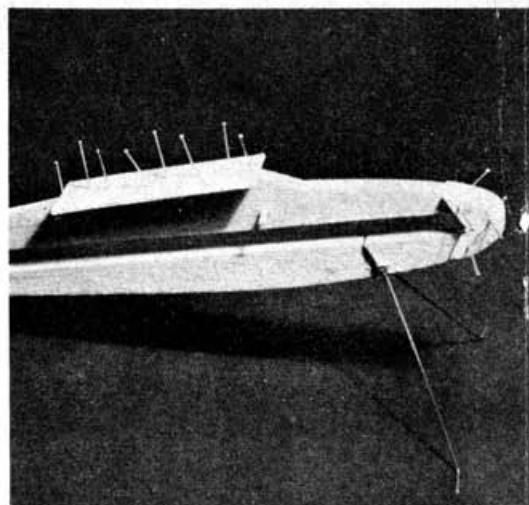


Simple, robust construction should enable youngest reader to duplicate this natty looking craft. Although balsa profile fuselage helps beginners, the built-up wing takes ship out of all-wood class.



After cutting out fuselage, add wing platform, nose reinforcement, landing gear, as shown here.

# Tufnut

by P. G. F. CHINN

*Full-size plans in magazine, detailed step-by-step construction notes, make a delightful little rubber job for sport.*

► "To: The Editor,  
Model Airplane News

"Dear Sir,

Recently I took up building model planes. I bought a rubber driven model but when I tried to assemble it, I ran into trouble. My wing was crooked and when I tried to paper it, the paper wrinkled and I couldn't seem to get the rounded body at all . . ."

This is part of a letter received recently by MAN. It is typical of a number of such letters regularly reaching this magazine. So the editor conducted a little research: he found that model building loses vast numbers of promising new members through beginners' failing to complete their first model successfully and he found out some of the reasons for such failures.

Firstly, of course, there is the age-old problem of the

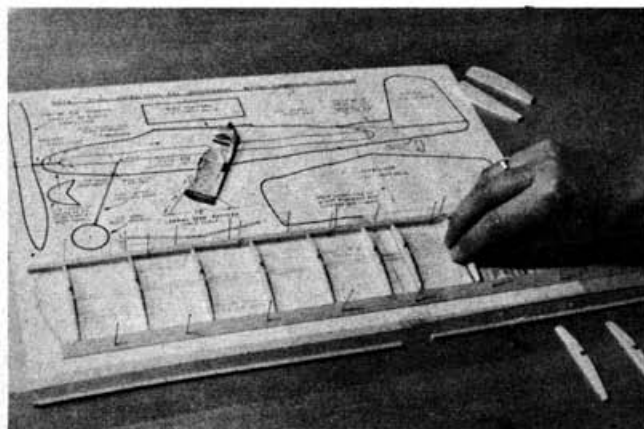
beginner trying to build something that looks good on paper but is much too tricky or tedious for him to tackle at such an early stage.

Secondly, there is a tendency for designers and manufacturers to over-emphasize performance. For high performance, a high power-to-weight ratio is needed and that means a light and relatively flimsy model. A flimsy model not only breaks when it hits something; it is difficult to keep in shape when you cover it, through the lack of rigidity in the framework. Moreover, such a model doesn't even have to crash to get broken: it can all too easily be accidentally damaged in handling. All this means that our "high performance" model will probably never get into the air, or, if it does, it will never get a chance to perform as the designer intended. Besides, long flights really aren't necessary. You will be surprised to see how long even a 20 or 30 second flight really is and how thrilling it can be.

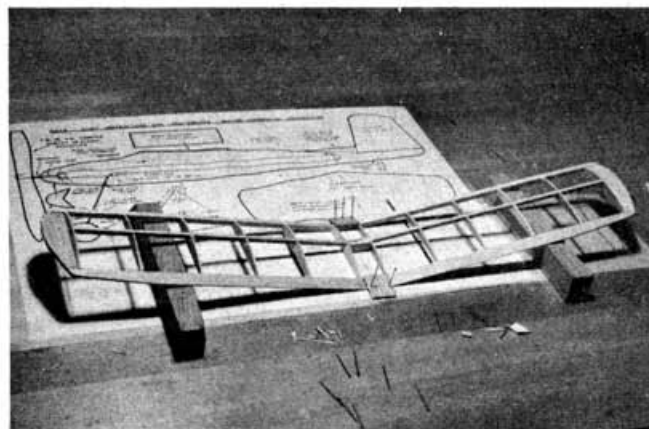
So, bearing all these points in mind, we set about trying to provide a model design and construction feature that would give the beginner a better chance of success. "Tufnut" is the result.

