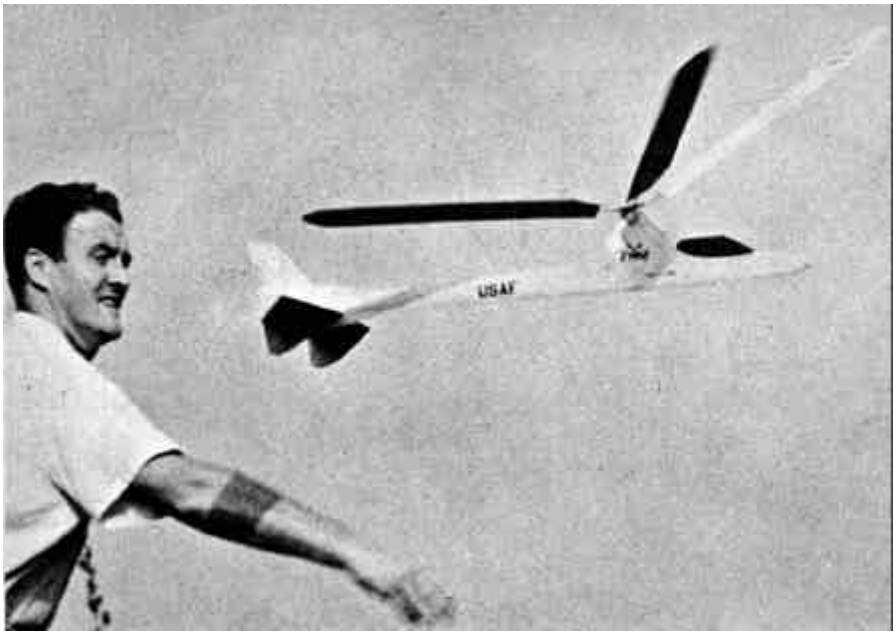
GYRO-Glider

by PAUL E. DEL GATTO

What is it? Glider? Kite? Or Gyro, like the man says? It is heavier-than-air, anyway. Different—but flies swell.



This may look like the old heave-ho but test glide really was quite gentle. If craft turns

Right, increase washout or negative tip angle. Left turn, vice versa. All wood, no paper.

Our enthusiasm for a gyro-glider was stimulated by the fact that we had seen or heard very little about such a variation on the autogyro. Possibilities were great.

Having had some experience with gas- and Jetex-powered autogyros, we did not anticipate trouble with such a gyro-glider. But what surprises were in store! Having completed the model, we ran into many disturbing problems, which required all kinds of modifications, before the model was stable and performance satisfactory.

The first problem was structural and required building a stronger fuselage, and using a stronger rotor assembly to minimize the flexing of the rotors and to eliminate tail flutter. Needless to say, these primary changes made our first test session a disappointment. However, from that time things got progressively better. Successive testing resulted in modifying the fin and stab assemblies, which were previously a little too large. Towing the model, which at first proved inconsistent, soon improved through successive flight tests and modifications.

One important factor in a good gyro design is a freely rotating rotor assembly with as little friction as possible. This is even more important in a glider because of the absence of a propeller, which can he utilized to help spin the rotors faster. The arrangement shown is perhaps as good a combination of simplicity and efficiency.

CONSTRUCTION: Begin with the rotor-mast assembly. The rotor mast itself is bent from .072" dia. wire and recessed into a 3/32" sheet-balsa center. The pylon sides and fairing are then cemented to it and the sheet balsa fairings are also added. This arrangement takes abuse and holds together very well.

Cut out the main part of the fuselage from 3/8″ hard sheet balsa, also the cabin and pylon fairings. Cement the basic *(Continued on page* 56)

Holding the gyro nose-up into the wind, Paul waits for the rotor blades to pick up rotational speed and lift before making an easy test glide. Can you fly this thing like kite?

And away she goes! The autogyro was machine of the future—until the helicopter appeared.

Gyro-Glider

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profile together before attempting to do any shaping. When dry, make a cut out at the nose and inset approximately one ounce of ballast in the form of lead or some other heavy metal. Then cement the nosepieces in position. When the assembly has thoroughly dried, trim down the entire structure using a modeler's knife, smooth-sanding to complete.

