH SAME CUB!
ART BY HANK CLARK
HAPPY CUB ANNIVERSARY
CUB CAKE



DRIVE UNIT BOLTS (4) THROUGH 1/4 PLY BOX
1/4" PLYWOOD BOX SUPPORTS ENGINE DRIVE UNIT
90" SPAN 7 FT. 6" THAT IS!
18"-8 PROP.
DU-BRO PROP DRIVE UNIT BELT DRIVEN FOR 12 LBS. OF THRUST
METAL OR FIBERGLASS COWL HINGES (4 UNITS)
SPINNER SCREWS TO 1/8" PLYWOOD BACK PLATES GLUED UP
K & B .61 ENGINE
1/8" PLYWOOD COWL MOUNT WEB IS GLASSED INTO COWL RIM
ENTIRE ENGINE COWL IS FIBERGLASS SHELL REMOVED IN ONE PIECE
CAM-LOC COWL LOCK FOR ACCESS PANEL
12 OZ. FUEL TANK ON FOAM BASE
MOUNT COWLING TO FUSELAGE WITH 10-24 (3) SCREWS AND SPACERS
METHOD OF ADDING OR REMOVING WHEELS OR PANTS
- DETACH ENTIRE L.G. WIRE FROM UNDER WING -
- WITH GEAR IN HAND PUSH PANTS UP ALONG SLOT-TO FULLY EXPOSE WHEELS
UNDO SCREWS
1/2" BALSA SEGMENTS CURVE IN AS FAIRING
1/4" PIANO WIRE! L.G. MAIN STRUT SECURED INTO WING BLOCKS WITH METAL STRAPS



CUT-AWAY DRAWING CONTINUED ON PAGE 15.



The glass cowl fits the Du-Bro Prop Drive like a glove. Large access doors have throw-out hinges; right-hand door provides access to needle valve and fuel line, locks in place with a Camloc.Cowl attaches to fuselage with three 10-24 bolts which project from the firewall.

well-known aerobatic pilot, set a light plane altitude record of 19,800 ft. Then, in May of 1937, at St. Louis, Rankin won the International Aerobatic Championship in a stock Ryan ST-A against a field of especially built foreign and U.S. aerobatic aircraft.

The ST-A was sold to several foreign countries as military trainers as the ST-M, and in this country it became the PT-16. Slightly improved models with larger cockpits, which were also moved closer together, were supplied as the PT-20. The Menasco's were unsuited for military training so a revised design using the 132-hp Kinner, or 165-hp Kinner, radial engines became the famous PT-21 and PT-22 series used to train thousands of pilots for World War 2.

The model was designed to use the Du-Bro Prop Drive Unit which fits the fiberglass cowl like a glove. If you are interested in the Ryan ST-A and would prefer to use a Quadra or other converted chain saw engine, then I would recommend building one of the radial engine series. This would simplify construction since none of the fiberglass parts used on the model would be needed. However, in my opinion, some of the beauty of the ST-A would be lost.

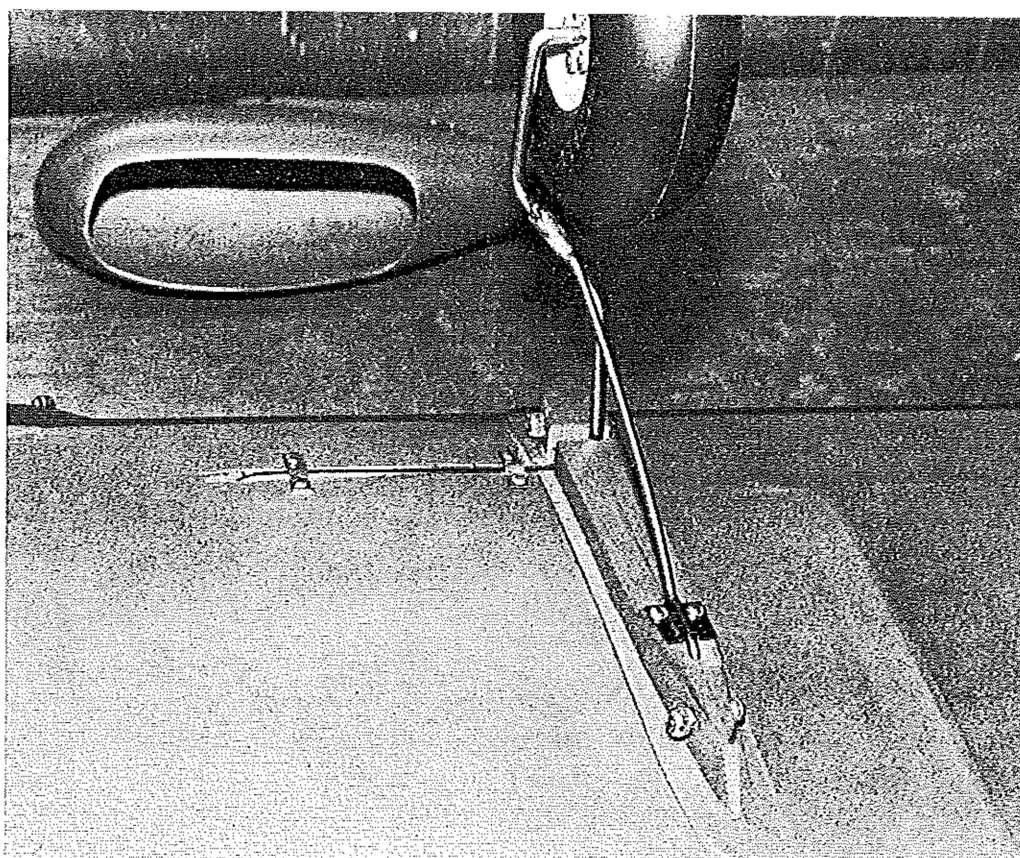
My Prop Drive Unit has been fitted with a K&B 61. This has proven to be a highly reliable, easy to start combination, with just the right power for realistic flight. Best performance has come from an 18-8 prop, which is very close to scale. Note the use of a cradle to hold the plane inverted for starting.

The model is true to scale in all areas except the landing gear. The landing gear was made 1 ½ inches short in order to improve ground handling, and to reduce any tendency for ground looping. Wing span is 90"; length 65"; wing area 1160 sq. in. All-up weight is only 15 pounds, including 5 oz. of lead located in the tail cone.

Because of its size, fuselage shape, and the large number of parts required, the Ryan will present more of a challenge than a scratch-built pattern plane. Only a reasonably experienced modeler, one who is willing to face up to a variety of problems during building, should attempt a model of this complexity. On the other hand, flying the Ryan is a completely different story. It is a very easy (gentle may be a better way of putting it) plane to fly. Anyone who can handle a pattern trainer would have no difficulty at all flying the Ryan.

When you study the plans you will see that a lot of balsa wood has been used. It is common practice with most quarter scale builders to make substitutions for this noble and precious material. Let me make a few comments.

