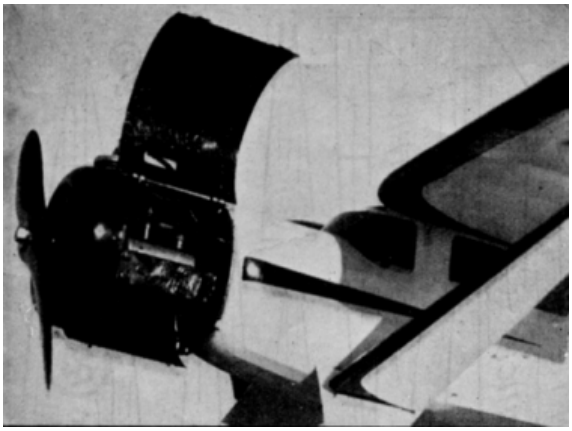
A Precision Contest Gas Job

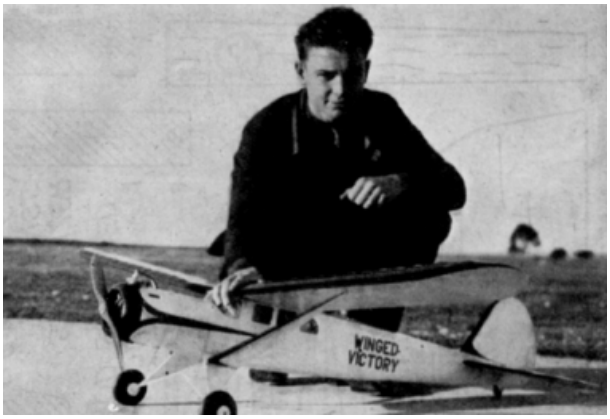
Part No. 2

Final Data Which Will Enable You to Complete One of the Most Realistic and Reliable Little Fliers That Ever Turned a Propeller

BY
ELBERT J. WEATHERS



The engine compartment with cowling raised



The author and the completed ship, ready to fly

The model in full flight is realistic, stable and a fine performer

IN THIS second and concluding part, drawing Plates 4, 5, and 6 are included, covering the parts for completion of the plane.

The landing gear ribs are cut out and installed in the landing gear "V's" as shown on Plate 1. These are found on Plate 6. Make sure that all are secure. Corner braces between the ribs and wire may be put in for added cementing area. Cut two ribs from No. 24 galvanized sheet metal and solder well to the piano wire in the correct position. It will be noted that all landing gear ribs are put in parallel to the fuselage, the first one next to fuselage being the only exception. (L-1 follows fuselage longeron.) See Plate 2 for the wing strut fitting detail at the landing gear. Cut four lengths as shown of 1/8" O. D. brass tubing. These are soldered in the positions indicated. A side of each

section of tubing should be flattened slightly with a file to insure ease of handling in soldering to the metal ribs.

The battery box, coil and condenser mountings are installed in the fuselage at this point, preparatory to wiring. See Plate 6 for perspective view of battery box. After completing, cement it securely to the cabin floor and also against the 1/16" sheet balsa bulkhead. The coil mounting pieces are made from 1/8" sheet balsa and fit directly against the forward side of the battery box. The condenser mounting brackets are also cut from 1/8" sheet stock and cemented to the cabin floor. Use metallic cement in connection with the installation of the coil and condenser in their respective cradles.

Study the wiring diagram on Plate 1 before beginning the job. Use stranded flexible copper wire, insulated covering of course, in all wiring, with the exception of that between the motor-mount bulkhead MM and the engine, which should be of heavier variety, similar to type used for automobile spark plug wiring, as these three wires (ground, timer and spark plug) are exposed to the gas, oil, etc., which will form to the rear of any engine to some extent after engine has been running. The plug cable should be well insulated by all means.

May the writer point out that the booster batteries in this wiring system are right in on the main line with the flying batteries, which works the best of any method, inasmuch as the booster lines need only be pulled out after motor is running, the flying batteries carrying on in an uninterrupted circuit. To use a booster battery with this system, one merely inserts the booster plugs and turns ON the switch and the engine is ready to begin operation. When the main switch is turned OFF and booster leads are still inserted in plugs, the current from booster also terminates with that of the flying batteries in the fuselage.

