A Precision Contest Gas Job

How You Can Construct a Small Realistic Gas Model That Has a Comparatively Slow Speed But High Consistent Performance

By ELBERT J. WEATHERS

Part No. 1

The miniature airplane ready to go through its paces

When motor adjustments are required, raise the cowl

Climbing steadily for altitude

The little ship in full flight

AS GENERALLY acknowledged, the Precision-Type Gas Model Contest is fast becoming standard, with purely durational meets now practically a thing of the past. Any conscientious builder, upon entering this more scientific type of competition, is immediately impressed with the new phases of judging his model, with engineering, construction and workmanship sharing with points awarded through actual flight of the plane. The writer is pleased, therefore, to offer the gas model enthusiast this ship, of original design, which will ably meet every requirement for this type of contest. The generally used point system in the precision contest is as follows:

A. Engineering (20 points-Maximum)
    1. Design
    2. Construction
    3. Workmanship
B. Take Off (20 points-Maximum)
    1. Take off
    2. Duration
    3. Approximate distance
    4. Altitude
C. Flight (25 points-Maximum)
    1. Stability
    2. Performance
D. Landing (35 points-Maximum)
    1. Approach
    2. Attitude as to landing position relative to restricted landing area of field

Total possible points-100

It should now be quite evident to any builder, heretofore unaccustomed to the precision meet, that the many "breaks" usually obtained by the favored few in strictly durational meets are cut to a minimum. Another phase of duration contests, that of the stubborn element of gas jobs flying out of sight and becoming lost, is entirely eliminated. The most important feature is the way in which this kind of competition literally "forces" design and workmanship advancement out of gas model builders, a fine feature which durational meets cannot generally claim.

Most precision meets allow two official flights, each being the usual limit of 45 seconds, or less, of the engine operation. As will be noted, this ship is equipped with a very efficient flight timer for this purpose.

Before going further, the writer would like to take this opportunity of expressing his complete satisfaction as a result of employing the X.G. aerofoil in this design, developed by Mr. Charles H. Grant and previously proven so successfully on the famous KG gas job. This has primarily kept the speed down to a conservative rate for this size model and engine power (5 ft. wing span - 1/6 hp. engine.) It also offers a steep angle of climb which is most important in flying this model in the precision - type contest, provided it stays over the field through proper circling adjustment. The glide is also benefited to a great extent by this wing section. Other design factors advocated by Mr. Grant have been incorporated in this design, all contributing greatly to the flight ability of the plane.

This gas model uses the Bunch Engine, although similar engines of 1/6 to 1/5 hp. can be used, provided the motor mounting plates and cowling holes are re-styled slightly. The wheels used on the original are Ohlsson Streamlines, but any of similar diameter (3-1/2 inch) will be satisfactory. Take ample time to build all units as construction and final finish are important factors.

One last word before the actual beginning of the construction. In installing all metal fittings used in the ship, that is, where each is to be cemented to balsa, use only metallic cement such as is on the market, but which can be easily prepared by any model builder. The writer employs it in connection with all metal fittings in all of his gas jobs, and the great strength resulting through its use makes its preparation very worthwhile. It is generally believed that a metallic cement is the result of painstaking chemical research. Possibly some of that on the market is, but anyone mixing aluminum powder (not too fine) with a good grade of model cement to correct consistency has a metallic cement equal in strength to any fancy preparations offered in stores at a fraction of the cost. Of course, use the customary clear cement in all balsa-to-balsa joints.

Fuselage and Landing Gear

To begin construction of the fuselage, first lay out the fuselage frame (side and top views) on paper, full size, enlarging from the assembly drawing (Plate 1) through use of the scale. Be sure to retain the long gradual curve in the rear section of the fuselage frame. When the frame has been drawn to actual size, select some 1/4" sq. hard balsa for the four longerons. All vertical and diagonal bracing is 3/16" sq. hard balsa. Be certain that stock for the vital members is of the best. Now build the side frames. Use 3/16" sheet balsa of widths specified in forming the cabin windows. Notice that the top longerons in the fuselage frame stop at the point where the front wing panel fittings are installed.