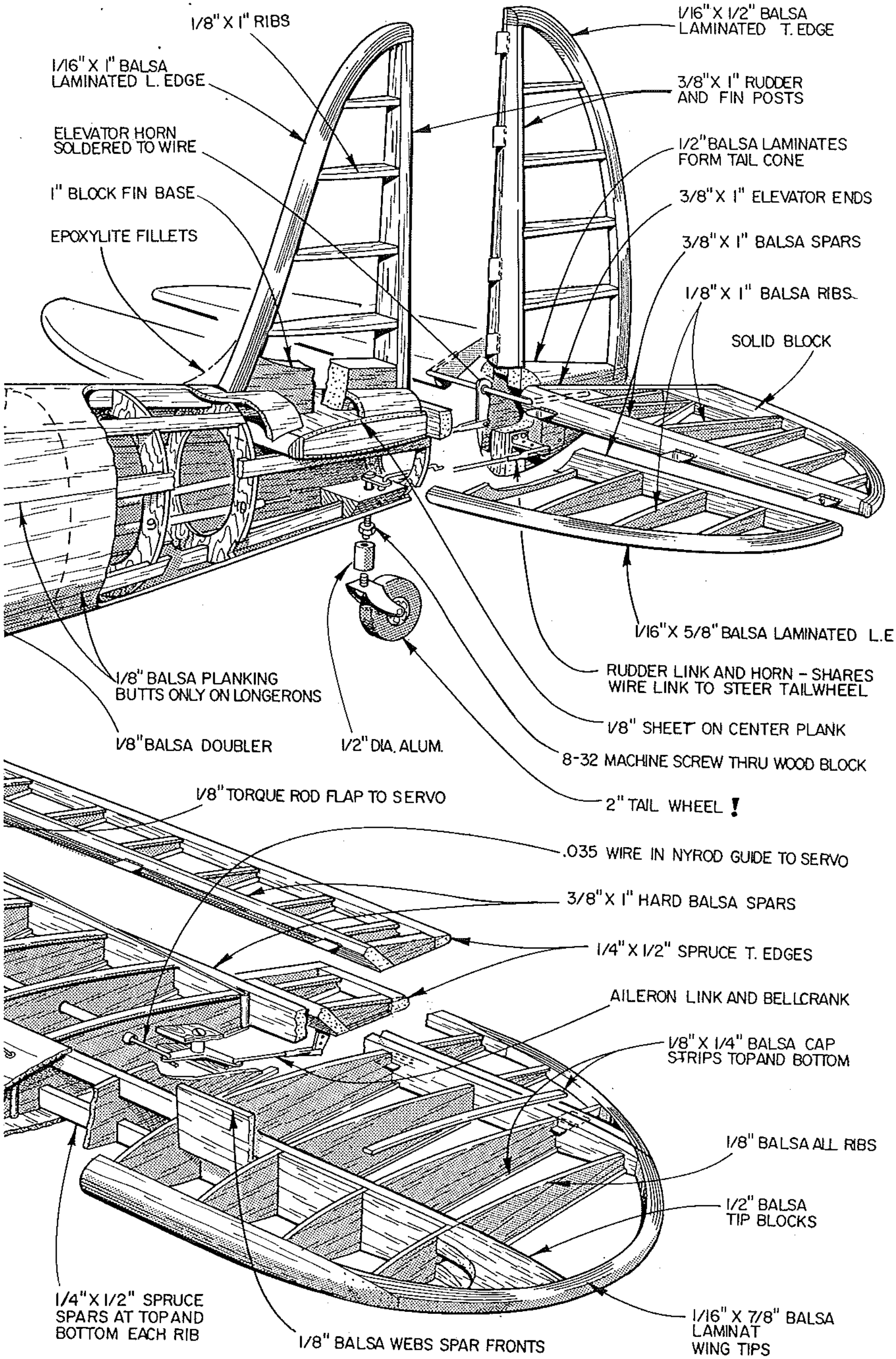
First, what do you think about replacing the 1/8 balsa used to sheet the fuselage with 1/32 ply? In this way the scale seams could be duplicated, rather than simulated, as I have done. A layer of light-weight fiberglass cloth and resin over the ply would make the perfect base for a simulated polished aluminum surface. Second, 1/32 ply might be substituted for the wing leading edge sheets. Ribs could be made from Foamcore and capped with 1/32 ply. In this way 99% of the balsa used would be eliminated. What, if any weight penalty may occur, I can't answer. Also, whether or not formers, longerons, and wing ribs would show through the ply skin is another question that would have to be answered. In any event these are things I may consider the next time around.



The landing gear is the single feature that has held back many tempted to build a remarkably beautiful and well-proportioned airplane. As you see here, designer has engineered simple arrangement, detachable in normal manner, without complicated attachment of pants and struts.

Fuselage: Start by tracing all the formers on appropriate size plywood. Note that all the formers from F3 to F11, and the fuselage deck, are made from Lite Ply. I made the F1A from 3/16 ply but this could be 1/4 ply, just as well. Cut out the area for the fuel tank and drill the three cowl mounting holes in F1 and F1A. If you plan to use the Prop Drive Unit, a ply box is used to mount the unit to the firewall. Parts for this mount can be cut out along with the formers. Note the use of additional members on the inside corners of the Prop Drive Mount. These are made from a hardwood and epoxy-glued in place. When assembling this mount, use plenty of glue and add screws for additional strength. The fuselage top view shows two of the four bolts used to attach the Prop Drive Mount to the firewall. Blind nuts are mounted in the firewall for this purpose. Sometime, during the latter stages of construction, the mount should be epoxy-glued, as well as bolted, to the firewall.

Eight longerons are used to form the basic fuselage structure. The top and bottom longerons form the fuselage keel and are made up in two