Engine Cowl and Exhaust Manifold

In building the cowl, extreme care must be taken in all operations. This unit will give any gas model builder good practical experience in metal working. The N.A.C.A. type cowl, as used with this ship, will allow better cooling of the engine than the "in-line" type cowling, and it contributes greatly toward the final appearance of the model, giving it a real plane appearance, even to the side panels, which can be raised for inspection, fueling, etc., similar to the N.A.C.A. cowl on the latest Fairchild cabin plane.

The primary step in the cowl construction is to get the front ring made. This is "spun" on a lathe and due to the easy curve, anyone having access to a lathe can easily make it himself with a little care. If one is not in a position to make it, any metal-working concern in his vicinity which does metal spinning will make it, including the hardwood form, for a very nominal sum.

However, if one plans its forming, the first thing to do is to make a hardwood form, turned on a lathe. This should be finished to 4-3/4" diameter, minus double the thickness of the 20-gauge aluminum forming the ring. In other words, allow for the thickness of the metal in turning the wooden form so that the aluminum ring itself will be 4-3/4" diameter when completed.

Secure a sheet of very soft (grade used for spinning) 20-gauge aluminum and secure with four screws against the front face of the form. Leave the sheet amply large for completing the ring to the rear edge, but don't leave too much excess, as it will be bothersome in the spinning operation. Begin to work it around the curve very gradually, using a hardwood stick (about 1" x 1") with corners all rounded off and smooth. The stick must be long enough to reach under one arm so that sufficient leverage and pressure can be obtained with it. The lathe should be operating as fast as possible. After the metal has been completely worked around to the rear face of the wooden form, use a cut-off tool to remove the excess metal and to form the rear edge of the ring. The next step is to polish the ring to a plating finish, which is followed by the use of a narrow lathe tool in cutting through the metal on the front face to obtain the desired size opening (3-1/4" diameter.) The ring will then fall free from the form. Remove a section of a 1-7/16" circle as shown on cowl detail, Plate 4. This is of course the opening through which the cylinder passes. The holes required on the front face of the ring should be drilled next. The three large holes are 120 degrees apart.

The landing upon which the side panels rest, at their front edge, is riveted in place around the cowl ring as indicated on Plate 4. This discontinues at the cylinder hole. When done correctly, a 1/8" strip will remain for the side panels. Use small aluminum rivets, 1/8" long with 1/8" flat heads, in all small riveting done on the cowling. The spacing of them for fastening the strip just described is clearly shown on the front view of cowl. The center top section of the cowling is made and installed next. It is 20-gauge aluminum (soft.) First cut out the remaining section of the cylinder hole to match that in the ring. Prepare the hinge notches and holes, also the needle-valve and spark-plug wire holes. When all holes are completed, bend the piece to the proper curve required, considering that it is a 2" section of a 4-3/4" circle. The two small brackets which secure the rear end of the top section to the rear cowl support ring are now riveted in place (one rivet each.) The hinges (which are purchased at any large hardware store) are to be riveted on this center

section also, before riveting it to the spun ring. Cut the bracer C-1 and cement it in place with metallic cement.

Proceed to rivet the top center section to the cowl ring (actually the riveted strip.) Obtain some sheet aluminum stock, half hard preferably and 24-gauge, for the two side panels. The hardened variety is preferable so that the side pieces will be springy after being rolled to shape. Cut two pieces, size each 3-3/4" x 6-7/16", and remove the section through which the exhaust manifold passes. Drill and install the pair of fasteners on bottom ends of the two pieces. Also file the hinge slots and drill the hinge holes. When all of these operations are completed, take the panels to a sheet metal or tin shop and get them rolled in a rolling machine. Take along a tin can or other object which is about the cowl diameter to use in getting the panels to the exact size curve to conform with the 4-3/4" cowl diameter. Before going further, make the three cowl support rods from 3/16" O.D. aluminum tubing, as shown on Plate 4. Rivet the two upper ones permanently in the two upper holes in cowl ring. (The lower one is removable so cowling may be removed with motor and tank in place.)

Now rivet the two side panels to the hinges. Trim each one slightly at this point so fasteners snap tightly, with each side panel just meeting and no more. Two 3/16" O.D. aluminum tubing brace rods are made to be used with the cowl. These extend from the two small holes, next to bottom cowl support-rod hole in front ring, to the first engine mounting screwhole in each engine mounting plate. Flatten the tubing and drill holes in the ends similar to the main cowl supportrods.

