

# ASYMMETRICAL PUSHER

by HENRY COLE, Jr.

**A**LTHOUGH this model is definitely out of the rut, it was not built just to be different. The most singular feature, the offset boom and asymmetrical tail, is the practical solution to many problems of pusher design.

In previous designs with a twin-boom arrangement the left-hand boom was in the way for cranking and the booms were difficult to align and detach. At this point we began to wonder: Why not remove the left-hand boom? The cross section of the right boom could be enlarged to provide a rigid support for the tail surfaces, and this would count as fuselage cross section under AMA rules. The single boom would need only one detachment point for transporting. But in theory the drag of the boom would tend to turn the model to the right, and the weight of the boom would shift the center of gravity (c.g.) to the right of the thrust line, which would turn the model to the right under power. (See Fig. 1.) This meant that drag and weight would be put to use to obtain desirable flight characteristics, and less rudder and thrust adjustments would be needed. Therefore, the efficiency of this arrangement would be higher than that of conventional designs for circling flight!

However, the shifting of the c.g. to the right required that the area of the right wing be increased to place the center of lift (c.l.) in line with the c.g. The c.l. of the stabilizer was also placed in line with the c.g. so that rolling moments would not be induced with changes in angle of attack. The rudder was built off-center because it serves as an end plate and increases stabilizer efficiency.

The one difficulty in the design was that the weight of the boom would cause a larger c.g. shift to the right than desired for a spiral climb. Hence, the boom weight was partially counterbalanced by mounting the engine on the side.

The main problem is adapting the engine for pusher use. Since the thrust is reversed, a thrust bearing should be installed between the prop and main bearing so that the crankshaft will not be forced out of line. The engine rotation should be reversed to allow use of conventional props. To accomplish this, change the timing so that the points break just before the piston reaches top dead center when the crankshaft is rotated clockwise. Engines with rotary valves cannot be reversed without changing the valve timing. An engine may be supercharged by directing air into the intake from an air-scoop, but the force of the airstream must also be directed to the gas tank or the engine will lean out in flight.

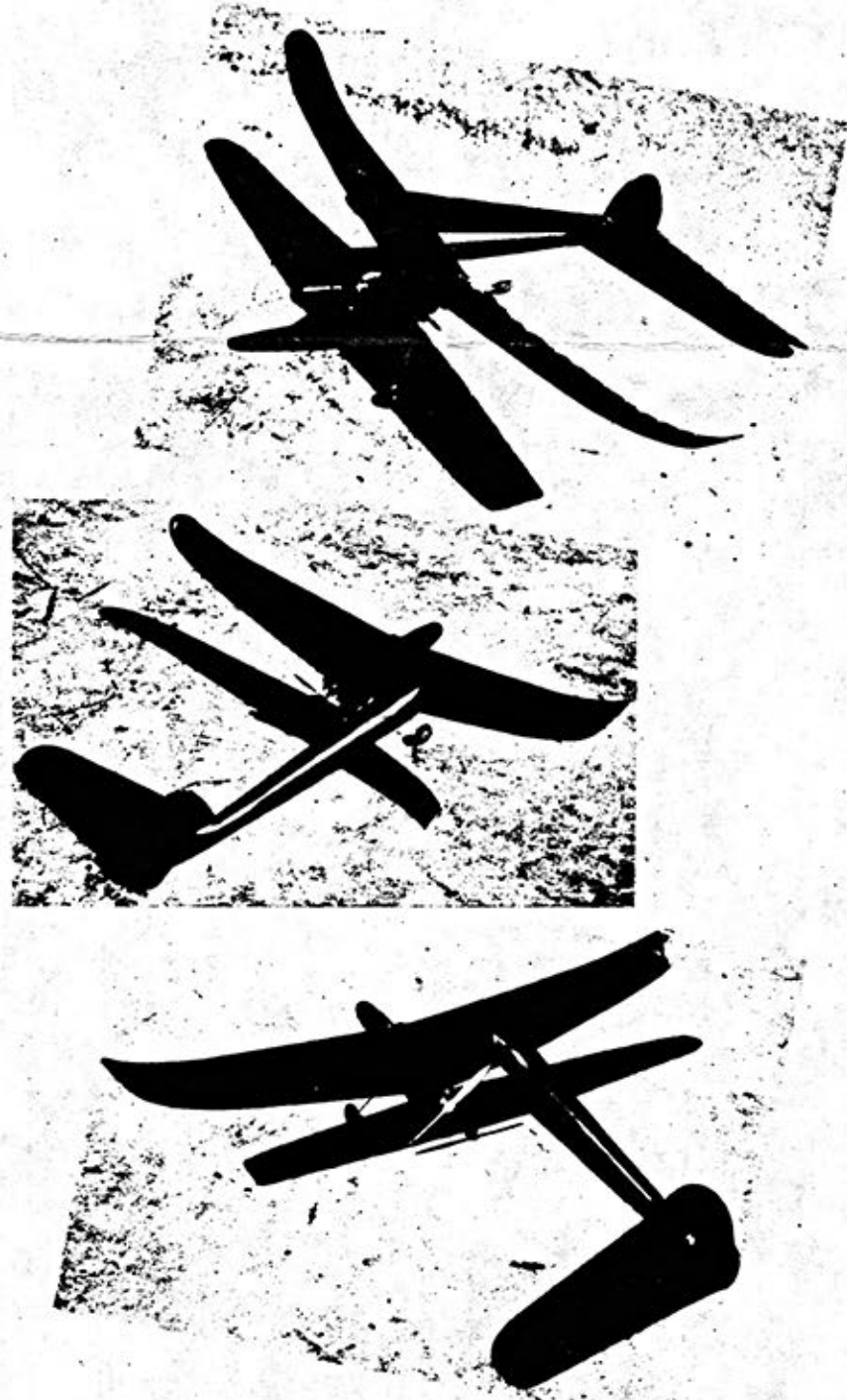
The engine on this ship was an Ohlsson "23," but other engines may be adapted to the design. A metal gas tank was fitted to allow the use of hot fuels, and a special exhaust stack was made to direct the exhaust gases aft.