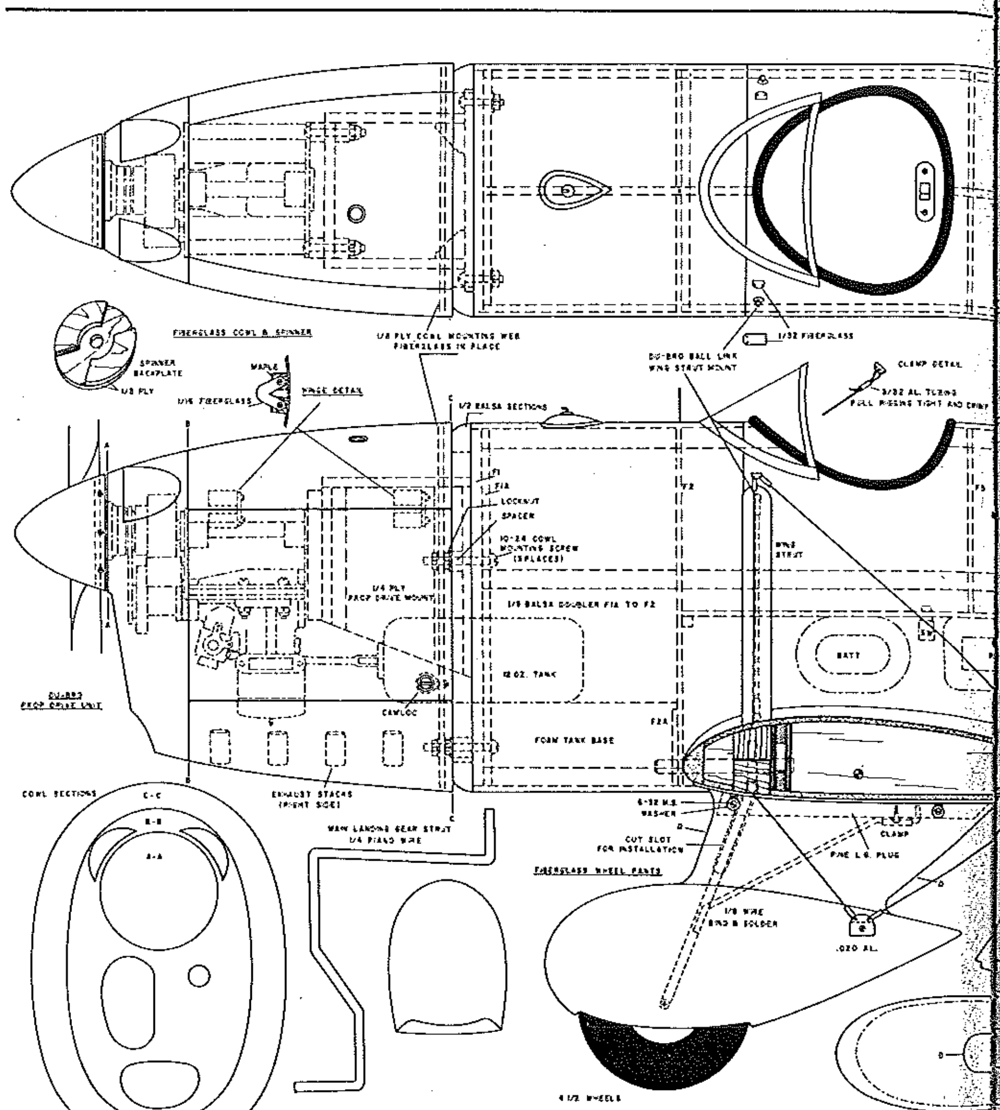

1/8" X 1" RIBS
1/16" X 1" BALSA
LAMINATED L. EDGE
ELEVATOR HORN
SOLDERED TO WIRE
1" BLOCK FIN BASE
EPOXYLITE FILLETS
1/16" X 1/2" BALSA
LAMINATED T. EDGE
3/8" X 1" RUDDER
AND FIN POSTS
1/2" BALSA LAMINATES
FORM TAIL CONE
3/8" X 1" ELEVATOR ENDS
3/8" X 1" BALSA SPARS
1/8" X 1" BALSA RIBS
SOLID BLOCK
1/16" X 5/8" BALSA LAMINATED L.E
RUDDER LINK AND HORN - SHARES
WIRE LINK TO STEER TAILWHEEL
1/8" SHEET ON CENTER PLANK
8-32 MACHINE SCREW THRU WOOD BLOCK
2" TAIL WHEEL !
1/8" BALSA PLANKING
BUTTS ONLY ON LONGERONS
1/8" BALSA DOUBLER
1/2" DIA. ALUM.
1/8" TORQUE ROD FLAP TO SERVO
.035 WIRE IN NYROD GUIDE TO SERVO
3/8" X 1" HARD BALSA SPARS
1/4" X 1/2" SPRUCE T. EDGES
AILERON LINK AND BELLCRANK
1/8" X 1/4" BALSA CAP
STRIPS TOP AND BOTTOM
1/8" BALSA ALL RIBS
1/2" BALSA
TIP BLOCKS
1/4" X 1/2" SPRUCE
SPARS AT TOP AND
BOTTOM EACH RIB
1/8" BALSA WEBS SPAR FRONTS
1/16" X 7/8" BALSA
LAMINAT
WING TIPS

parts directly over the plans. Continue the forward sections right through the cockpit and wing areas as they will be cut away after the sheeting has been applied. The structure is started by glueing all the formers to the two keels. Next, glue the two side longerons in place, and follow up with the remaining longerons by working on both sides simultaneously to prevent distorting the structure. When installing the longerons, make sure they are not recessed below the outline of the formers. They should extend above the notch and then be sanded so that the contour at each former can be made smooth and continuous. Any flat sections left in the longerons may end up being visable after sheeting.

The 1/8 ply deck is installed at this time. It is made the full width of the formers and runs, as indicated, between F2 and F6. The 1/8 balsa doublers are installed next. They consist mainly of small rectangular sections installed between the formers and longerons. The entire section between F1A and F2 receives doublers; the sections between F2 and F6 have doublers installed below the deck only.

The fuselage is sheeted in two sections. The first sections runs between F1 and F6; the second runs from F6A to F11. Use the 4-in.-wide sheets and butt-join over the middle of the longerons. Start with the forward top section and then alternately add sheeting to each side from the top down. The top sheet extends across the top keel and meets the sides at the first two longerons located on either side of the keel. Follow the same procedure when sheeting the rear section. After the sheeting is completed, sand flush any overlapping balsa at F1 and F11. Next, add 1/2 × 3/4" balsa sections around the periphery of F1 and round off as shown on the plans.

At this time, protect the fuselage from dents and nicks by applying light-weight fiberglass cloth and resin to the surface. Since the entire surface can be covered in one operation, I made a jig to hold the fuselage. This jig, which held the fuselage off the workbench, and permitted rotation, was made in the form of two bookends. A 1/4–20 bolt, wing nuts and a few small pieces of wood were used to attach the jig to the fuselage at F1 and F11. Just about everything done with the fuselage hereafter is aided by the use of the jig.