At first, we had intended to make it a traditional "stick" model. We chose, instead, the profile-fuselage type for three reasons: it is stronger, it rules out the need for making a special metal propeller bracket and it looks more attractive.

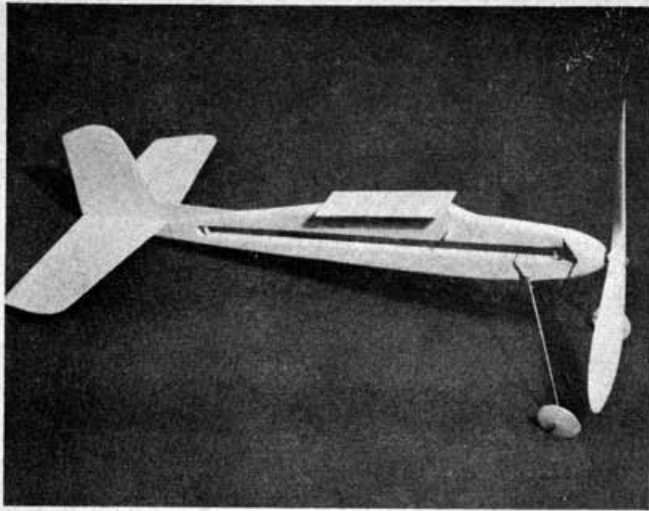
To answer our second requirement, we have made the plans as easy to understand as possible and supplemented them with a series of photographs, taken during the con-



Cover plan with transparent wax paper and assemble wing by pinning down parts shown and cementing ribs in place. Wing spar goes on top.



When wing is built, notch leading and trailing edges at the dihedral break and block up each panel to form correct dihedral angle. Cement.



To finished fuselage add prop shaft and bearing, wheels. Cement, temporarily pin stabilizer in place, then the vertical tail surface and fin.

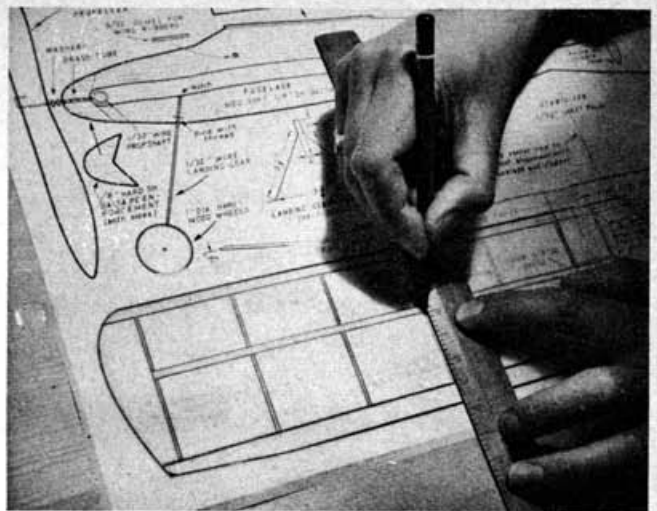
struction of the original model, to show the various stages in its assembly. These pictures are referred to in the detailed instruction which we shall come to in a moment.

In answer to our third point, Tufnut really is tough. We gave the original model to two young friends of ours who immediately flew it into the side of a shed and then crashed it several times in quick succession because of their inexperience, but it came through with no damage.

The solid 1/4 in. sheet balsa fuselage is stronger than one of built-up strip balsa and tissue. The tail unit is simply cut from 1/32 in. sheet, which is quite strong enough, and this, and the various fittings, such as landing gear and prop assembly, are fixed with a minimum of trouble. For utmost ease of construction, the wing, like the tail, could have been made of sheet balsa, but such over-simplification does little to prepare the beginner for bigger and better projects and so we have provided an efficient double-surfaced, built-up wing which is of sufficiently heavy construction to simplify covering and resist damage in a crash.