Auxiliary 1/8" sq. longerons of comparatively short length are built in to form the bottom line of the cabin windows and which extend to the front ends of the side frames. As the curve of the fuselage frames is somewhat abrupt on the bottom side at the nose, take care in forming this section. Now cut two 1/8" medium sheet balsa panels, to be installed in each frame at the rear end for ample protection and strength where tail surfaces are attached. This will complete the side frames of the fuselage, and now it is possible to build the two frames together as shown in the top view. Again, in completing the bending operation at the nose, caution should be used, and it is probable that the 1/4" sq. longerons at this point will have to be steamed to obtain the correct curve.

Now that the bare fuselage is completed, including all diagonal bracing, install diagonal bracing internally at each vertical member station, from the rear of the cabin to the start of the solid balsa panels in rear end. This insures a very rigid fuselage. Be sure to install them from one corner to another in alternate fashion. Avoid having the whole series of these internal 3/16" sq. balsa braces running in the same direction. Put in the rear motor beam anchorage bulkhead, which is shown on Plate 3. Carve the solid balsa section (over the windshield) from medium balsa: Install it, with a section removed from lower rear corner, against the ends of the upper longerons and the cross brace which has been previously cemented at this point. Permanent rigid bracing of the balsa block will be possible only after the 1/16" alum. tubing braces have been installed, when the nose formers are in place. The dotted lines around the edge of cabin windows and windshield indicate the single pieces or celluloid which are installed later, flush with fuselage surface, so that when fuselage is covered, they are perfectly flush with the surface.

In installing the wing panel fittings in fuselage, run 3/32" O.D. alum. tubing across fuselage, leaving ends projecting slightly on each side, so they may be spread with a center punch after passing through the square aluminum pieces which are cemented in position flush with the fuselage sides. Use cement freely in this installation. The tail post of the fuselage should now be cut to correct shape and installed, after first drilling three, holes through it to obtain negative adjustment on the stabilizer. (This model should not require any positive setting, but if such is needed, the holes in the front metal fittings on stabilizer can be elongated with a file.) The aluminum plates which are

installed on each side of the tail post are cemented in position flush, matching the holes drilled through the balsa. The aluminum tubing going through the fuselage for the stabilizer pins is 1/8" O.D. Each length is riveted over the small aluminum plates in the same manner as the wing panel fittings in the forward end of the fuselage. Before the sheet balsa filler on top of fuselage is cemented in place (section under fin) cut out and install an internal piece of 1/8" sheet stock also, which supports the lower ends of the 3/8" O.D. aluminum tubing into which the fin pins slide. Drill it with two 3/8" holes first, in proper positions. Now the top filler can be installed permanently, after first drilling it for the tubing. Cut two sections of the 3/8" O.D. aluminum tubing and install them, cementing securely at each joint with the balsa.

Before proceeding with building up the nose, the landing gear must be installed. Be sure that the 1/4" x 1/2" cross braces under fuselage frame, upon which the wire members of the landing gear are mounted, are installed very securely, and it is suggested that pins be run in for additional strength. Install the corner braces cut from sheet balsa, only after the wire has been installed on cross beams and securely bound with very heavy thread. Use the metallic cement here very generously; if it is done correctly, there is no reason for it to ever jar loose. The landing gear itself consists of three 1/8" piano wire frames, formed first to the correct spread and length. The front, side landing gear wire is the one which forms the axles. After installing on cross beams, connect the two side frames and the center shock - absorbing member together at the bottom, using small copper wire to bind the two joints together. Solder these well, allowing the flow of solder to form a good union. The balsa landing gear ribs will be presented in the second installment, as it is not necessary to put them in just yet.

Cut out the nose formers and install them at the correct locations. At this time the formers used on the removable hatch on top of fuselage should also be cut and installed. Now procure some hard balsa stringer stock, size 1 /16" x 1/8". The nose has quite a number of stringers, but these enhance the appearance greatly in this vicinity. As will be observed by looking at the assembly drawing, the completed stringer installation blends from a perfect circle at firewall out to almost square form at their termination point.