Construction of the cambered stabilizer may be a new experience for you, but should not be too difficult. Begin by cutting out the stab ribs which serve to maintain the camber and act as stiffeners. Select 1/16" medium sheet balsa for the stab, that has a moderate amount of flexibility, sufficient enough to take the shallow curve without undue strain. Cut out the flat outline, following approximately 1/16" for the curve (note on the drawing the dimension 2 x 15/16", after bending; use a 3" wide sheet on this portion). Add a thin coat of clear dope to what will be the underside of the stab and work in the camber while it is drying. When this is done cement the ribs in their respective positions to accurately maintain the same camber on both sides. Round off the leading and trailing edges with sandpaper and cement in position on the fuselage.

The fin, rudders and dorsal assembles are all blanked out from 3/32" sheet balsa. Smooth-sand them to a streamline cross-section for lighter weight and less drag. Then cement them in their respective positions. Note that the tip rudders serve as a tip rib for the stab as the proper camber is automatically provided.

The heart of the design is, of course, the rotor assembly, and care should be taken to obtain a smoothly operating and structurally sound assembly. Begin by cutting the rotor hub to shape from 1/32" brass, or any comparable metal to which the rotor arms can be soldered. The rotor arms themselves are bent from .072" dia. wire; do not attempt to use a heavier gauge of wire; if this size is unavailable go down as low as 1/16" if necessary. Solder the rotor arms as indicated on the drawing. Be sure to obtain a suitable bond between both surfaces, which will permit you to make extensive adjustments to the rotor arms. If you should experience some difficulty, then we would suggest drilling a few small holes on the hub through which you can pass some soft copper wire binding to increase the strength of the bond. When this has been completed, add the approximate amount of twist as indicated in the drawing.

The rotor blades are then blanked out from 1/8″ hard sheet balsa. In selecting the sheet though, use balsa that has some degree of flexibility. Blank out the rotor outlines, then rough-shape them to the desired cross-section with a modeler's knife. Sand them smooth to complete. Then, at the hub put a groove on the bottom of each rotor blade, where the rotor arm is to be affixed. Recess each rotor blade about half way and then cement them in position on the rotor arms. Then recess the 3/32" hard sheet balsa doublers similarly and cement them to the bottom of the rotor blade, completely enclosing the rotor arm. Sand the doublers to a streamlined cross-section.

To complete the rotor assembly, cement a large face eyelet to the top of the rotor pylon. Then add several flat washers with a ball bearing washer between them, and place the rotor blade assembly on the mast. To retain the blades on the mast, solder a small face eyelet on top of it with sufficient space to permit free rotation with a minimum of friction.

For a finish—use four coats of thinned clear dope, smooth-sanding between each coat. To enhance appearance—trim all the leading edges with two coats of orange-yellow and add a few decals.

FLYING: Check the model for balance before attempting any flights whatsoever. If the center of gravity is not in the approximate position shown, then add some clay ballast to the nose, as most likely the plane is tail heavy.

Begin flight-testing with several glides. To do this, spin the rotor and hold the model at a high angle to the air stream to speed up its rotation. When the rotors have started to spin rapidly, just ease the model gently out of your hands. Do not heave it as you would a conventional free-flight model.

If the model has a sharp turning tendency to the right, this indicates that there is too much lift on the left side, and necessitates that we increase the negative angle of twist in the rotors. The reverse is true if there is too much left turn. If the model should have a tendency to fall backwards after launching, this indicates that the model is stalling and can be trimmed by warping the stab down slightly or adding additional ballast to the nose in the form of clay. Try to achieve a glide at least with some forward speed for the initial test. If the model has a hovering descent you may find it a little difficult on the towline to begin with. In towing the model, observe the weather. If there is a prevailing wind, which will speed up the rotation of the blades rapidly, it is not likely you would have to move from your spot while the model is being towed up. In dead calm air a rapid walking pace should be sufficient to tow the model up satisfactorily.