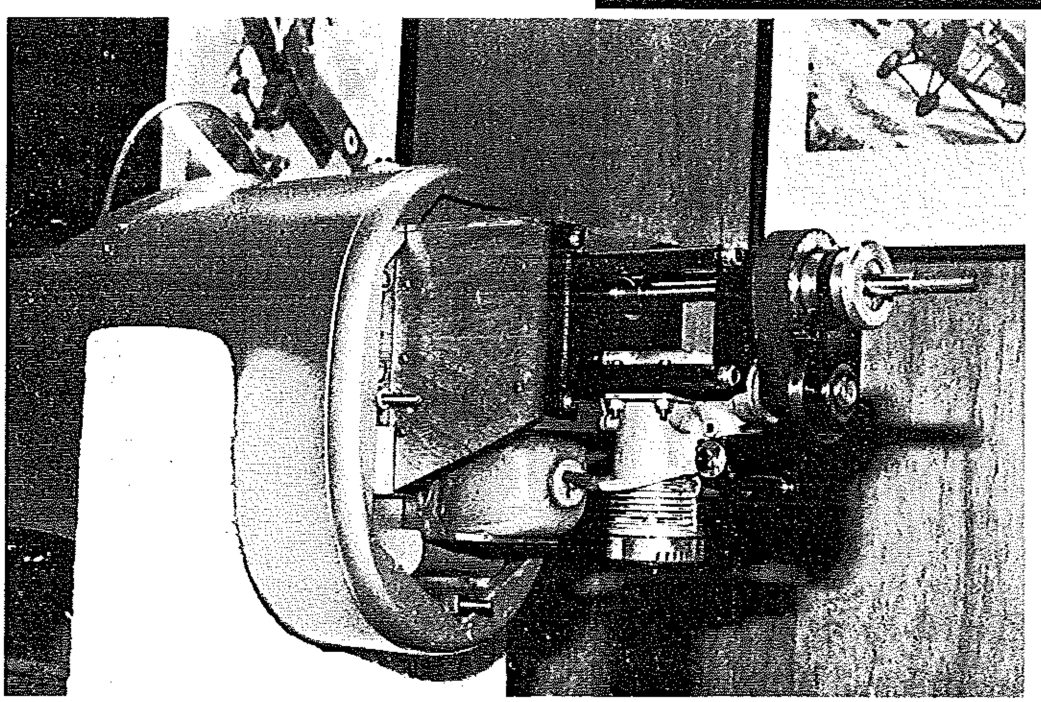


FULL SIZE PLANS AVAILABLE . . SEE PAGE 128

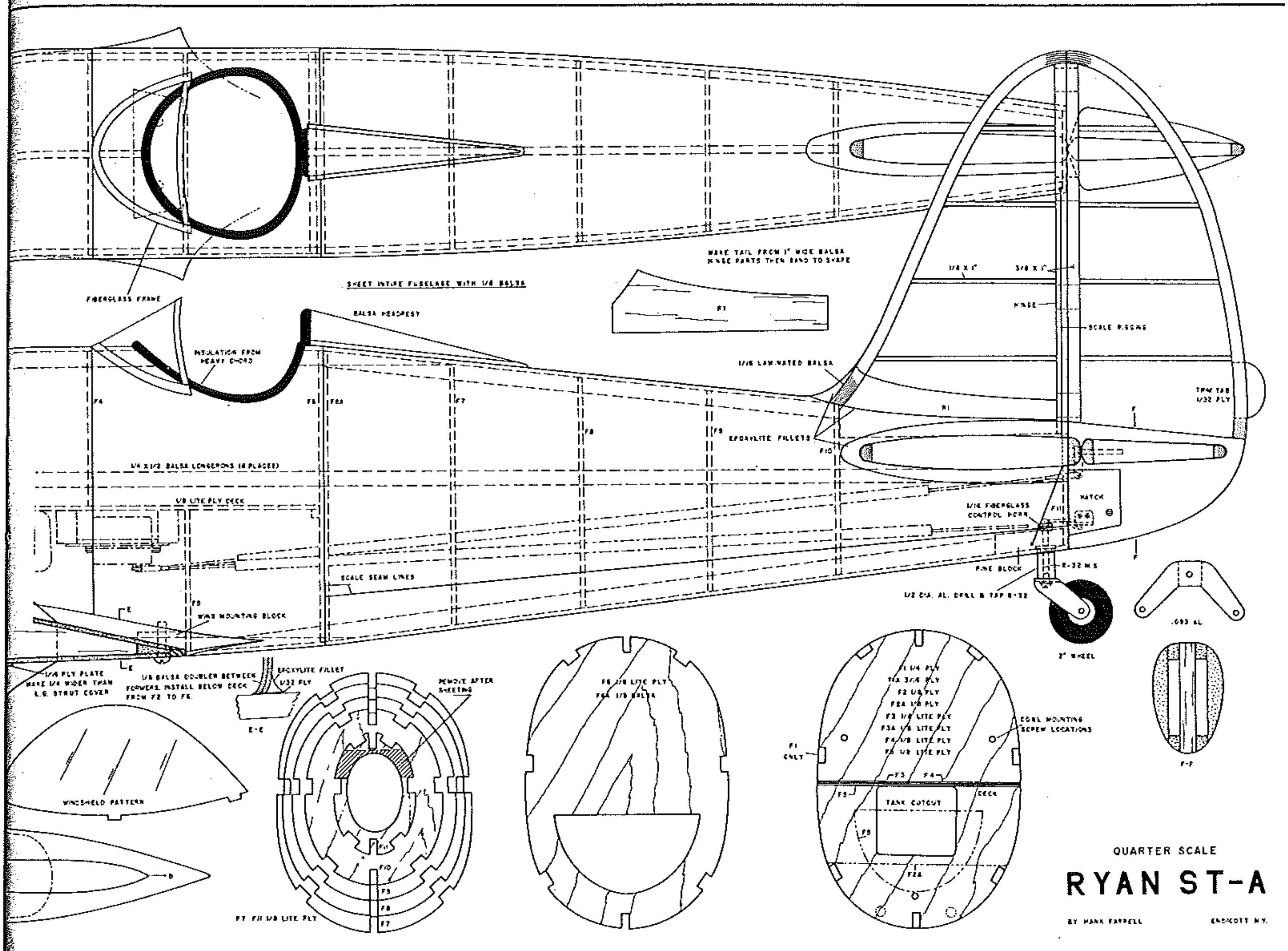
One exception to this is the tail-wheel assembly. Shape a wood block to the inside contour of the lower fuselage tail section and epoxy in place. This block must take up all the stress of the tail wheel when bouncing across the runway during takeoffs and landings. Make up a 1/16 × 3/4 long fiberglass control horn, and attach it to an 8–32 machine screw with a nut and lockwasher. Drill a clearance hole through the fuselage and block, and install the control horn using a loosely tightened nut. The installation can be completed later. Eventually, the tail-wheel control horn is connected to the rudder horn with a short length of wire with z bends on each end. Use the inside holes for this link.

The rudder pushrod should connect to the outside hole on the rudder horn. Final alignment of the tail wheel is made when bolting the tail-wheel bracket in place.