The firewall should now be made. It is shown full size on Plate 2 and is circular in form, being the same diameter as the engine cowl, 4-3/4". It should be formed from medium hard balsa having a thickness of 3/4". The rectangular motor beam holes are cut out by drilling with a 3/16" drill in the sections to be removed and using a coarse file or sandpaper on narrow block to procure the correct size and shape holes. Prepare the other necessary holes and the three studs upon which the cowl support rods are hung. Use 4-36 brass machine screws for these studs and get the correct length by cutting them off if necessary. Each should project 1/4" after sinking and cementing flush, from the rear side of the firewall. See assembly drawing for correct curving on edge of firewall. Cut four 3/16" aluminum tubing spacers and cement to firewall, near edge, as shown. The firewall may now be cemented to nose former N-1. Use an ample quantity of cement in attaching it securely. Now that the nose stringer installation is completed, the 1/16" aluminum tubing bracing can be installed between the top section of former N-3 and the solid balsa block over windshield.

In making the engine mounting beams, use high grade wood only, as a lot depends on this material. The writer feels that hardwood beams are far superior to a metal motor mounting, from personal observation. A metal mounting can only bend and collapse while the hardwood beam type absorbs all sudden shocks to which it may be subjected, provided it has the required "spring" in it. Black walnut makes an ideal mounting material, having the required "spring" and being a tough, hard-to-split wood. Maple also is excellent. Cut two pieces, size 3/16" x 15/16" x 7-3/4". In installing them, use metallic cement and make sure that all joints are very solid. Drill all holes necessary for metal mounting plates before installing the wooden beams in fuselage.

Use 1/16" sheet balsa for making the cabin floor and the vertical bulkhead which is installed at the rear end of the cabin. It is not necessary to cover the sides of the cabin interior unless desired. The motor mount bulkhead MM forms the enclosure for the front end of the cabin.

The stringers on the main part of the fuselage should now be made. They are cut from 1/16" sheet balsa and must have a curve as shown on assembly drawing. The top of the fuselage has five stringers, while the sides and bottom have three, respectively. The top stringer on each side of the fuselage is terminated where the tail surfaces begin, when in place, as shown. Soft balsa is sufficient for this fairing work. Now that the fuselage is practically completed, the removable hatch over the cabin should be constructed. Formers F-1 and F-2 are at each end, and 1/8" sq. balsa bracing is installed diagonally. Dress snaps are installed with cement flush with the surfaces. The switch and booster socket panel, as described on Plate 3, is installed where indicated on drawing. Any electrical supply or department store can supply a small "button" switch. It will be necessary to paint two sections on opposite sides of the revolving button, to show when switch is on or off. This switch is obtainable at a nominal price and is small in size,

insuring a neat switch installation. So many gas jobs are spoiled by using a cumbersome, large toggle or throw switch, when a "button" type could be used just as readily. The wiring of the ship and the battery box detail will be discussed in the next installment.