The ready-made wheels may be of hardwood plastic, either of which can be obtained from your local model dealer. You can use a ready-made prop, too. We used a 7 in. Kaysun plastic prop supplied by America's Hobby Center. For longer flights, you can use an 8 in. saw-cut balsa prop, if you don't mind a little extra work finishing it off.

Before you attempt to start construction, take a good look at the full size plan printed here and study all the



Pin plan to building board, then make tracing of wing-half. Use drawing to complete wing plan as, bottom, outside photo opposite page.

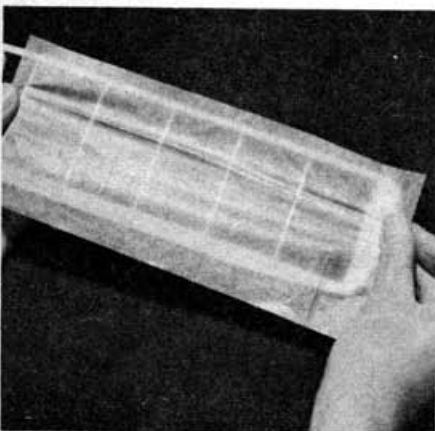
photos. We would also recommend that you read through the rest of this article so that you are quite sure that you understand everything in advance. In this way you will eliminate the likelihood of making a mistake and having to rebuild any parts.

The first thing to do is to cut out the various sheet balsa parts. To do this, detach plan and trace outlines onto the wood with a piece of carbon paper laid under the plan. Make sure that you have the grain of the wood running in the right direction as indicated on the plan. Note, for example, that the grain of the rudder runs vertically, not across. Don't use warped balsa wood, especially in the case of the 1/32 in. material for the tail surfaces.

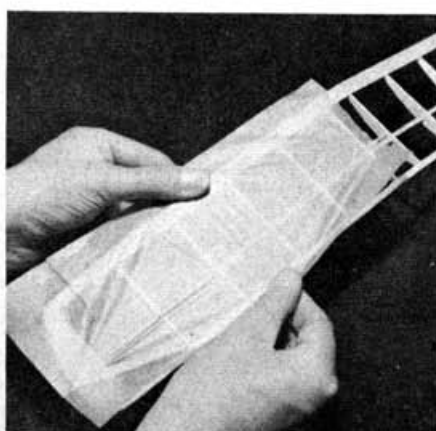
For cutting out the parts, use a modeling knife or a steel backed razor blade. Keep the blade upright, especially when cutting thick wood, such as the fuselage. When making the wing ribs, you may use one of two methods. The first method is to cut out all the ribs individually: an aid here is to make a thin metal or plywood pattern to the shape of the rib, as given on the plan, and then to lay this on the balsa and cut around it. The second method is to pin together 12 pieces of 1/16 in. sheet balsa, each measuring 2-11/16 in. x 3/8 in., to form a block 3/4 in. thick. The top of this block is then rounded off with a sandpaper block to obtain the required rib shape and, after cutting the slot for the spar, the finished ribs are separated.

(Continued on page 77)

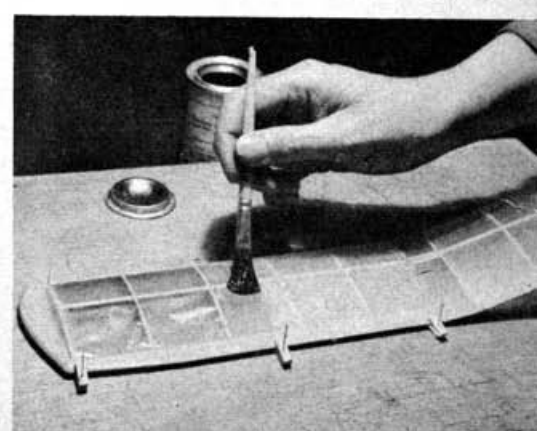
FULL SIZE PLANS ON FOLLOWING 2 PAGES



Commence covering on bottom surface by stretching tissue tip to tip. Follow the directions.



After sticking ends at one point, pull tissue across wing, as shown, and work toward the tips.