The wing cutout is a bit of a problem because of the oval-shaped fuselage. I made up a slightly oversized paper template of the wing section shown on the plans, and traced its outline on the fuselage with a nylon tip pen. Any excess material cut away is easily built back up when the wing saddle and Epoxylite wing fillet is applied. (See section E-E on the plans.) Wing alignment to the fuselage is best accomplished after the horizontal stab is in place. This provides the artificial



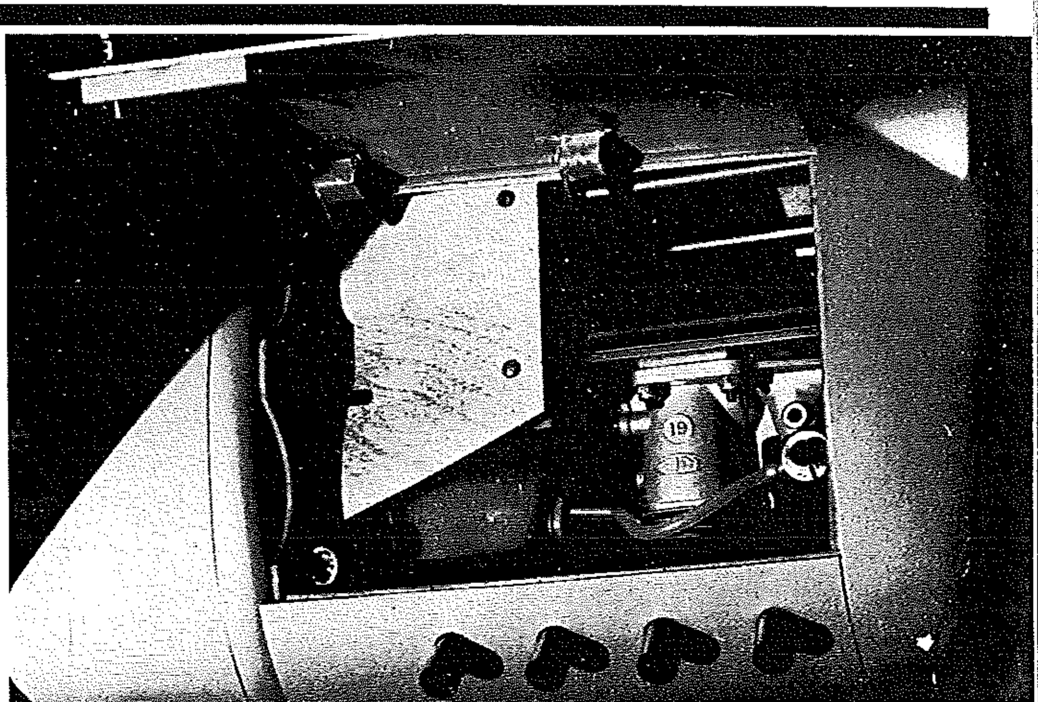
The Du-Bro Prop Drive Unit, showing its plywood mounting box, the inverted K&B 61, and 12-ounce tank which projects through opening in firewall. The 90-in. plane weighs only 15 pounds all up, with 5 ounces of lead in the tail cone. Ship handles as easily as a pattern trainer.



horizon needed for wing alignment. Make sure the wing mounting block is thoroughly glued. I have also used a couple of long 4-40 machine screws to bolt the block to F5.

The windshield is made from .030 clear butyl sheet. The frame around the windshield is made from a thin sheet of fiberglass which I made when making up the cowl and other fiberglass parts. The frame is cut to size and cemented to the windshield while the windshield is held against a 5- or 6-in.-diameter cylinder. (Like a coffee can.) The best cement I found for this is Wilhold's R/C 56 glue. Use it to glue the windshield to the fuselage. The tabs shown on the windshield pattern are used to anchor the windshield to the fuselage. The tabs are not included in the frame, and therefore, the slots cut in the fuselage to receive the tabs are hidden by the frame.

Wing Structure: The laminated tips are made first. Since the leading edge and trailing edge of the tail sections also use laminated strips, these could be made at the same time. The laminations are made by rubber-banding balsa strips over forms which can be made from a low grade plywood or even cardboard. Cut the forms to the inside dimension of the curved surfaces. The strips will have to be soaked in water to take the tight curves. After the strips have thoroughly dried reform a second time using epoxy glue between the strips. This technique will yield structures which are as strong as hard wood.



Close-up of the finished engine installation and compartment with door swung up to show its hinging. If the builder prefers to use a Quadra, etc., author says radial-engine version is better. Construction would be simplified in that none of the fiberglass parts would be required.

The remainder of the wing structure is typical of just about all built-up wings. The alignment tabs on the ribs extend 1/8 of an inch below the bottom spar, so use 1/8 scraps to raise the spar for assembly. This is necessary since the spar is not located at the thickest part of the wing. Incidentally, the airfoil is a modified high-lift Ritz. I suggest that the ailerons and flaps be cut out after the basic structure has been completed. Locations for scoring the ribs to facilitate cutting is shown on the plans. Use hinges with hinge pins when installing the flaps, and make sure they can be lowered to 50 degrees or more without binding.

Complete each wing panel up to the top center sheeting and carve and sand to shape before joining. Do as much as possible with the separate panels since a 90-in. wing does have a way of creating space problems. When ready, join the panels with 3-in. dihedral under each panel at the spar at R3. If your work bench is too short, borrow a door from somewhere. In fact, if you can find one with the right airfoil, skip the wing.

Complete the center section and prepare the wing for covering. For covering, I use a lightweight nylon that I purchased from a fabric store. Its cost is very reasonable and can be used just like silk. Another advantage is, if you should develop wrinkles from a minor dork, they can be removed with a heat lamp.

Tail Structure: The easiest way to built tail surfaces having airfoils is to build them flat, then carve and sand to shape after assembly. The exact shape is not critical, but they should be made as symmetrical as possible, with their maximum thickness about 1/3 the way back from the leading edge. The lower part of the rudder is made from 1/2-in. sheet, on which the rudder control horn is mounted. Insert a piece of 1/8 ply for the control horn base.

At the rudder hinge line, the tail cone has the same contour as the fuselage, but tapers rapidly to the contour shown at section F-F. A hatch is built in the tail cone for access to the rudder and elevator control horns. The vertical and horizontal tail sections also were covered with nylon.

Miscellaneous: The cowl is attached to the fuselage by three 10–24 bolts which project from the firewall. A mounting web, made from the outline of the section shown at C-C, was cut from 1/8 ply and glassed in place. The web has a large rectangular hole cut out to clear the tank and Prop Drive Unit.

The cowl doors are attached to the cowling with throw-out hinges as shown on the drawing. The maple blocks also are glassed in place. If the top screws used to mount the fiberglass part are kept loose, and those on the door made tight, the doors will swing out before rotating upwards. After rotating fully upward, the cowl doors will remain in that position by themselves. The right door, where access to the needle valve and filler tube is made, is held down with a Cam Loc fastener; the left door, which normally doesn't have to be opened at the field, is held shut by the muffler. The muffler is a Du-Bro mounted with a short length of Du-Bro muffler extention.

Wing struts are attached to the Du-Bro ball links epoxied in the fuselage and wing. The ball-link sockets are mounted on threaded wire sections and adjusted for length. These were then installed in lengths of K&S streamlined tubing using balsa wedges and silicone rubber sealant. The edges of the tubing were filed to fit flush, but loosely, against the fuselage and wing. The edges were then lined with leather to prevent marring the surfaces.

