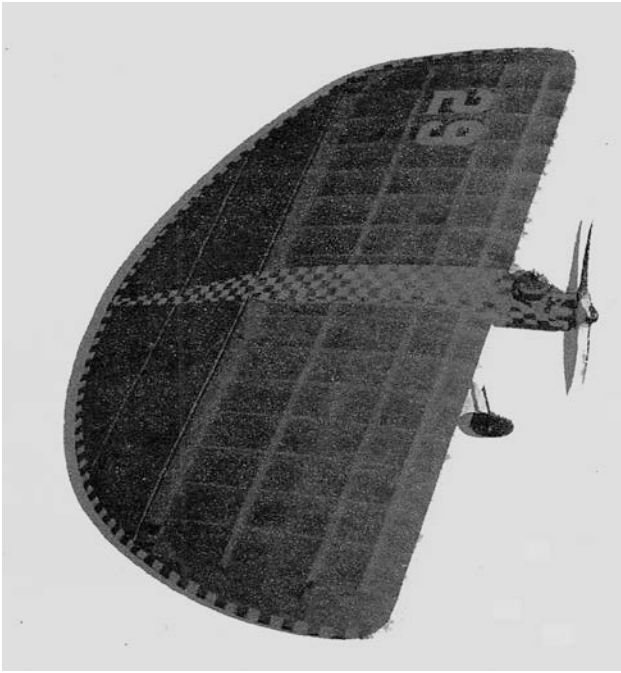


## Aces



**AT's designing doodlers come up with some refreshing new stunters including one Italian winner by M. Denker.**

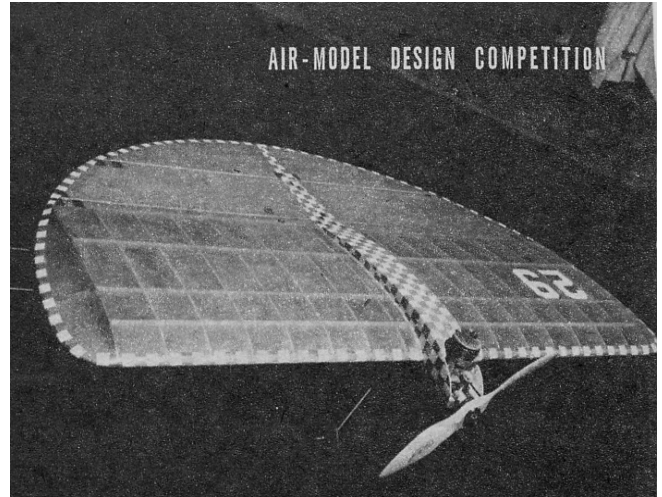
Early stunt models were nothing but trainers for speed flyers. Most of them required a tremendous amount of sky room to perform loops. The wing just was not able to generate enough lift to counteract the centrifugal force encountered in smaller loops.

In time, the designers realized that a low wing loading (lots of wing area for the weight) was needed for tight and easy maneuvers. In conjunction with a low wing loading, the stabilizer moment arm was also shortened. So, many present day designs have the stabilizer practically on the wing's back porch.

Theoretically, this design evolution follows a sound aerodynamic principle.

In adhering to the ideal of low- weight and lots of wing area, what could be more natural than a flying wing plan outline? Hence the reason for selecting as outstanding the stunt design submitted by James M. Denker, Egypt. Mass.

The only additional suggestion that the committee can offer in conjunction with this design is that a dolly take off would eliminate the weight off the landing gear.



**Top design this month is from Egypt (Massachusetts) and can turn on a dime.**

A flying wing used as a free flight design is very touchy about power or speed changes. A speed just a bit higher than the glide would mean a loop. But on control flying wings, the flyer can easily "adjust" the wing to generate the amount of lift required at any particular moment.

Normally, the wings we have seen have a single elevator or one flap. This arrangement more or less means a sharp break of surface which may contribute more than a reasonable amount of drag. Note how Mr. Denker solved this problem by an elevator-flap combination linked to produce a gradual curve like that of a true airfoil. This idea might also work out well on regular or standard stunt models. In most current cases the elevator has to move through a large angular moment to obtain the required results.

In many ways, the flying wing stunt model is in its infancy. The very nature of using down elevator to obtain a nose down, and an up movement to obtain a loop, is an awkward way of doing business. If you look at the situation, you will see that we are forming an under cambered airfoil to develop low lift, and form a reflex trailing .edge type to obtain high lift. This just the opposite to full scale practice. However, for the moment, this is the only way we have to bring about conditions which will make the model perform the maneuvers desired.

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The fact that the model seems to work well despite the awkwardness of the situation, should not keep us from trying to develop a more "economical" system. By economical we mean reduction in drag. A deeply under cambered airfoil held at a negative angle, produces a lot of drag. And conversely, a streamlined reflex section has to be held at much higher angles of attack to obtain the same amount of lift as a streamlined section at lower angles. A reduction of drag means higher speed for the power used.

Talking about high speed, we wonder just how fast a model should fly before the speed begins to backfire. This backfiring occurs because of the centrifugal force whose value can be found by:

Weight (pounds) x Speed (feet/second)<sup>2</sup>

32 x radius (feet) of loop

Try a couple of examples. Take any speed and size of loop you like. You will note how rapidly centrifugal force builds up with an increase in speed. And remember, the model has to develop lift equal to the centrifugal force to maintain that particular size loop. If it cannot produce enough lift, the loop will open up automatically, no matter how hard you may try to tighten it up with the control. As a matter of fact, the elevator may actually force the wing into a stalled condition in which you get sloppy response.