Dope underside first. Support edges on scraps 1/8 balsa, pin down then dope the top surface.



model. A light fishing line or strong heavy thread is very suitable. Attach the lines securely to the bellcrank clips after passing them through the wing tip guide. The other end of each line is attached to your control-line handle. The front line from the bellcrank should be attached to the top of the handle. Make sure that the top of the handle is easily identified to prevent accidental reversal of controls when picking it up.

If you have not flown a controlliner previously, we strongly advise you to get an experienced CL flier to test-fly your Scorpion for you. If you can then persuade him to show you how to fly, so much the better. The most important thing to remember when you attempt your first flight is not to over-control.

### Tufnut

(Continued from page 45)

When bending the landing gear, use a pair of pliers and start from the center, where the legs join the fuselage. A shallow slot, or notch, is cut in the fuselage at this point and the landing gear is then "sewn" to the fuselage with thread, two small holes being bored through for this purpose with a 1/32 in. drill or a piece of wire. A drill will also be useful for boring the 3/32 in. dia. holes for the dowel for the wing rubber and rear motor peg. Secure these with cement and also put a little cement around the landing gear notch and binding.

The next thing to do is to add the two side pieces which reinforce the nose. "Pre-cement" the joints by rubbing cement into the four surfaces to be joined. When these are dry, apply more cement and pin the strengtheners to each side of the nose. At this stage, too, the wing platform should be added. Having made sure that the fuselage is quite flat and at the right angle at this point, pre-cement this, too, and then pin in position.

The tail unit is the next thing to fit. Again, check that the fuselage is true and flat, then pre-cement the surface. When dry, cement and pin the stabilizer in position, after accurately aligning it. Let this dry for a while, then remove pins and cement rudder in position, again after pre-cementing. When fitting the rudder, view the model from the front to make sure that the rudder is in line. Finally, add the small dorsal fillet which helps to strengthen the rudder fitting.

The wheels may now be added. These are just slipped over the axles, the latter being bent up at the ends to retain them, or, if preferred, wheel retaining collars can be fitted. A piece of brass tubing, 1/2 in. long, is used as a propeller shaft bearing. The nose of the fuselage is carefully drilled or reamed out to the required size and the tube then inserted with plenty of cement to secure it. At this stage, the corners of the fuselage and the nose may be rounded off with sandpaper.

The propshaft should have the rubber motor hook bent to shape first. It should then be passed through the nose bearing and, after adding two washers, the propeller may be fitted. If a plastic prop is being used, it will first be necessary very carefully to drill a 1/32 in. dia. hole in the hub parallel to the shaft hole. The end of the shaft is then bent over and pulled back into this hole as shown on the plan. This completes the first stage of the assembly. We now come to the wing construction and covering.

You will note that only the left-hand wing is shown in the plan. The first thing to do, therefore, is make an accurate tracing of this. This tracing is then reversed to give us the right-hand wing panel and is

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then added to the plan as shown. Make sure that you have the two half drawings accurately aligned. If you do not want to spoil your plan, it is a good idea to cover it with a piece of transparent waxed paper. This will prevent the framework from sticking to it. If waxed paper is not available, a piece of grease-proof paper, although not quite so satisfactory, will do.

Start assembling the wing by pinning the full length leading and trailing edge strips in place. Ready-shaped, trailing edge stock is available at most dealers and saves the necessity of sanding down to the required triangular section.

Now insert the ribs at the various stations as shown on the plan. Pre-cement each joint for maximum strength and make sure that each rib is upright. Add the 1/8 in. sheet balsa wing tips and then fit the center spar. This spar is in two parts, left

and right, and there should be a 3/16 in. gap in the center to allow it to close up when the tips are raised for the dihedral angle.

When the wing structure has been completed, the leading and trailing edges should be notched, as shown on the plan, to allow the outer panels to be raised at the tips. The center section should be very firmly pinned down to the building board and each tip blocked up 1 1/2 in. after squeezing some cement into the notches. Finally, the dihedral keepers should be cemented in place and the whole assembly allowed to set for about one hour. After this, it may be removed from the board and the leading edges and tips rounded off with sandpaper.

We now come to the job of covering the wing with tissue. You may find this just a bit tricky and tedious at first. We can only

say that even the experts found covering tricky when they first started to build model airplanes and that when you have built one model plane, you find that covering the next one is a lot easier.