The plane was prepared for painting by priming with acrylic lacquer primer. It was then painted

FULL SIZE PLANS AVAILABLE . .
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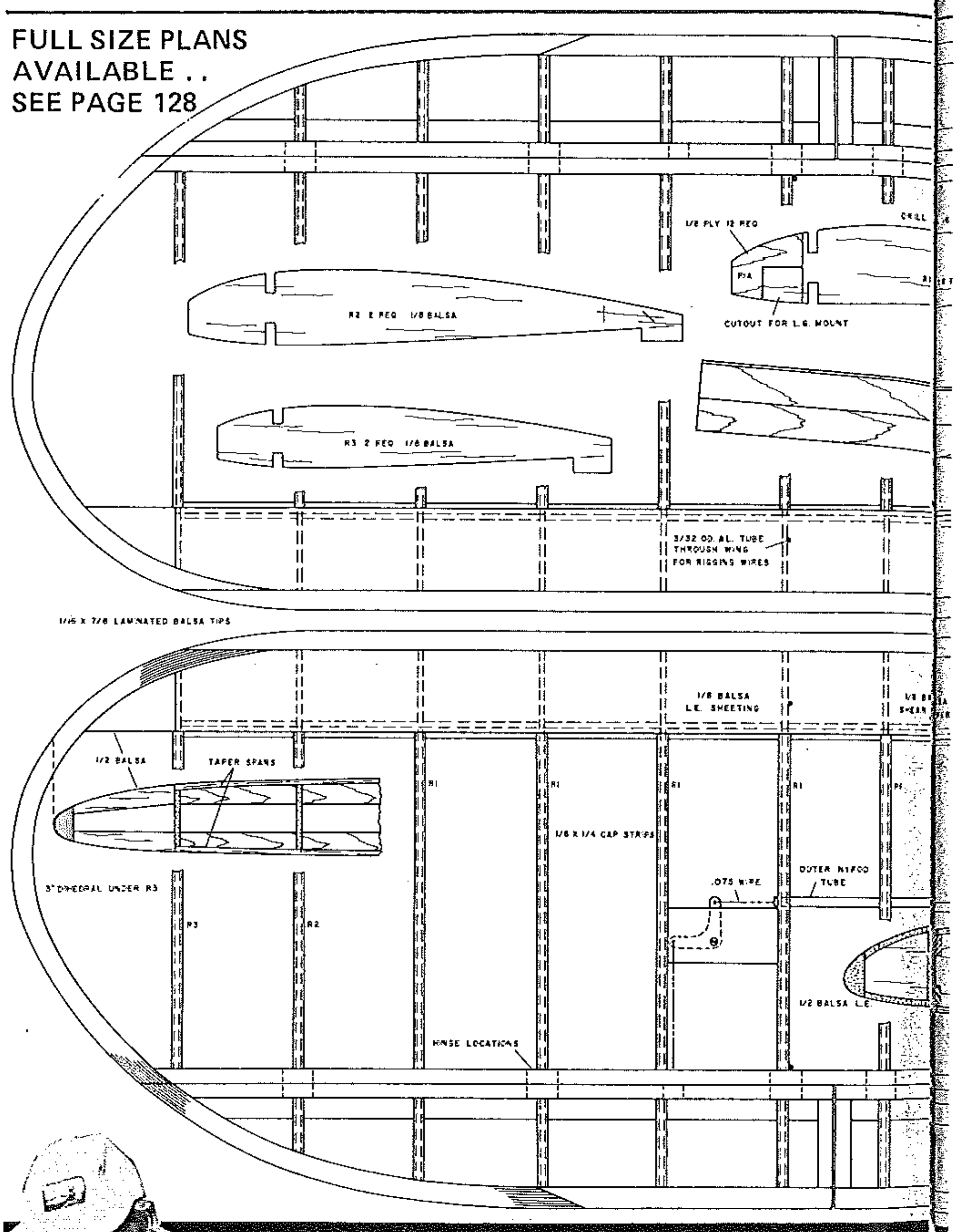
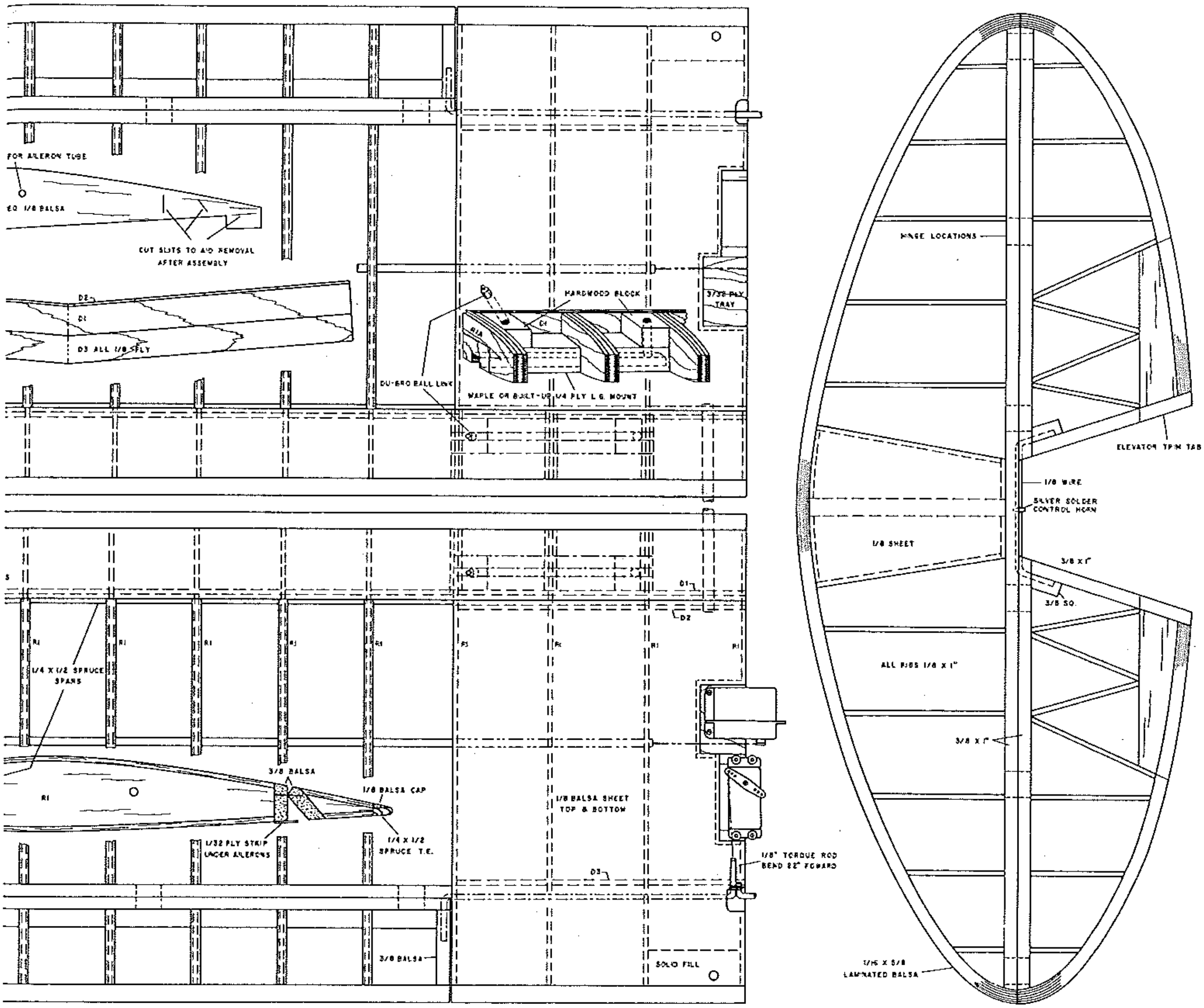