The metal ring supporting the cowling at the rear and the engine mounting plates (mounted on the hardwood beams) are shown on Plate 2.

Cut the ring from 20-gauge soft aluminum and punch holes, size 3/8", around the ring for passage of air. These can be drilled if no punch is available. Drill the four mounting screw-holes and also the two holes at the top to which the small brackets on the top section of cowl are attached. Mount the ring on the previously prepared aluminum tubing spacers with. 5/8" round head wood screws.

The two engine mounting plates are of 24-gauge galvanized sheet metal. Drill the holes to match those previously drilled in the hardwood beams. The holes for the engine and tank mounting screws should be put in at the same time. (Check your own engine and tank holes for spacing against those on mounting plate illustration.) Bend each plate at right angle where indicated. Mount each one on the wooden beams with 6-32 machine screws (use dural screws and nuts if possible.)

The exhaust manifold, illustrated on Plate 4, is constructed of sheet tin (coffee can, etc.) over a balsa form. The seam is a simple lap joint, brazed. The exhaust manifold should fit tightly between the bottom cylinder fin and the intake jacket. File two brass pieces to the shapes shown and have them brazed to the sheet tin butt-joints. A little care must be taken in all brazing done on this unit as the tin is rather thin and a brazing torch can easily and quickly burn a hole in it if caution is not used. File the manifold smooth with rounded corners. Drill holes to accommodate 4-36 screws in the solid brass pieces as shown. The strap for holding the exhaust manifold in place is a 20-gauge strip of aluminum. It is suggested that the completed manifold be dull nickel-plated. This "hides" all brazing and gives a one-piece appearance.

An extension will have to be made on the engine needle valve so it may be operated through the cowl. This can be merely a brass screw soldered firmly on the head of the standard valve. Regarding the timer advancement with cowl in place. The writer has always been able to start his engine with the timer in fully advanced position, bringing the engine up to proper r.p.m. through carburetor adjustment only (needle valve.) However, this may not be the case with all power plants. If a timer extension through the cowl is necessary, it is suggested that a slot be cut in the cowl ring to operate an extension lever on the timer.

Tail Surfaces

Both the fin and stabilizer are of identical construction. See assembly drawing (Plate 1) for detail on empennage members.

Cut out the leading and trailing edges, tips and designated ribs from 1/16" sheet balsa of firm variety. All diagonal bracing is of 1/8" sq. balsa. The fin and stabilizer spars should be of very hard stock, especially the stabilizer spar. The dowel pins in fin are of hardwood and should be of such diameter (5/16" approximately) as to fit tightly in the aluminum tubing in the fuselage. The fin tab for torque adjustment is fastened in place with copper or brass wire hinges.

Cover the leading edge of both the stabilizer and fin with 1 /32" medium sheet balsa. It is advisable to wet the sheet where it takes the abrupt bend on the actual leading edge of each tail member. The stabilizer fittings for securing it in place on the fuselage are clearly shown on Plate 5.

Wing Panels and Wing Struts

Select very hard, good quality, 1/8" sheet balsa for the wing spars. All other balsa in wings should be medium hard. Due to the up-curve on the wing tips (excellent insofar as lateral stability is concerned) and also the tapering of the wing panels at

the fuselage end, the wing spars are rather irregular, being curved for these purposes. After cutting them from sheet stock, begin the cutting of the ribs, leading and trailing edges, and wing tips. To build a wing panel, first slide all ribs over the spars in their approximate positions. Now pin the spars in place over the full-size wing panel drawing. The ribs are now put in position and cemented. The trailing edge (1/8" x 3/8" balsa, tapered in cross-section) is laid down and cemented in place. The wing stubs at fuselage are carved from solid balsa blocks, as shown on assembly drawing, and are securely attached to wing ribs W-1. The wing strut fitting for the wings is shown full-size on Plate 3. The fittings for the wing panel pins, which are very securely attached to the stubs, as indicated are, like the wing strut fittings, formed from 20-gauge sheet aluminum. A hole, which 1/8" O.D. aluminum tubing will just pass through, is drilled through these wing stub fittings and the balsa stub after fittings have been cemented in place. The tubing is spread on each end and hammered over to form a strong rivet, as was done on the fuselage for the stabilizer pins, etc. Each wing panel is covered with 1/32" sheet balsa on the front section, the same as was done on the tail surfaces. Due to the curve at the ends of each wing panel, it will be found necessary to piece the veneer to a certain extent. The diagonal bracing is 1/8" x 1/4" balsa and gussets are added to the trailing edge at each rib for additional strength.