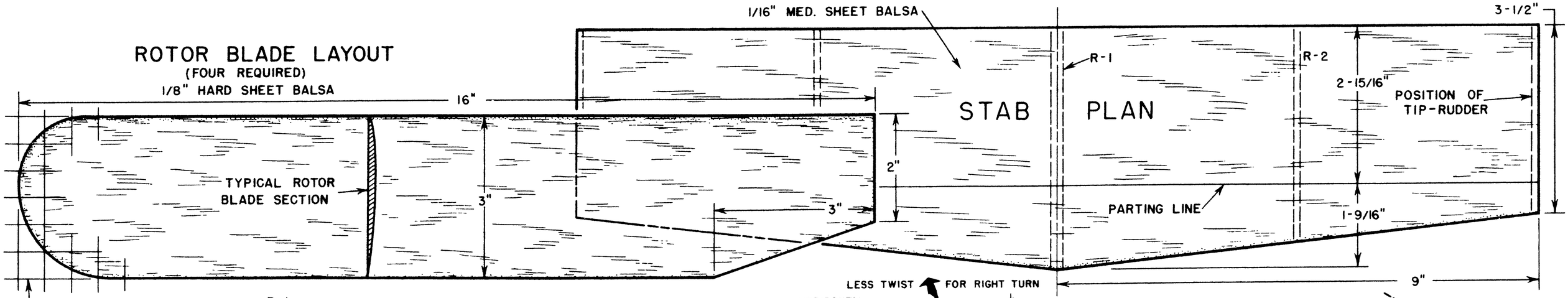
Once you have reached this point in flight-testing, the performance of the model will depend largely on your ability to tow the model properly; as it would for any other conventional model. Properly trimmed, the model is no more difficult to handle than a conventional airplane.

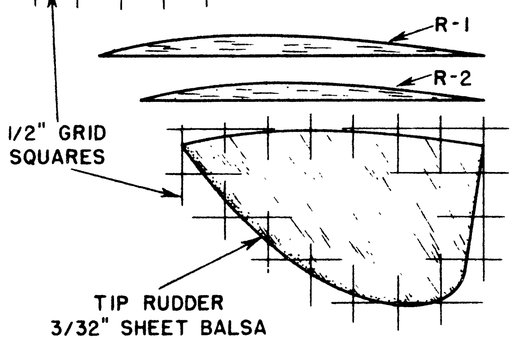
BILL OF MATERIALS (Balsa unless otherwise specified): 1-3/8" x 3" x 36" (hard), fuselage; 1-1/16" x 3" x 36" (med.), stabilizer, fuselage, nose pieces; 1-3/32" x 3" x 36" (hard), fin and rudders; pylon center, doublers, stabilizer ribs; 3-1/8" x 3" x 36" (hard), rotor blades, pylon sides, and fairings; .072" dia. wire for rotor mast and arms, .040" dia. wire tow hooks, 1/32" brass for rotor hub, cement, clear and colored dope, large face eyelets, ball bearing and flat washers, lead ballast, decals.

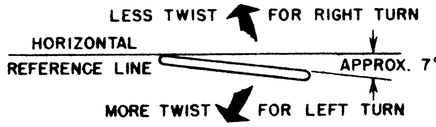
ROTOR BLADE LAYOUT

(FOUR REQUIRED)