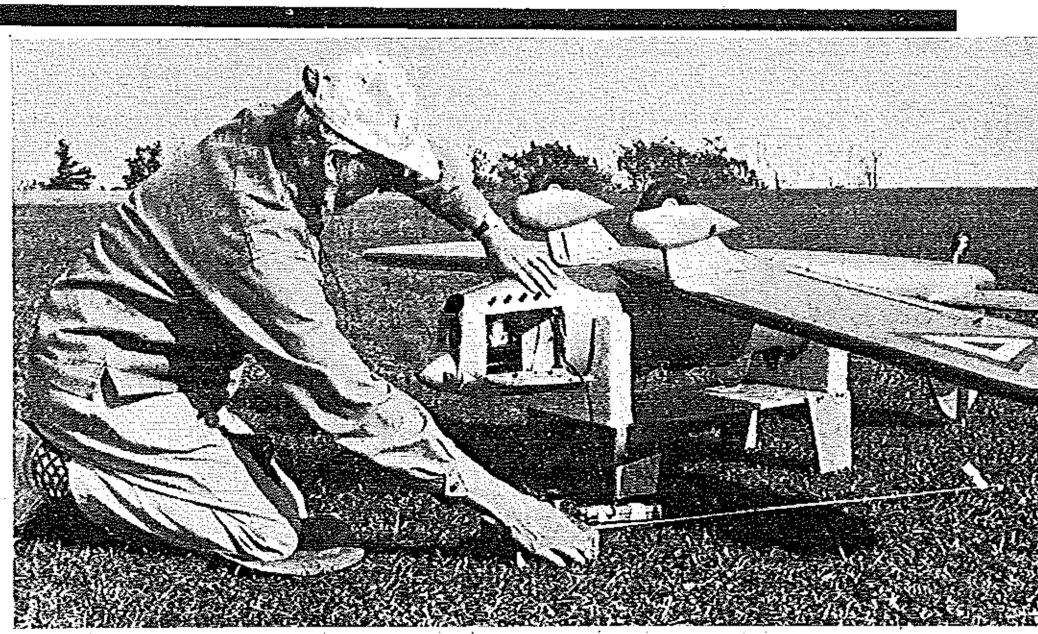
Sitting in its special cradle, the big ship is quickly fueled. Large rectangles of 2-in. foam are cut out to match fuselage sections, then glued to low ply stand to keep rudder from touching the ground when the ship is inverted. Note how easily Farrell handles crate without a helper.



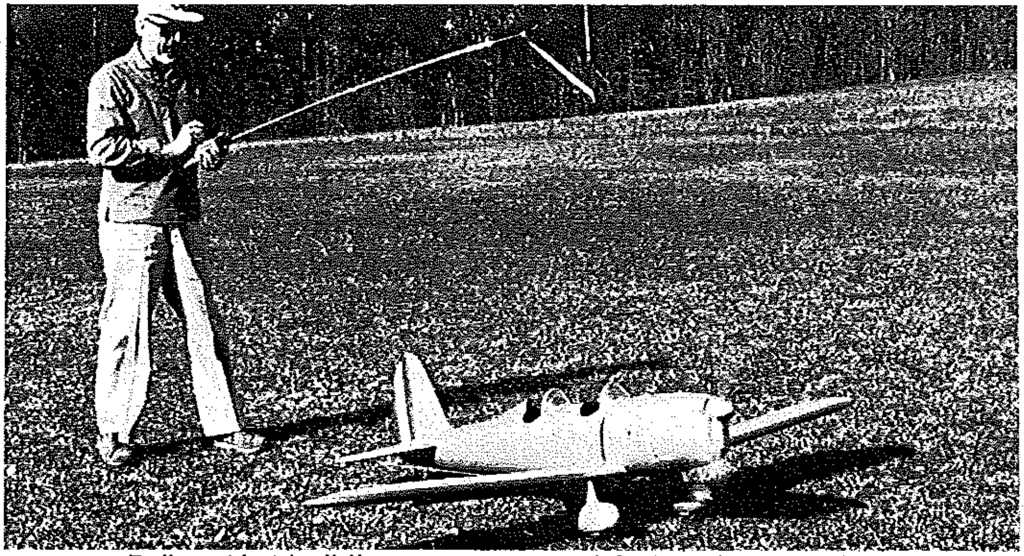
with acrylic lacquer poly aluminum to simulate the polished aluminum fuselage and silver-colored wing and tail surfaces. The lacquer was plasticized by adding Southern Product's Flex All. For trim, I used the insignia of the Mexican Air Force. *Profile Publications* has this and several other color schemes from which one can choose.

Conclusion: As mentioned previously, a cradle is used to hold the plane inverted for starting. It is also used for transporting the plane to the field and for assembling the wing and rigging. The cradle was made from two pieces of 2-in. styrofoam cut into 9 × 11" rectangles. An area is cut out in the shape of the section shown at C-C about 6 inches deep. The styrofoam is then glued to a plywood stand which is made just high enough to keep the rudder off the ground when the plane is in the inverted position.

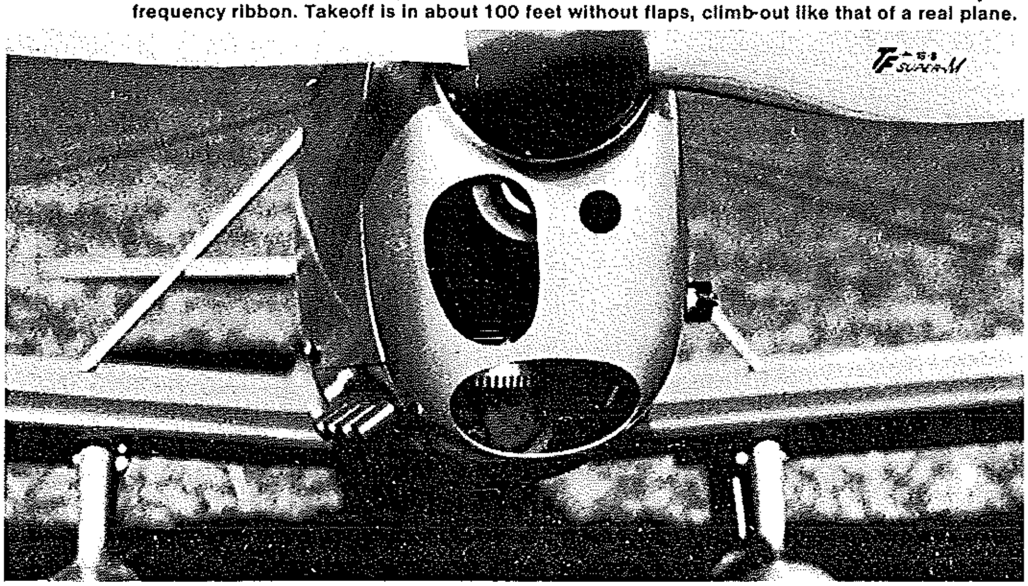
If you have had any experience with inverted engines you know they flood easily and can be very difficult to start. Inverting the plane for starting prevents this. However, the tank, which is installed in the usual manner must be filled when the plane is upright. Hence, I fill the tank first, then invert the plane, while holding the nose