The wing struts are rather unusual in design. Each is formed from 1/2" sheet balsa stock, which should be medium hard. See assembly drawing for detail on this part. Carve and sand each one to the aerofoil shown on Plate 6. The fitting which slides in between the brass tubes on the landing gear is shown on Plate 4. This is riveted to the struts using 1/8" O.D. aluminum tubing in the same manner as the wing stub fittings. The metal fitting at the small end of the strut is shown on Plate 5. It is also riveted, as well as cemented, in same fashion as the fitting at the base of the strut, but 1/16" O.D. aluminum tubing is sufficient in this application.

Now we shall return to the fuselage for the installation of the windshield and side cabin windows. See Plate 6 for the windshield template. Get good sheet celluloid, preferably .015 thickness, for this work. Be sure it has no prominent scratches on the surface. Using the template, cut the windshield out and install it, using cement carefully so as not to smear the celluloid. Use pins until cement is dry. The side pieces of celluloid are cemented in next and each should be perfectly flush with the balsa surface of the fuselage sides, done by removing balsa around window frames the thickness of the culluloid (see assembly drawing for dotted lines showing this.)

On the original model the writer conceived the idea of shellacking the entire nose construction of the fuselage, from the firewall back to the windshield. This has proved to be most successful in the prevention of gas and oil softening cement joints in this vicinity. Engine fuel will eventually get to most parts of the nose on most any gas job, and by shellacking, no breakdown of cement at joints can possibly result from such a condition. So it is suggested that this be done at this time, just prior to covering the plane.

Covering and Finishing

The writer's model was covered with a good grade of bamboo paper, as it is easier than silk to apply and less expensive. It has ample strength in addition. Cover in small sections where necessary, such as the fuselage nose, wing stubs, etc. Be sure to cover thoroughly around all the cabin windows, using narrow strips. Cover all solid balsa parts such as the wing struts, and balsa block over windshield. When covering is completed, apply two coats of clear nitrate dope, brushed. In applying the color job to the gas model, use the spray method if at all possible. A much finer finish will result. In preparing the parts for the application of the pigmented dope, first cut some cabin window protectors from gummed paper. Round the corners off. (See photographs.) These are securely stuck to the windows. Be certain that all edges are actually adhering to the celluloid. Other items on the ship should be protected also with paper, such as the wheels, flight timer wind-up arm, etc.

The original is painted all white with bright red trim, which is a very effective and pleasing color scheme. Two sprayed coats of white pigmented dope were given the parts. Trim as desired with the contrasting color as soon as the other has dried. Use a brush for this work. To conclude the paint job, apply a coat of dark "Prism-Lac" type lacquer (novelty finish) if possible, to the inside of the cowl, motor mount and firewall. This is the type of finish usually put on the more modern aircraft instrument panels. If it can be secured in your neighborhood paint store, the application is well worth the while in such a place, as far as final appearance of the model is concerned.

Assembly

Mount the engine and fuel tank on the mounting plates first. Hook up the timer, ground and spark-plug wires. It is a good idea to check the engine operation before the cowling is installed. If it is running okay, proceed to put the cowl on. This is done by first removing the lower cowl support rod. The cowling, with sides raised, is now lowered over the cylinder, with the needle valve removed and the spark-plug wire guided through the hole provided as cowl is lowered. Work it on, holding the two upper cowl