**Construction:** Wing spars are cut from sheet balsa and tapered as shown on the plans. The ribs are cut with a single template by cutting the bottom camber first, then rotating the template to give the right thickness at the trailing edge. This is done by pushing a pin through the template and sheet near the leading edge as a pivot point. By this method tapered wing ribs may be cut as easily as the constant chord type. Assemble the wing and sand to a smooth contour, then lay the center spar over the top of the ribs and mark the edges. Cut notches  $\frac{3}{16}$  inch deep to fit. Glue center spar in place and glue  $\frac{1}{16}$  inch square strips to fill space at the top of the ribs. A tapered wing is more difficult to build than a constant chord one, but the strength, light weight, and good looks obtained are well worth the extra work.

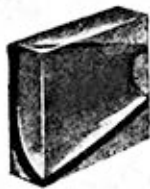
The elliptical tips are worthy of special mention. The spars are constructed by cutting  $\frac{1}{32}$  inch strips of spar planform and bending them around pins along the dihedral outline. Four strips bonded together with glue make up a laminated spar which is strong and retains its shape. Elliptical wing tips are more effective than poly-dihedral wings and have lower drag.

The boom is made by bending four pieces of soft  $\frac{1}{16}$  inch sheet about a skeleton framework. Stabilizer attachment (Turn to page 121)