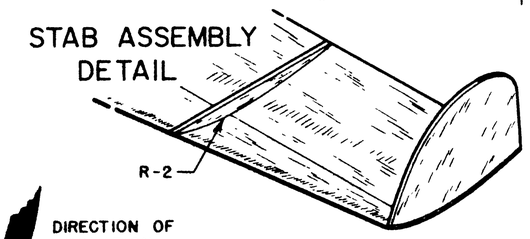
1/8" HARD SHEET BALSA

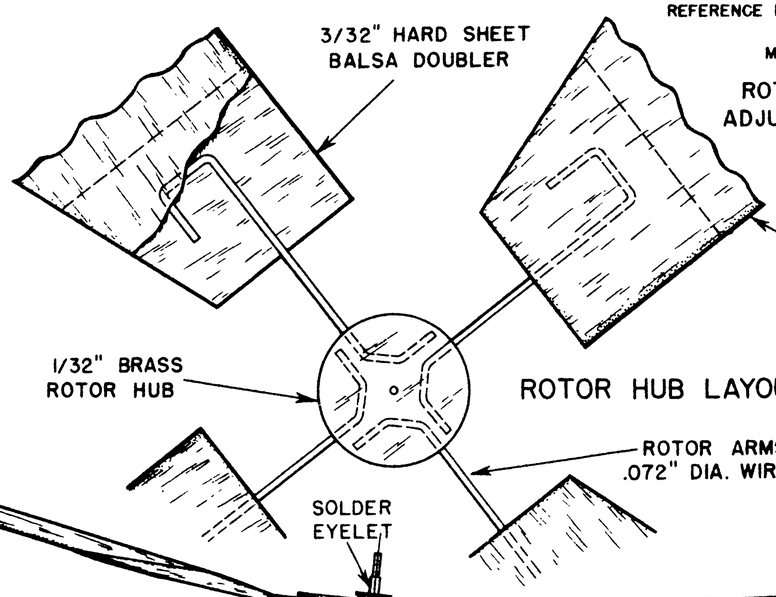




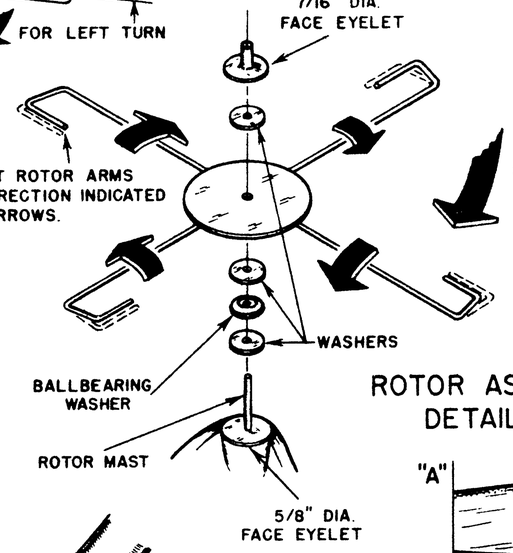


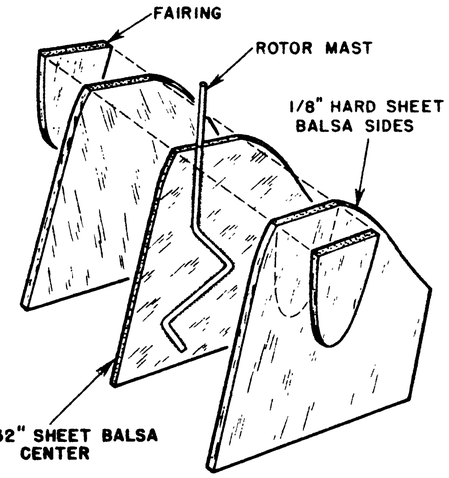
ROTOR ARM ADJUSTMENT

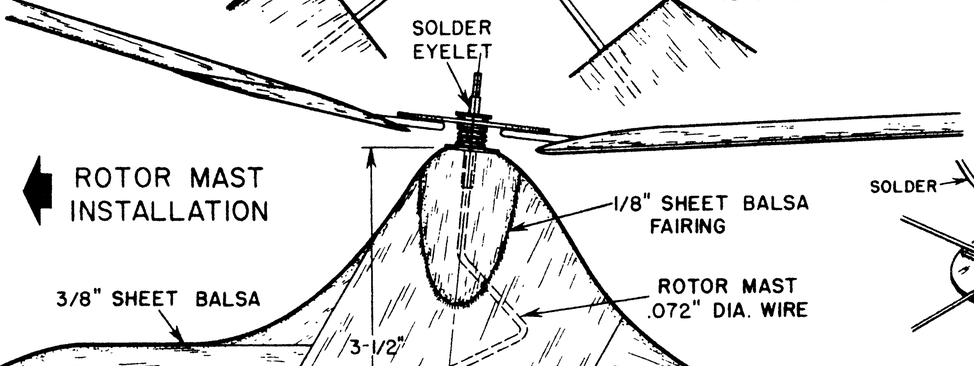


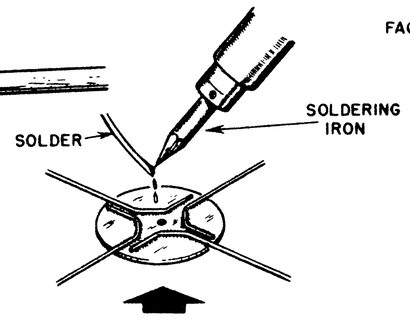


ROTOR HUB LAYOUT