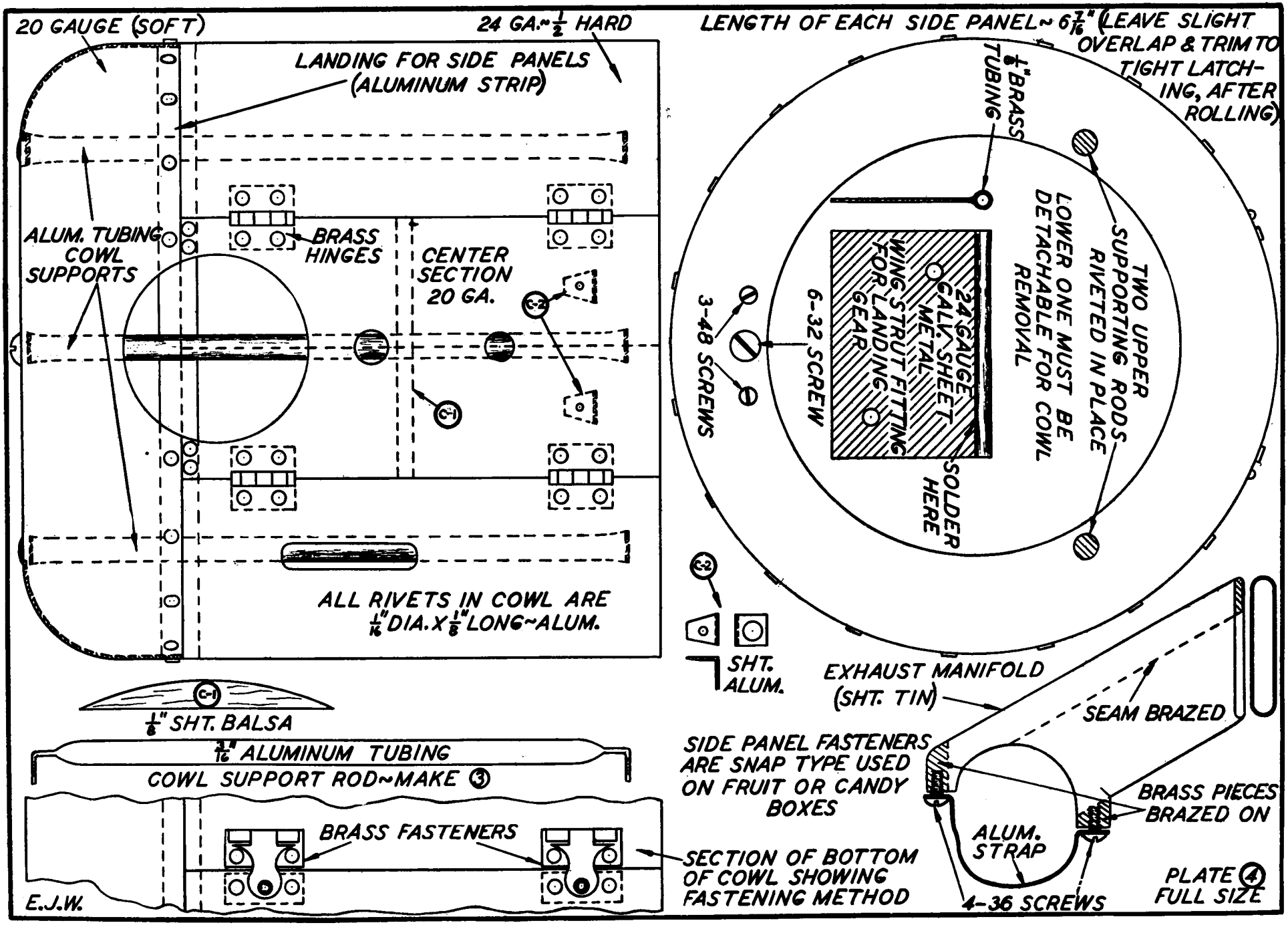
support rods away from their respective studs, until they are in line and can be slipped on. Now put the two upper stud nuts on and tighten. Connect the spark-plug wire to the plug and put the needle valve back in place through the cowl hole. Now fasten the top stationary section of cowling to the rear cowl support ring. The lower cowl support rod is now put in place, the rear end being secured to the lower stud with a nut and the front end to the cowl ring with a 6-32 screw. Remove the first motor mounting screw from each plate preparatory to putting in the 3/16" O.D. aluminum tubing bracers, which extend from the bottom of the cowl ring to these first mounting screws. The lower ends are secured to the front cowl ring with 3-48 screws and nuts. This concludes the cowl installation.