Inverted on its stand for starting, the Ryan's engine starts with a few flips of the prop and the author found he did not require a starter. Best performance with an 18/8—close to scale.



Taxiing out for takeoff, Henry seems unconcerned about a moderate crosswind revealed by the frequency ribbon. Takeoff is in about 100 feet without flaps, climb-out like that of a real plane.



In addition to scale cooling openings, large bottom opening insures engine won't be subjected to high temperatures. Flaps are applied on approaches but, even so, there is a tendency to float on landings, so care must be taken not to overshoot. Big ships are surprisingly light on their feet.

slightly high, to complete assembly and static (engine not running) preflight. Because of the fiberglass spinner I do not use an electric starter. Fortunately, one has never been needed since the engine almost always starts in just a few flips of the propeller.

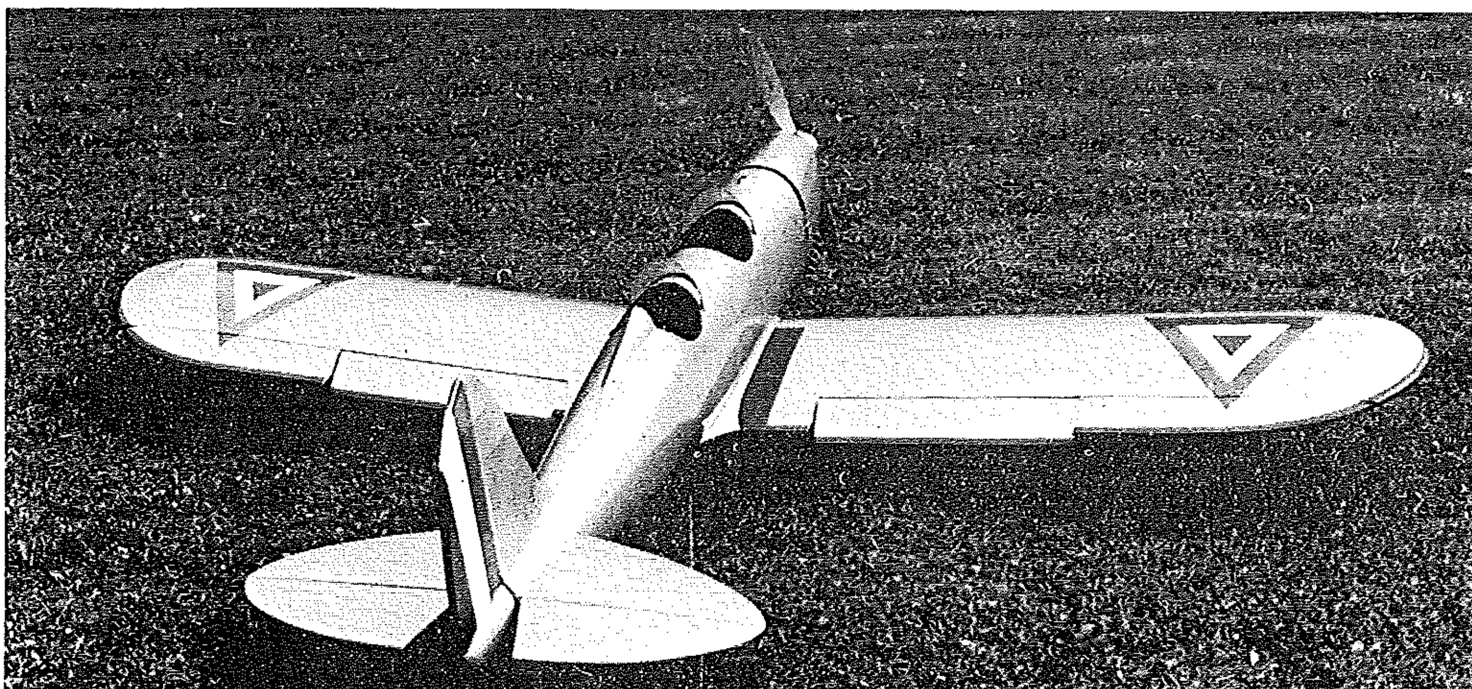
For starting, I use a Du-Bro (I might as well say it now, the wheels are also made by Du-Bro) glow plug clip hooked to a pair of 20-year-old surplus nickel cadmium batteries that were once used in NIKE missiles. The clip is easily installed and removed from the engine through the cowl door. After the engine starts, the needle valve can be adjusted and the cowl door closed before rotating the plane to its landing gear.

Takeoffs are very smooth and require only a very slight touch of the right rudder. Flaps are not normally used for takeoff as the plane will brake ground after about a 100-ft. run. Attitude on climb-out is exactly like any full-size light plane. So far maneuvers have been limited to rolls, loops, wing overs and slow fly-bys. All looping and rolling maneuvers are started by first entering a shallow dive to build up speed. This is exactly as was done with full size ST-As, so that flight performance is very realistic. Landings are made by adding full flaps on the downwind leg. No change in pitch is noted when the flaps are lowered. Even with flaps, the plane wants to float on landings and much care must be taken not to overshoot the runway.

Well, this about sums it up. I will conclude with a list of sources for 3-view drawings which should be of considerable help in scale drawings.

THREE-VIEW SOURCES.

1. *Profile Publications,* Number 158
2. *American Aircraft Modeler,* August, 1971
3. *American Modeler,* July, 1962
4. *Radio Control Modeler,* February, 1973
5. *Air Classics,* July, 1973
6. *Air Progress,* Winter, 1962/1963
7. *Harold Osborne,* P.O. Box 2033, Fullerton, CA 92633



The Mexican Air Force markings certainly are a cinch to duplicate. Ship primed with acrylic lacquer primer, then painted with acrylic lacquer poly aluminum to simulate the polished aluminum fuselage and the silver colored wing and tail surfaces. *Profile Publications* offers a variety of color schemes. So far, the author has limited maneuvers to rolls, loops, wing overs, and slow fly-bys. No pitch change with flaps.