Model tissue comes in various colors and grades. We would recommend an American tissue, such as Silkspan, rather than one of the Japanese varieties. Japanese tissue may be all very well for lightweight contest jobs, but Silkspan is a lot easier to apply. Dope is usually employed for sticking the tissue to the frame.

When you buy a sheet of tissue, it may be a bit creased and wrinkled. It is worth while, in this case, to smooth it out with a warm iron. The next thing to do is to lay the wing on the tissue and cut a piece large enough to cover the bottom surface of one side. Tissue has a "grain" and its maximum shrinkage is always at right-angles to this grain. It is generally advisable to have the shrinkage spanwise so as to prevent undue "sag" between the ribs. Therefore, make sure that your grain runs across the wing; i.e., from leading to trailing edge. Also, be sure to cut the tissue with about 1/2 in. surplus margin.

Have your work table cleared of everything except the items essential to the job: tissue, good sharp razor blade, tissue adhesive and, of course, the wing. With your first piece of tissue cut to size, apply dope to the framework. Paste the tip first, then the trailing edge, then root (center) rib and leading edge. Do not apply adhesive to any of the other ribs.



Dope thickened with cement (must be same type), or photo mount paste are suitable adhesives to attach the edges of covering to the framework.

Now carefully lay the tissue over the panel and gently pull it out spanwise. Next, draw the tissue across the chord at the center of the panel. Finally, work toward the four corners, carefully easing out the wrinkles and folds.

Don't try to pull the covering drum tight. It will become tight with subsequent shrinking and doping. Simply concentrate on getting the tissue applied evenly without any bad wrinkles.

The surplus tissue may now be trimmed off and the raw edge stuck down. Cover the other wing panel in the same way and then the two upper surfaces. When dealing with the top surfaces, it is generally easier to cover the tip separately with a small piece of tissue between the tip rib and the edge of the wing tip itself. Finally, cut two strips approximately 1-1/4 in. wide and apply to the center section.

For shrinking and doping, it is essential to have a true, flat surface on which the wing can be pinned so as to prevent warping. If your building board is not entirely free from warps, select a short piece of board that is. You will also need about a dozen scraps of sheet balsa, about 1/2 in. by 1/4 in. and 3/32 in. or 1/8 in. thick.

Some expert modelers, long practised in the art of tissue covering, do not use water-

(Continued on page 80)

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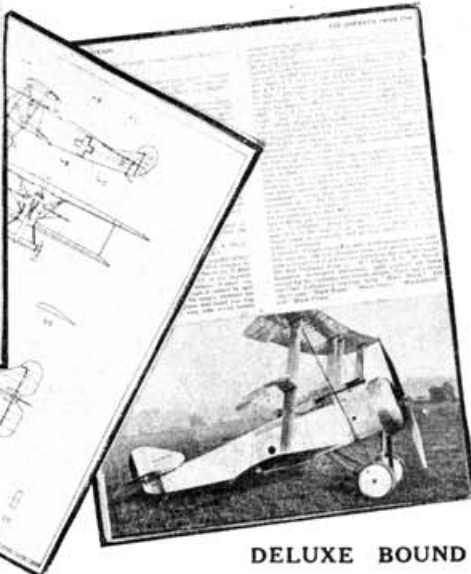
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shrinkage, but, generally, it is advisable for the beginner to watershrink before doping. For this, you will need a simple spray, either an old perfume spray or a simple mouth type spray.

Spray the underside of one wing panel first. The tissue will be seen to go quite slack. Using six of the small scraps of balsa under the wing to hold the wet tissue from contact with the board, pin it down, using six more scraps on the top surface. Now water-spray the top of the wing.

After a while the covering will dry out. It may not be completely tight, but this does not matter. Repeat the procedure with the other wing panel.

The same system of pinning down is adopted when doping. Dope has two purposes: to pull the covering tight over the framework and to make it airtight. Make sure that the covering is absolutely dry (following the watershrinking) before applying dope, otherwise you will find ugly white "blush" marks appearing on the covering when dry.

Apply the dope with a soft doping brush and do not go back over any part previously covered as dope soon becomes tacky. Again, the tissue will go slack, but when dry, you will see that it has become tight and strong and that, as a result, your wing is now quite rigid.

The longer you leave your wing panels pinned down, the better. So, though you may be tempted to fit the wing as soon as it is dry and go out and fly the model, it is much wiser to leave it undisturbed for a day or two, or, at least, overnight.