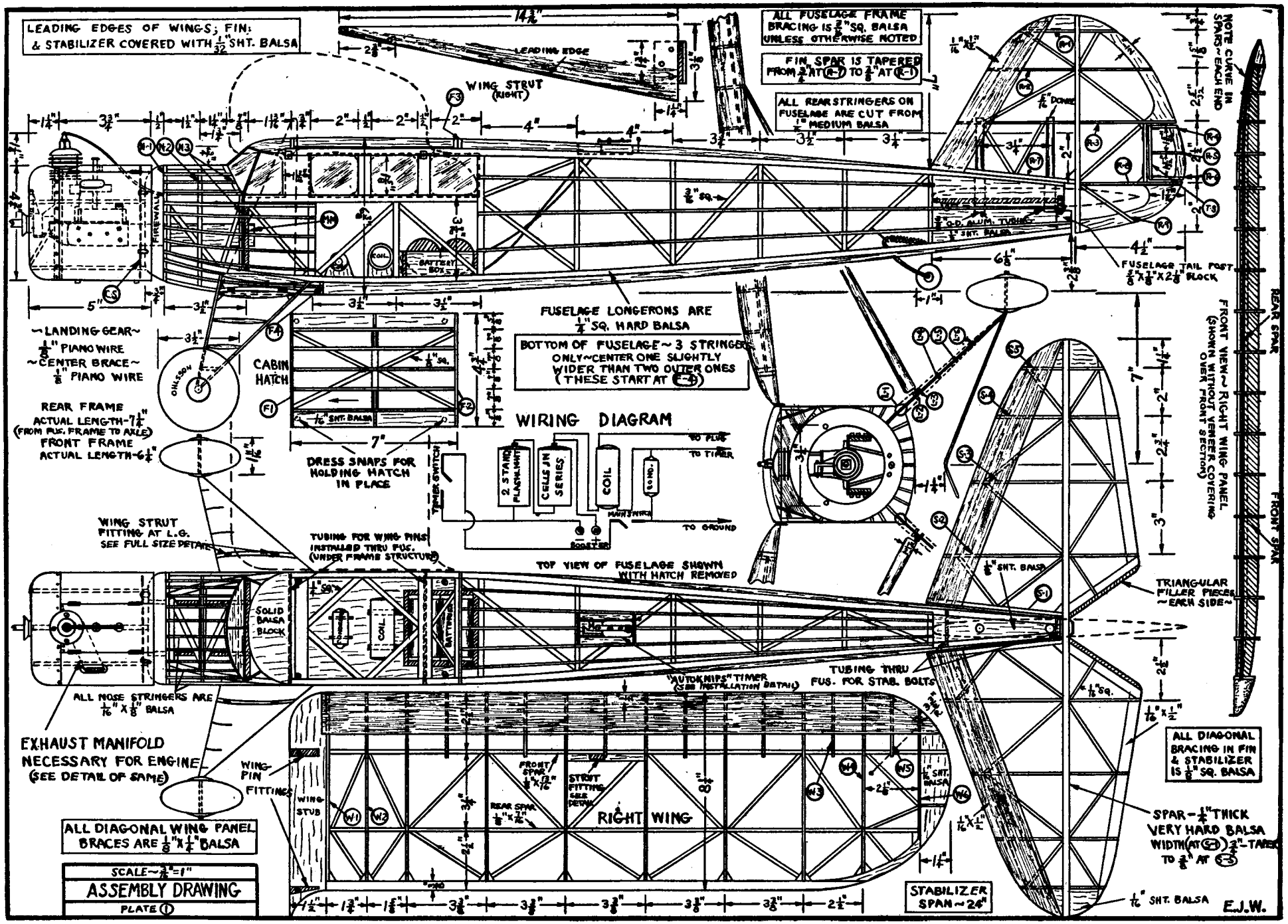
The flight timer and timer switch installation should prove self-explanatory. See Plates 1 and 2 for this detail. This timer is obtainable from the same concern which manufactures the engine used in this model.

