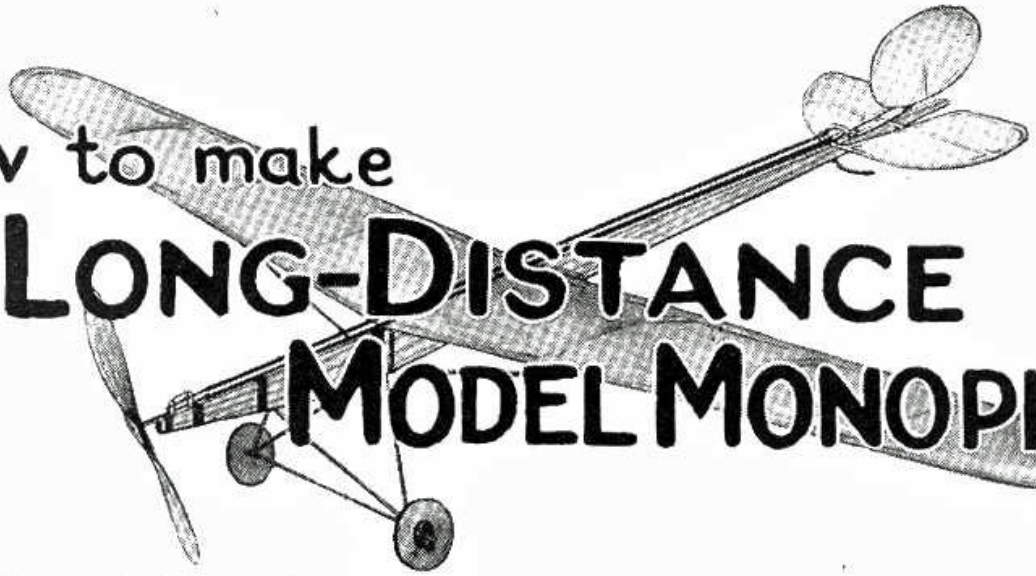
How to make A LONG-DISTANCE MODEL MONOPLANE



Making and flying model aeroplanes is a fascinating pastime, but to be satisfactory your model should be able to fly a good distance. This model monoplane will travel half a mile.

A MODEL monoplane that will cover distances up to 800 yards is a possession in which anyone might take immense pride. To *make* one for oneself would naturally increase the pride tremendously. Well, why not? It is easy, and so long as the job is not "rushed," and you try hard to cut down weight of material wherever possible, this long-distance model monoplane will turn out to be a most excellent flier. Fig. 1 (in the heading) gives a view of the model when completed and ready to "take off."

It will be seen that it is of the tractor type; that is, it has the propeller in front. The first thing to make is the spar, or body, of the model. This is hollow, and is made from a piece of silver spruce 4 ft. long, $1\frac{1}{2}$ ins. wide, and $\frac{3}{8}$ in. thick. Next shape the spar as shown at Fig. 2, and, with a fretsaw, cut out the pieces as shown at Fig. 3, in order to reduce the weight.

Now carefully clean up the wood with No. 0 glasspaper. Then cut out of whitewood veneer two pieces of the same shape as the side of the spar; that is, as shown at Fig. 2. These pieces are to be glued one on each side of the spruce spar. The gluing needs to be carefully done as the success of the model depends largely on the rigidity of these joins. Do it thus: Get two pieces of wood measuring about 4 ft. in length, 2 ins. wide and $\frac{3}{4}$ in. thick, to serve as a press. Place a veneer on top of one of these and smear its upper face with a thin glue, such as "Croid" or "Seccotine."