While waiting for the wing panels to dry, you can apply a couple of coats of dope to the fuselage (and to the prop if a balsa one is used). This will make the surface of the wood more durable. Do not,

however, dope the rudder or stabilizer as these are likely to warp if so treated.

The model is powered with four strands of 1/8 in. rubber. Make this up into a loop from a piece 38 in. long. Fit the wing to the wing platform with a long rubber band (or two bands joined together) through the motor slot, over the wing and onto the peg on each side of the fuselage.

Ready for flight, the model should balance on the finger tips when supported beneath the wing center spar. If the model is slightly nose heavy, the wing can be moved forward fractionally on its mount to compensate for this. If it should be tail heavy, move the wing back. If the balance point (center of gravity) is badly out, it will be necessary to add a small amount of clay to the nose or tail, but this will not be necessary if you have built the model accurately.

Hand-launch the model gently into the wind to test its glide. Move the wing slightly if it shows nose- or tail-heavy tendencies. Next, wind 50 turns on the motor and try again, then 100 turns. On 100 turns, the model should climb up to 15 ft. or so and fly a distance of 100 to 150 ft. You will now be able to see whether it flies in the desired direction. Gently bend the rudder, after breathing on it, if the model turns too sharply to one side.

On anything more than 100 turns, the model will rise off ground. You will probably find that 300 turns will give you a very satisfactory flight, with a minimum of time spent on rewinding. Actually, the motor, if properly treated with rubber lubricant, will take many more turns than this, but the life of the rubber is greatly extended by not winding to the maximum.

Take your time in building Tuffnut. In return, you will have a model that will

give you hours of fun and provide you with the necessary experience for tackling more advanced models.

One piece medium soft balsa 15 x 2 x 1/4 for fuselage; one piece medium balsa 12 x 3 x 1/32 for tail surfaces; one piece medium balsa 12 x 2 x 1/16 for ribs, wing-platform, etc.; one piece medium balsa 4 x 2 x 1/8 for tips, etc.; one strip trailing-edge stock 20 x 3/8 x 1/8; one strip medium balsa 20 x 3/16 x 3/16 for leading edge; one strip medium balsa 20 x 1/8 x 1/8 for center spar; 12 in. 1/32 steel wire for landing gear and propshaft; 1/2 in. brass tube and two washers to fit above; 2 in. 3/32 hardwood dowel; one pair 1 in. hardwood or plastic wheels; one 8 in. or 7 in. dia. plastic or balsa prop; 38 in. 1/8 in. flat rubber; one sheet model tissue; one tube model cement; one small bottle clear dope; one small bottle rubber lubricant.

## Take Care of That Engine

(Continued from page 59)

additives which improve the octane number rating of the fuel. In this way, they lower the compression ratio necessary to achieve self-ignition and also smooth combustion considerably. The most commonly used additives are amyl-nitrate and amyl-nitrite. About two per cent is normally used.

With some Diesels there is mechanical limitation on the compression ratio that can be used. Some designs (e.g., the Mills) employ a pin in the cylinder head which restricts movement of the compression-screw. The Cub has a special flanged contraption which can move only a limited way down the bore. High prop speeds re-

(Continued on page 82)

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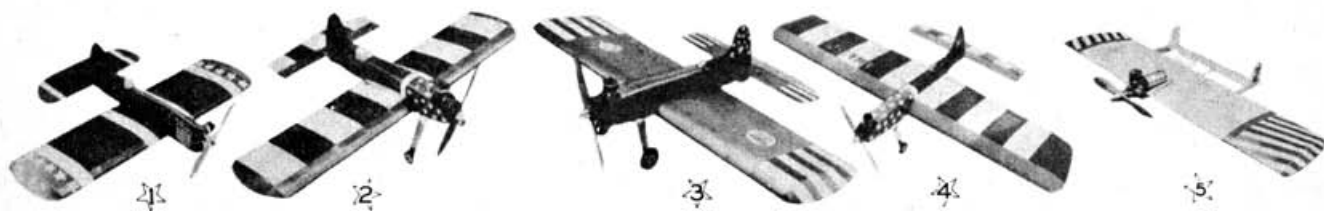
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