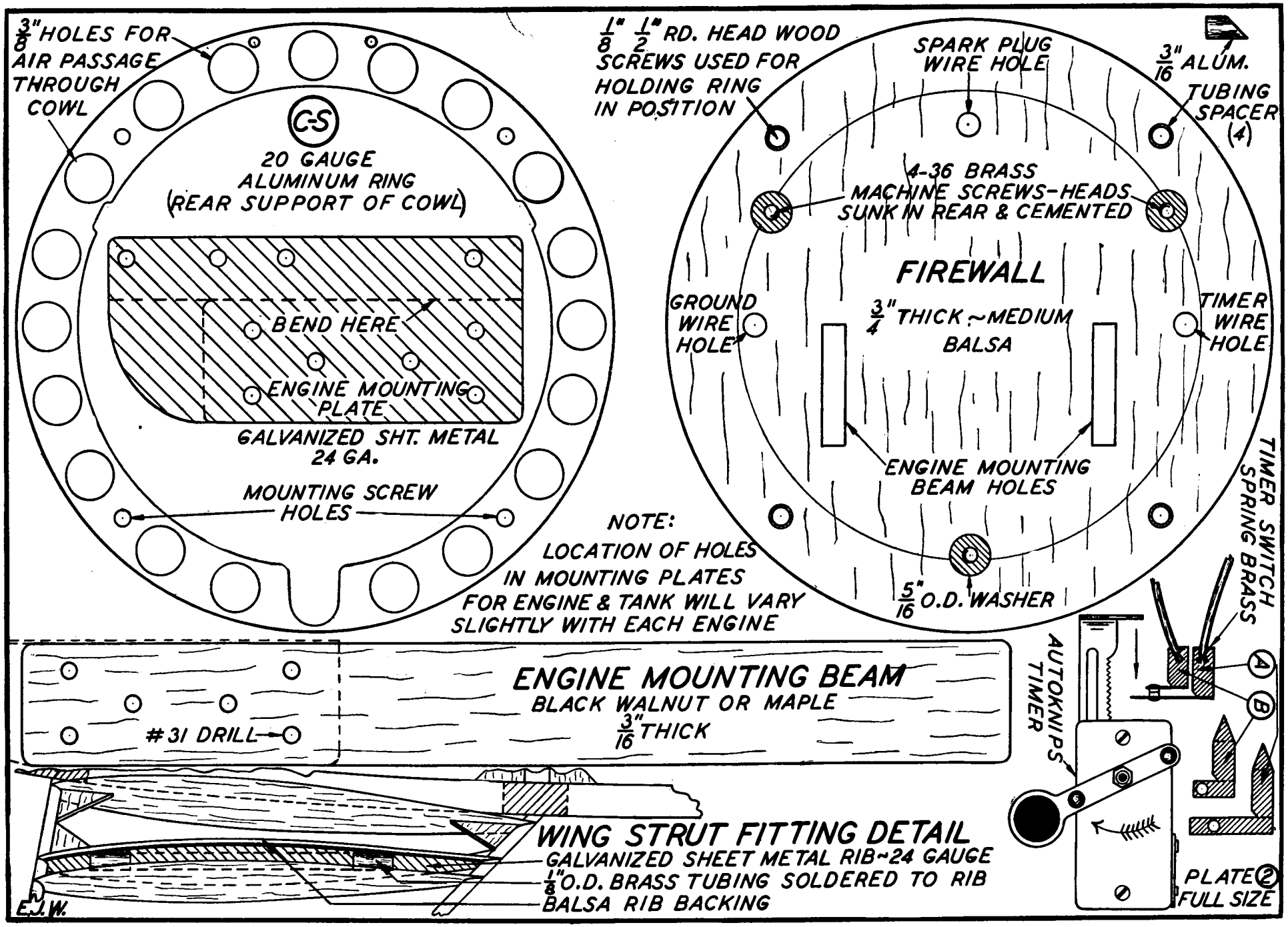
The tail wheel unit is a simple fork of 1/16" piano wire which pivots on a piano wire cross-arm, installed across the two lower longerons at the point shown. A spring is now fastened to the tail wheel fork and secured a little to the rear, in the fuselage, at the other end. Be sure spring is of right type. It should be fairly stiff in action.