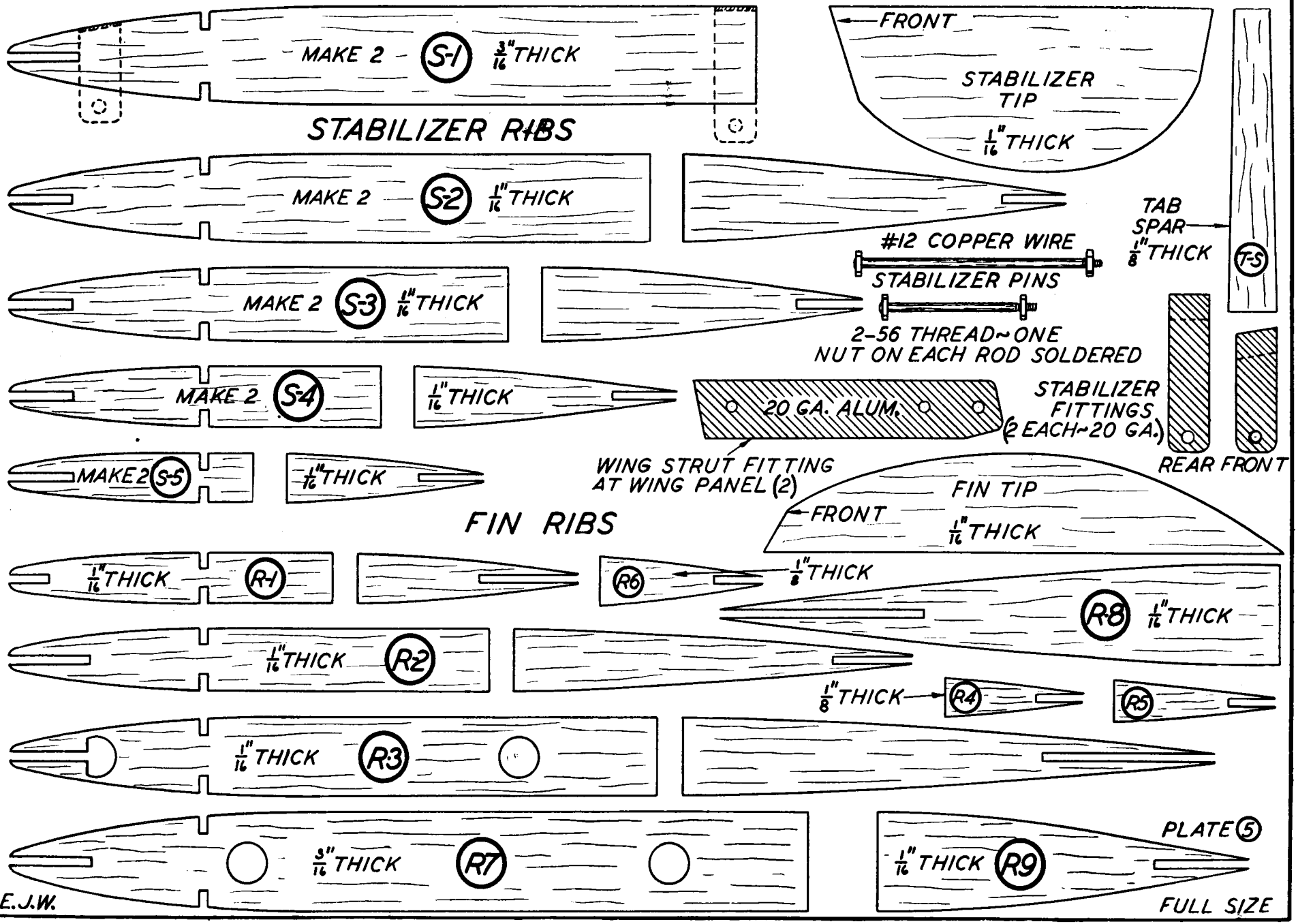
The fin should slide in the fuselage on its pins rather tightly. The stabilizer pins, previously prepared and illustrated on Plate 5, are merely put through the stabilizer fittings and fuselage and the nuts tightened. The wing panels and also the landing gear ends of the struts are held in place with lengths of brass wire of such size that it will just pass snugly through 3/32" O.D. tubing, such as that which runs across top of fuselage under the hatch for the wing pins.