A MOST UNUSUAL AND INTERESTING DESIGN  
WITH A KNACK FOR ATTRACTING SPECTATORS



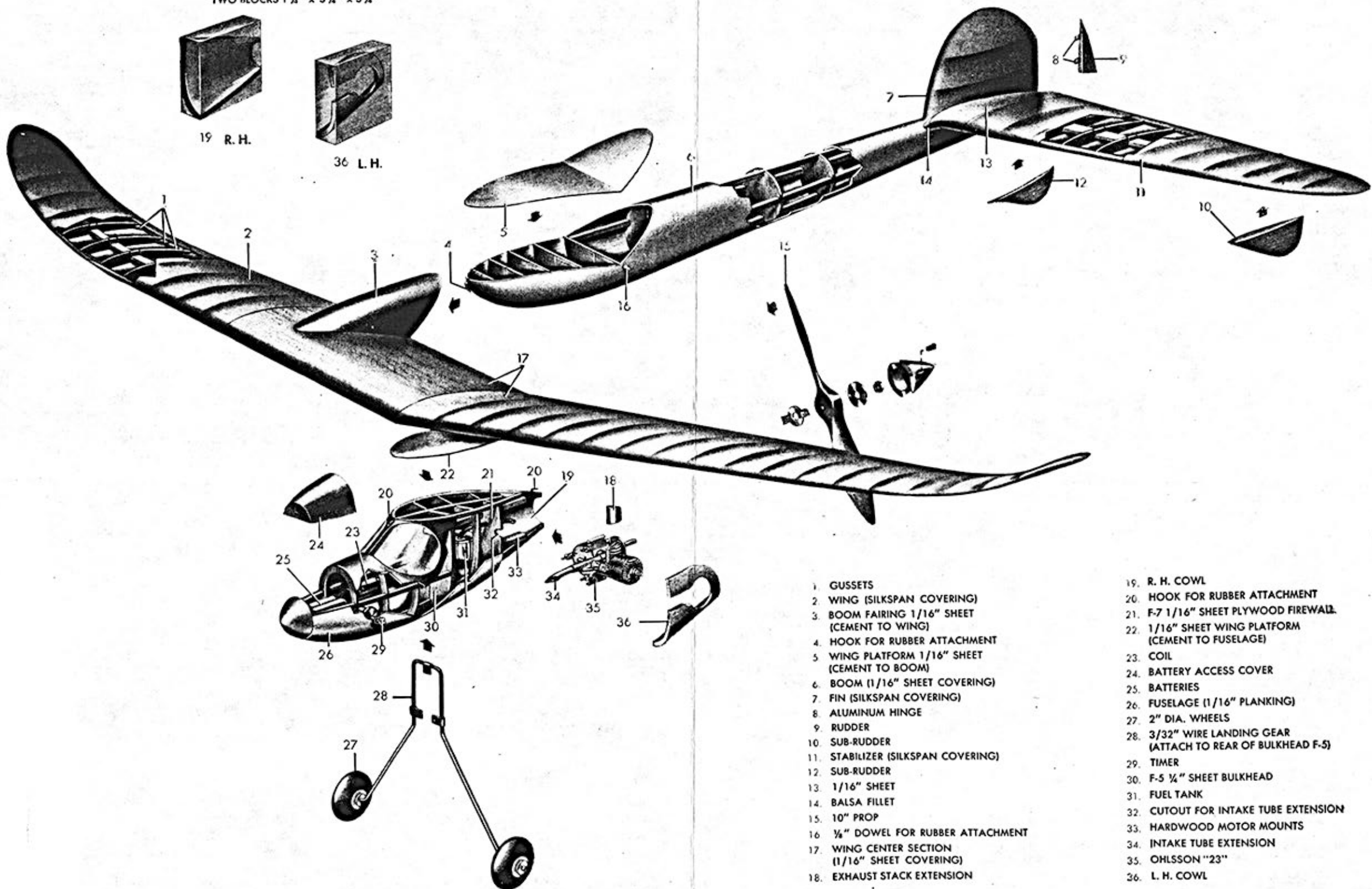
**COWL DETAILS**  
TWO BLOCKS 1 1/4" x 3 1/4" x 3 1/4"



19 R. H.



36 L. H.



1. GUSSETS
2. WING (SILKSPAN COVERING)
3. BOOM FAIRING 1/16" SHEET (CEMENT TO WING)
4. HOOK FOR RUBBER ATTACHMENT
5. WING PLATFORM 1/16" SHEET (CEMENT TO BOOM)
6. BOOM (1/16" SHEET COVERING)
7. FIN (SILKSPAN COVERING)
8. ALUMINUM HINGE
9. RUDDER
10. SUB-RUDDER
11. STABILIZER (SILKSPAN COVERING)
12. SUB-RUDDER
13. 1/16" SHEET
14. Balsa FILLET
15. 10" PROP
16. 1/4" DOWEL FOR RUBBER ATTACHMENT
17. WING CENTER SECTION (1/16" SHEET COVERING)
18. EXHAUST STACK EXTENSION

19. R. H. COWL
20. HOOK FOR RUBBER ATTACHMENT
21. F-7 1/16" SHEET PLYWOOD FIREWALL
22. 1/16" SHEET WING PLATFORM (CEMENT TO FUSELAGE)
23. COIL
24. BATTERY ACCESS COVER
25. BATTERIES
26. FUSELAGE (1/16" PLANKING)
27. 2" DIA. WHEELS
28. 3/32" WIRE LANDING GEAR (ATTACH TO REAR OF BULKHEAD F-5)
29. TIMER
30. F-5 1/4" SHEET BULKHEAD
31. FUEL TANK
32. CUTOUT FOR INTAKE TUBE EXTENSION
33. HARDWOOD MOTOR MOUNTS
34. INTAKE TUBE EXTENSION
35. OHLSSON "23"
36. L. H. COWL