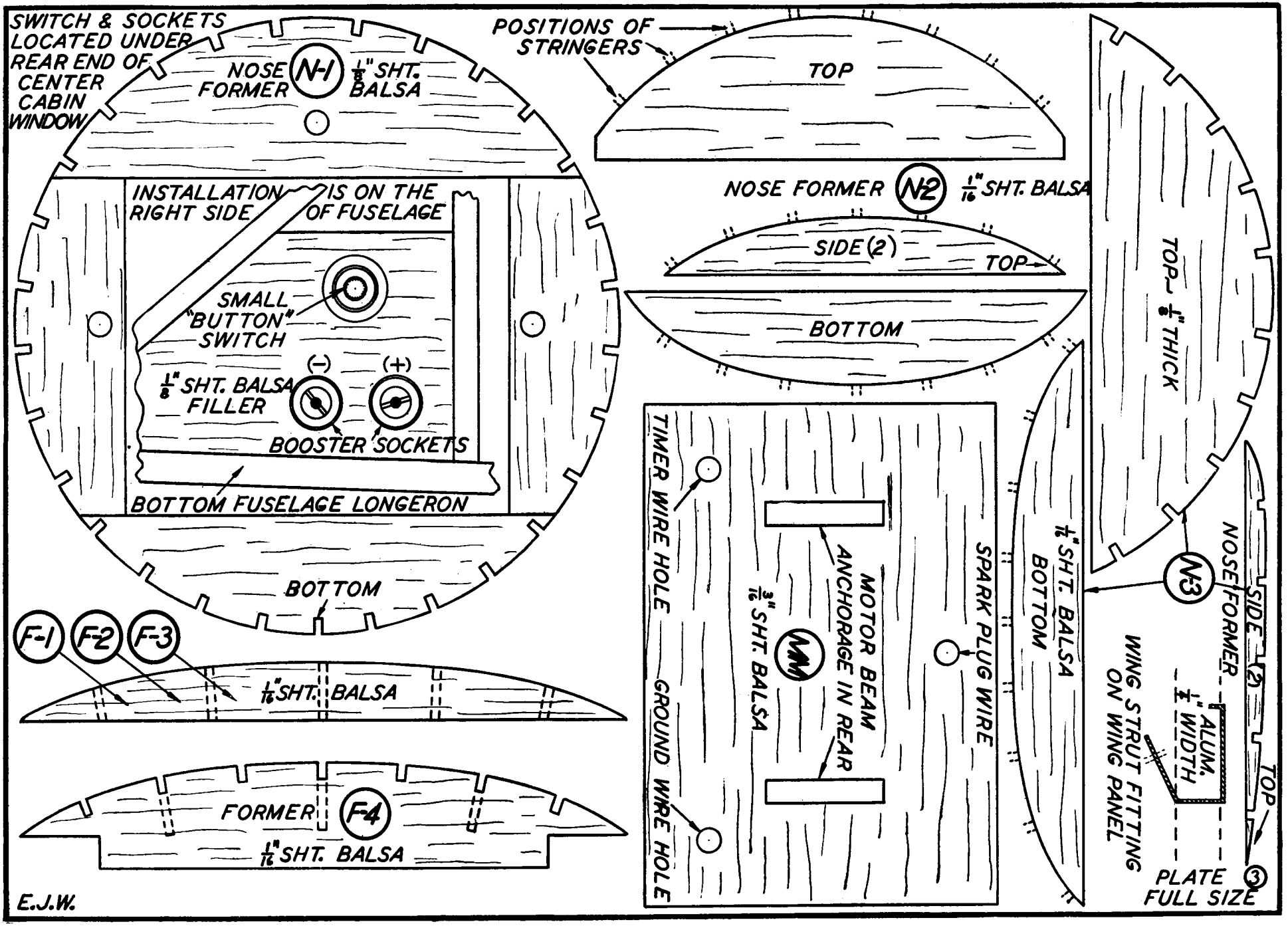
The cabin windows are put in later. The original model has its cabin painted with a dark color dope to remove the "raw wood" appearance. It improves any gas job greatly and may be done at this time.

The fuselage should now be practically complete and should be lightly sandpapered to remove any drops of excess cement, etc., so it will be smooth when covered. All marks left by a circular saw where balsa has been stripped should be sanded out.

Next month the engine cowl, tail surfaces, wing panels and remaining details will be described.


LEADING EDGES OF WINGS; FIN; & STABILIZER COVERED WITH 1/32" SHT. BALSA
ALL FUSELAGE FRAME BRACING IS 1/8" SQ. BALSA UNLESS OTHERWISE NOTED
FIN SPAR IS TAPERED FROM 2 1/2" AT (R-7) TO 1/8" AT (R-1)
ALL REAR STRINGERS ON FUSELAGE ARE CUT FROM 1/16" MEDIUM BALSA
NOTE CURVE IN SPARS ~ EACH END
WING STRUT (RIGHT)
LEADING EDGE
FIREWALL
COIL
BATTERY
3/8" SQ.
3/8" O.D. ALUM. TUBING
1/16" SHT. BALSA
FUSELAGE TAIL POST 5/8" X 1/8" X 2 1/8" BLOCK
FUSELAGE LONGERONS ARE 1/4" SQ. HARD BALSA
BOTTOM OF FUSELAGE ~ 3 STRINGERS ONLY ~ CENTER ONE SLIGHTLY WIDER THAN TWO OUTER ONES (THESE START AT (F-4))
~LANDING GEAR~ 1/8" PIANO WIRE ~CENTER BRACE~ 1/8" PIANO WIRE
CABIN HATCH
REAR FRAME ACTUAL LENGTH-7 1/4" (FROM FUS. FRAME TO AXLE)
FRONT FRAME ACTUAL LENGTH-6 1/4"
DRESS SNAPS FOR HOLDING HATCH IN PLACE
WIRING DIAGRAM
TO PLUG
TO TIMER
2 STAND. FLASHLIGHT
CELLS IN SERIES
COIL
SW.
TIMER SWITCH
MAIN SWITCH
TO GROUND
BOOSTER
WING STRUT FITTING AT L.G. SEE FULL SIZE DETAIL
TUBING FOR WING PINS INSTALLED THRU FUS. (UNDER FRAME STRUCTURE)
SOLID BALSA BLOCK
TOP VIEW OF FUSELAGE SHOWN WITH HATCH REMOVED
FRONT VIEW ~ RIGHT WING PANEL (SHOWN WITHOUT VENEER COVERING OVER FRONT SECTION)
REAR SPAR
FRONT SPAR
TRIANGULAR FILLER PIECES ~EACH SIDE~
1/8" SHT. BALSA
ALL NOSE STRINGERS ARE 1/16" X 1/8" BALSA
"AUTOKNIPS" TIMER (SEE INSTALLATION DETAIL)
TUBING THRU FUS. FOR STAB. BOLTS
EXHAUST MANIFOLD NECESSARY FOR ENGINE (SEE DETAIL OF SAME)
WING-PIN FITTINGS
WING STUB
FRONT SPAR 1/8" X 1/2" X 16"
REAR SPAR 1/8" X 7/16"
STRUT FITTING SEE DETAIL
RIGHT WING
1/16" SQ.
1/16" X 1/2"
ALL DIAGONAL BRACING IN FIN & STABILIZER IS 1/16" SQ. BALSA
ALL DIAGONAL WING PANEL BRACES ARE 1/8" X 1/4" BALSA
SPAR ~ 1/4" THICK VERY HARD BALSA WIDTH (AT (S-1)) 3/4" ~ TAPER TO 1/8" AT (S-3)
STABILIZER SPAN ~ 24"
1/16" SHT. BALSA
SCALE ~ 1/16" = 1"
ASSEMBLY DRAWING
PLATE (1)
E.J.W.