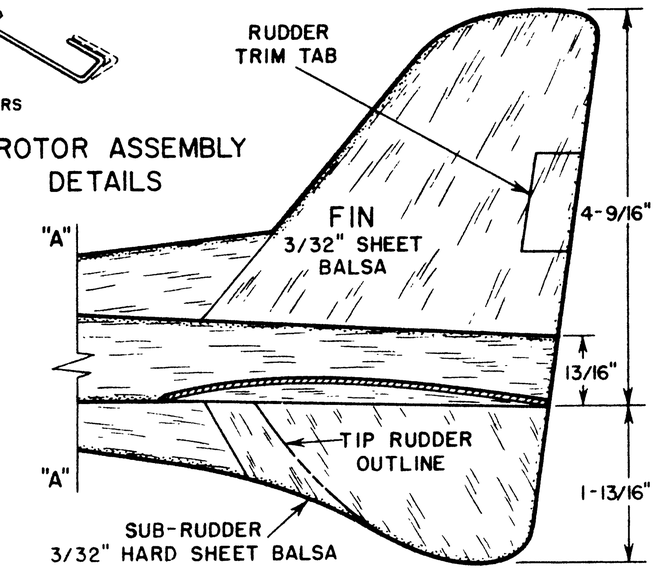




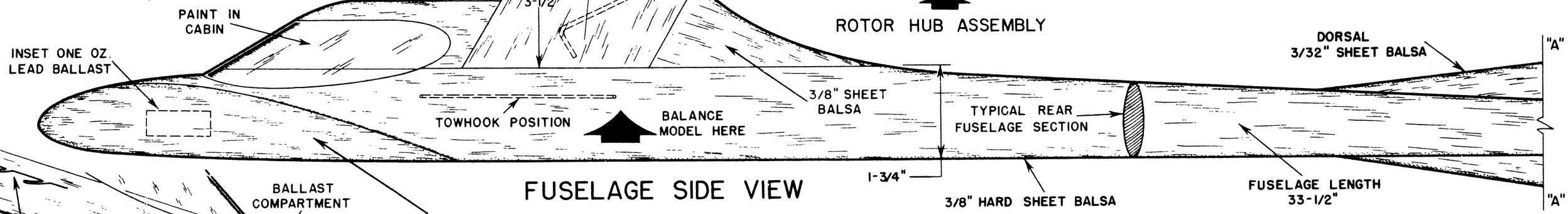




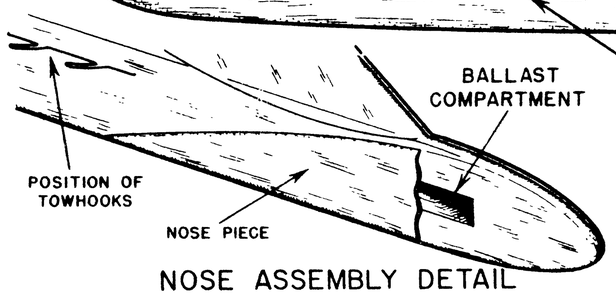
ROTOR HUB ASSEMBLY



ROTOR ASSEMBLY DETAILS

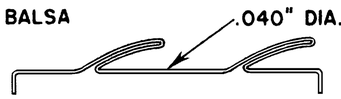


FUSELAGE SIDE VIEW



NOSE ASSEMBLY DETAIL

NOSE PIECES 1/16" HARD SHEET BALSA



TOWHOOK LAYOUT

SCALE IN INCHES

0 1 2 3 4 5 6 7 8 9 10 11 12