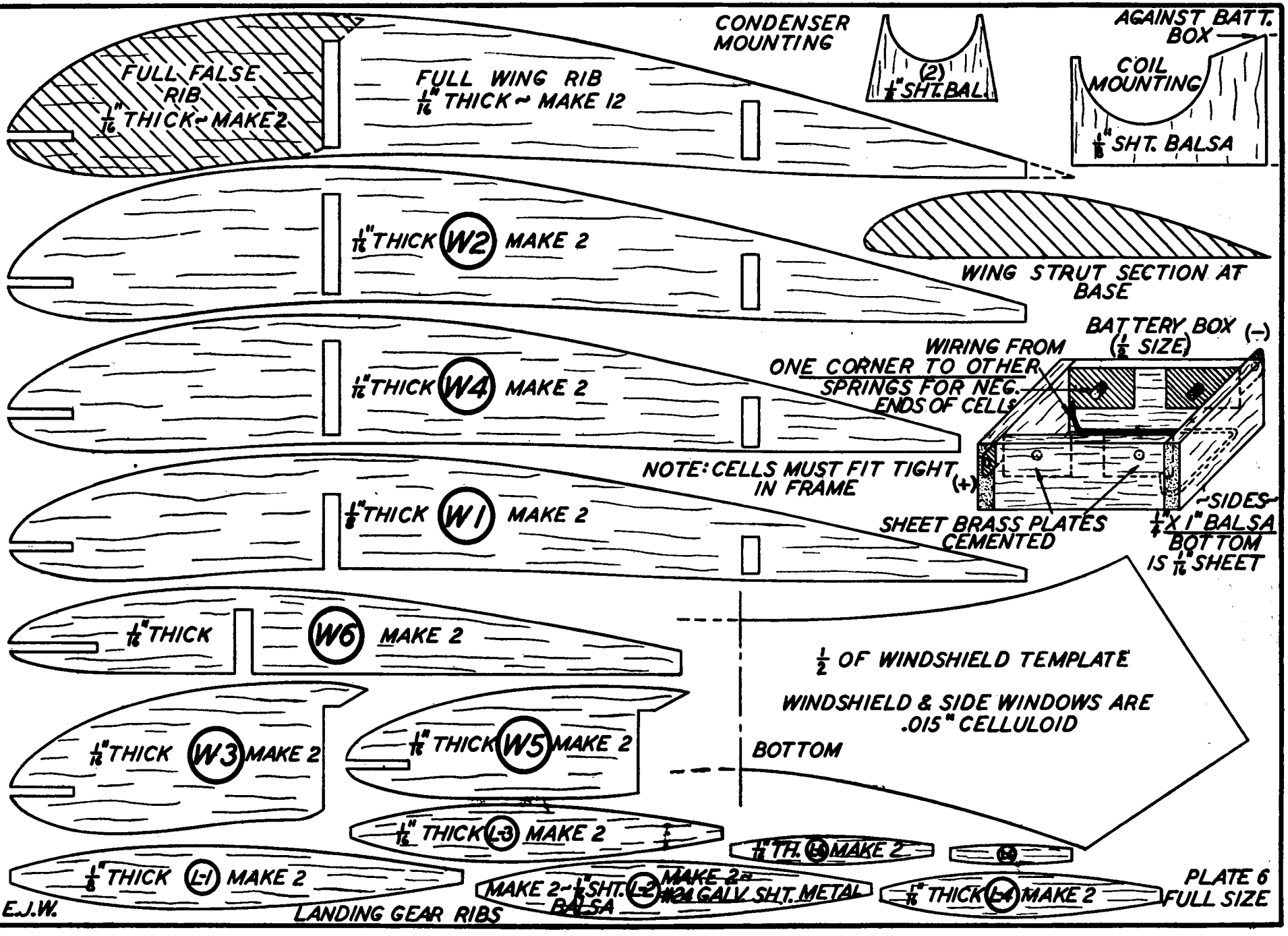
To connect the wing struts at the wing panels, use two 3-48 or 2-56 brass screws and nuts. The design of the wings and struts on this gas model allows them to separate from each other should the need arise. Also, as all parts are readily demountable, the plane is easily carried in an automobile, consuming little room.

Flying

The original model balanced for a flat glide almost perfectly upon completion. A slight bit of negative adjustment on the stabilizer was all that was required. It is not too crtical in obtaining the correct glide, due to the long moment arm. The "Autoknips" timer, as used on this gas job, has an average run-down time of 45 seconds, which is excellent in completing test flights.