3/8" HOLES FOR AIR PASSAGE THROUGH COWL
C-S
20 GAUGE ALUMINUM RING (REAR SUPPORT OF COWL)
BEND HERE
ENGINE MOUNTING PLATE
GALVANIZED SHT. METAL 24 GA.
MOUNTING SCREW HOLES
1/8" 1/2" RD. HEAD WOOD SCREWS USED FOR HOLDING RING IN POSITION
SPARK PLUG WIRE HOLE
3/16" ALUM. TUBING SPACER (4)
4-36 BRASS MACHINE SCREWS-HEADS SUNK IN REAR & CEMENTED
FIREWALL
3/4" THICK ~ MEDIUM BALSA
GROUND WIRE HOLE
TIMER WIRE HOLE
ENGINE MOUNTING BEAM HOLES
5/16" O.D. WASHER
NOTE: LOCATION OF HOLES IN MOUNTING PLATES FOR ENGINE & TANK WILL VARY SLIGHTLY WITH EACH ENGINE
#31 DRILL
ENGINE MOUNTING BEAM
BLACK WALNUT OR MAPLE
3/16" THICK
WING STRUT FITTING DETAIL
GALVANIZED SHEET METAL RIB ~ 24 GAUGE
1/8" O.D. BRASS TUBING SOLDERED TO RIB
BALSA RIB BACKING
E.J.W.
AUTOKNIPS TIMER
TIMER SWITCH SPRING BRASS
A
B
PLATE (2) FULL SIZE


SWITCH & SOCKETS LOCATED UNDER REAR END OF CENTER CABIN WINDOW
NOSE FORMER N-1 1/8" SHT. BALSA
INSTALLATION IS ON THE RIGHT SIDE OF FUSELAGE
SMALL "BUTTON" SWITCH
1/8" SHT. BALSA FILLER
(-)
(+)
BOOSTER SOCKETS
BOTTOM FUSELAGE LONGERON
BOTTOM
F-1
F-2
F-3
1/16" SHT. BALSA
FORMER F-4
1/16" SHT. BALSA
POSITIONS OF STRINGERS
TOP
NOSE FORMER N-2 1/16" SHT. BALSA
SIDE (2)
TOP
BOTTOM
TIMER WIRE HOLE
GROUND WIRE HOLE
MOTOR BEAM ANCHORAGE IN REAR
3/16" SHT. BALSA
M-M
SPARK PLUG WIRE
1/4" SHT. BALSA BOTTOM
TOP 1/8" THICK
NOSE FORMER N-3
SIDE (2)
1/2" ALUM. WIDTH
WING STRUT FITTING ON WING PANEL
TOP
PLATE FULL SIZE
3
E.J.W.