Talking about stalled condition brings us to the type of airfoil to use. Some builders are using very thick airfoils, as much as 25% of the chord. Thick airfoils will stall at higher angles than thinner ones, say 18%. However, thick airfoils must operate at higher speeds to obtain full benefit. At low speed they have poor stalling characteristics. An 18% section may stall at about 8 degrees, but it will do so gradually so that you can adjust your controls to suit the situation. A thicker section will be abrupt in its action. Therefore, for a novice flyer, a thinner section seems more desirable.

Since the flying wing has a light loading which means lower speed in loops the selection of the airfoil indicated seems sensible.

The natural balance or C.G. position is shown. Assuming a working chord of 14", this position seems to follow the general rule of having the C.G. 20% to 25% from the leading edge.

Construction of this flying wing is on the sturdy side. It should take a lot of abuse or experimental changes. Start by cutting the ribs. Note the use of 1/4" ribs at center, and how stub spars are used to make up for strength lost by cutting out the upper spars. If you plan to have regular type tank, continue the upper spars and leave out the stubs. This will also eliminate the hinge fairing. A bit of motor fairing will be sufficient.

Although the original design specified 1/4" plywood motor mount base, the 3/8" basswood proved more practical. Note how landing gear is held in place with straps. The balsa block fairing under the motor mount is carved to fit the type of motor you use.

The hinged fairing is made from 1/16" sheet. It should fit snugly between 1/4" ribs. It can be held down with a rubber band. Note notch. The elevator flap combination is made from 1/8" thick balsa sheet quarter-grained stock preferred. Two or more sheets may be cemented together to obtain the required 4 1/2" width. Dope them several times with clear dope with in between sandings before cementing them in place with the cotton tape hinges as shown.

The linkage system will take a bit of time but it is worthwhile. Use the top hole (A) for initial flying, not the bottom one as shown on the plan. The fittings are designed to eliminate as much play as possible. Note how the main lever is hinged on a bolt with washer spacing to prevent wobbling. It might be advisable to assemble the linkage as a sub-assembly and then bolt it to the elevator and other points.

This design might also be a good one to work out your own idea of control motion or linkage. The elevator and flap areas are on the generous side so that many combinations can be tried without changing the areas. Don't use the bottom hole on the rear flap (as shown on the plan) until you've tested the model with the aft pushrod in top ("A") position.

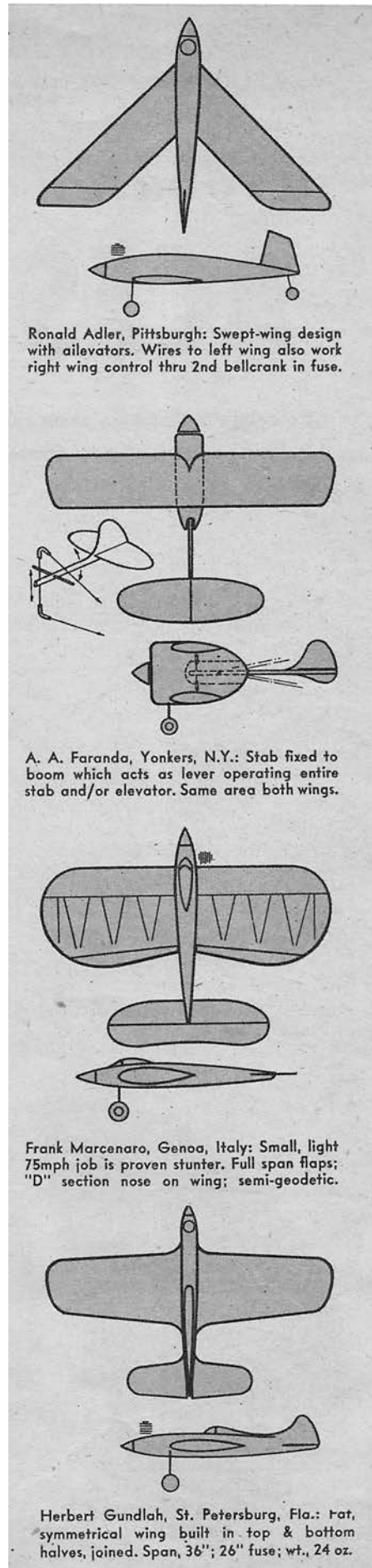
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The model is finished with several coats of clear dope. No color dope was used since weight had to be held low.

In testing this model, be gentle with control. Note the large flap area. The landing gear is sturdy and will allow safe taxiing for initial try. During this stage you should have an idea if the C.G. is in the correct position. If the C.G. is far forward, you will have to use a bit of "up" control to hold the model in level flight. If the C.G. is too far back, practically no control will be required, or you may actually need a bit of "down." Of the two conditions, forward C.G. position is preferred.

In stunting, do not try full control as you may stall the model.

**ABOUT THE DESIGNS:** You are not required to build a model in this contest! All you do is submit detailed 3-view drawings of your favorite "brain-child" (plus sketches if you are artistically inclined). These drawings should not be less than 8x10 inches and must show dimensions. Give data on wing sections and settings, cross sections, center of gravity, weights, proposed power and the like. It's not your drafting skill that will win, but your designing ability and imagination. AT selects meritorious designs and presents them in 3 view form payment of \$5 will be made for each one published. The top design will be built and test-flown by AT's design and research team and model will be given to the winner with all the equipment that goes with it. You have until Sept. 1, 1951, to have entries postmarked for model-helicopters utilizing any type of motive power. SEND YOUR DESIGNS TO: Air Model Design, c/o Air Trails, 304 E. 45th St., New York 17, N. Y. Decision of Air Trails staff is final because of the large number of entries received none will be returned and the editors cannot enter info correspondence concerning these.



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