20 GAUGE (SOFT)
24 GA.~1/2 HARD
LANDING FOR SIDE PANELS (ALUMINUM STRIP)
ALUM. TUBING COWL SUPPORTS
BRASS HINGES
CENTER SECTION 20 GA.
C-1
C-2
ALL RIVETS IN COWL ARE 1/16" DIA. X 1/8" LONG~ALUM.
LENGTH OF EACH SIDE PANEL ~ 6 7/16" (LEAVE SLIGHT OVERLAP & TRIM TO TIGHT LATCHING, AFTER ROLLING)
1/8" BRASS TUBING
TWO UPPER SUPPORTING RODS RIVETED IN PLACE
LOWER ONE MUST BE DETACHABLE FOR COWL REMOVAL
24 GAUGE GALV. SHEET METAL WING STRUT FITTING FOR LANDING GEAR
SOLDER HERE
6-32 SCREW
3-48 SCREWS
3
SHT. ALUM.
EXHAUST MANIFOLD (SHT. TIN)
SEAM BRAZED
SIDE PANEL FASTENERS ARE SNAP TYPE USED ON FRUIT OR CANDY BOXES
BRASS PIECES BRAZED ON
ALUM. STRAP
4-36 SCREWS
PLATE 4 FULL SIZE
C-1
1/8" SHT. BALSA
3/16" ALUMINUM TUBING COWL SUPPORT ROD~MAKE 3
BRASS FASTENERS
SECTION OF BOTTOM OF COWL SHOWING FASTENING METHOD
E.J.W.


MAKE 2 S-1 3/16" THICK
STABILIZER RIBS
MAKE 2 S-2 1/16" THICK
MAKE 2 S-3 1/16" THICK
MAKE 2 S-4
1/16" THICK
MAKE 2 S-5
1/16" THICK
FRONT
STABILIZER TIP
1/16" THICK
TAB SPAR
1/8" THICK
T-S
#12 COPPER WIRE
STABILIZER PINS
2-56 THREAD~ONE NUT ON EACH ROD SOLDERED
20 GA. ALUM.
STABILIZER FITTINGS (2 EACH~20 GA.)
REAR FRONT
WING STRUT FITTING AT WING PANEL (2)
FIN RIBS
FIN TIP
FRONT
1/16" THICK
1/16" THICK R-1
R6
1/8" THICK
R8 1/16" THICK
1/16" THICK R2
1/8" THICK
R4
R5
1/16" THICK R3
3/16" THICK R7
PLATE 5
1/16" THICK R9
E.J.W.
FULL SIZE


FULL FALSE RIB
1/16" THICK ~ MAKE 2
FULL WING RIB
1/16" THICK ~ MAKE 12
CONDENSER MOUNTING
(2) 1/8" SHT. BAL.
AGAINST BATT. BOX
COIL MOUNTING
1/8" SHT. BALSA
1/16" THICK W2 MAKE 2
WING STRUT SECTION AT BASE
1/16" THICK W4 MAKE 2
BATTERY BOX (-)
(1/2 SIZE)
WIRING FROM ONE CORNER TO OTHER
SPRINGS FOR NEG. ENDS OF CELLS
NOTE: CELLS MUST FIT TIGHT IN FRAME
(+)
1/8" THICK W1 MAKE 2
SHEET BRASS PLATES CEMENTED
~SIDES~
1/4" X 1" BALSA
BOTTOM IS 1/16" SHEET
1/16" THICK W6 MAKE 2
1/2 OF WINDSHIELD TEMPLATE
WINDSHIELD & SIDE WINDOWS ARE .015" CELLULOID
BOTTOM
1/16" THICK W3 MAKE 2
1/16" THICK W5 MAKE 2
1/16" THICK L-3 MAKE 2
1/16" TH. L-5 MAKE 2
L-5
1/8" THICK L-1 MAKE 2
MAKE 2 ~ 1/8" SHT. BALSA
L-2
MAKE 2 ~ #24 GALV. SHT. METAL
1/16" THICK L-4 MAKE 2
LANDING GEAR RIBS
E.J.W.
PLATE 6
FULL SIZE