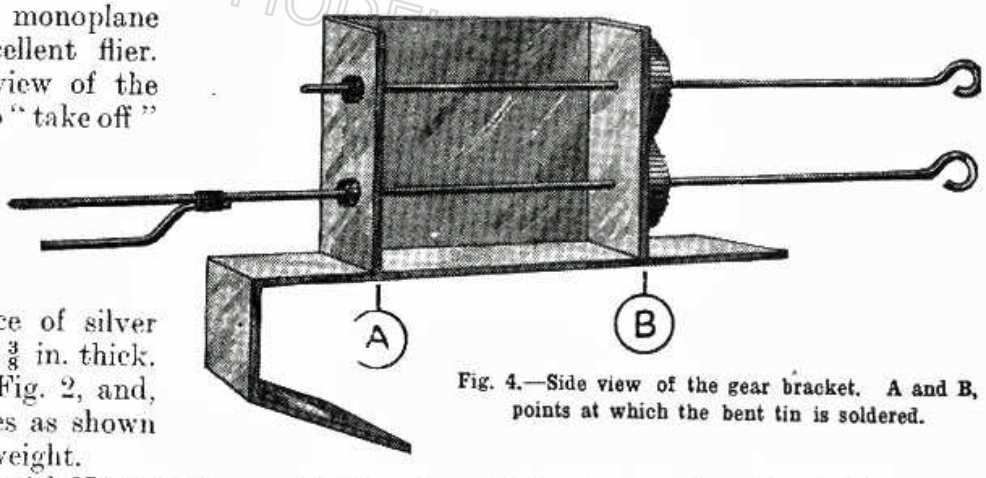


Fig. 4.—Side view of the gear bracket. A and B, points at which the bent tin is soldered.

Now smear a little glue on the side of the spruce piece that you have fretted and press firmly into contact with the veneer. A little more glue is put on the spruce part of the spar and also on the other veneer piece. The latter is then placed in position to complete the boxing-in of the spar. Place the other length of the "press" on the top of the whole and bind the two pieces together with elastic. Aeroplane elastic will serve excellently. The surplus glue will be squeezed out and a good, strong join will result.

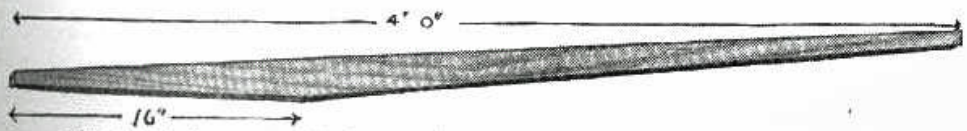


Fig. 2.—Cut the spar to this shape, with a fretsaw, to make the body of the model.

Fig. 3.—Then cut out the pieces shown, to reduce the weight.

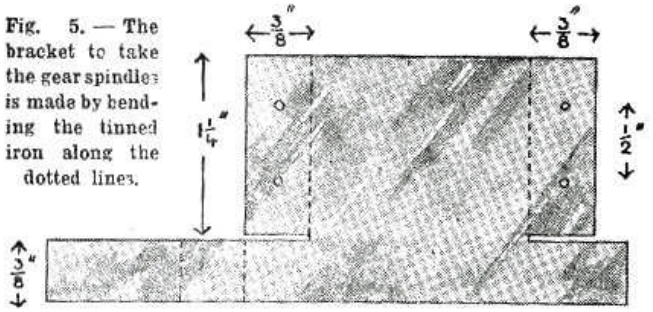


Fig. 5. — The bracket to take the gear spindles is made by bending the tinned iron along the dotted lines.

It would perhaps be as well to place paper between the veneer side and the press pieces to avoid the former sticking to the latter. Allow at least twelve hours for the glue to set, after which time the spar may be removed from the press and smoothed up with a plane and glass-paper. Use Middle No. 2 glass-paper first, then No. 0 for the final. A coat of varnish finishes this part of the model.

It will be seen that this model is fitted with a gear. The object of this is to divide the rubber motor into two parts so as to enable about double the number of turns to be given to the rubber. It would be as well to mention here that contrary to one's expectations the smaller the amount of rubber used the longer the model will remain in the air. The reason is that as the amount of rubber is increased so the number of turns which you can give it decreases, and so the propeller " runs out " more quickly. Fig. 4 shows a side view of the gear.

To construct this obtain a 16 gauge cycle spoke for the shafts, and two $\frac{1}{2}$ in. gear wheels. These gear wheels are important, and it is best to obtain them from a model aeroplane firm, who have them specially cut for the purpose. Now cut the spoke in two and solder a gear wheel on to each piece, bearing in mind that the part of the spoke with the thread is to serve as the propeller shaft. The hooks at the spoke-ends to hold the elastic are made with a pair of round-nosed pliers.

The bracket to take the gear spindles is made of a piece of tinned iron of about No. 28 standard wire gauge. Cut a piece to the shape and size shown at Fig. 5 and drill the holes for the spoke spindles, making sure that they are accurately spaced. Now bend the tin along the dotted lines shown at Fig. 5, and solder at A and B, Fig. 4. The shape of the bracket will then be as shown at Fig. 4. The gear spindles are threaded through the holes in the bracket, first slipping a washer on to each. A washer is then soldered on to the other end of each spindle to keep the gears in mesh and to take the pull of the elastic.

Fig. 7 shows the finished gear. It will be seen that the bottom of the bracket is bent to embrace the front of the spar. At A, Fig. 7, is a piece of No. 18 gauge steel wire bent as shown, bound with floral wire and soldered. This is the clutch to hold the propeller in position on the spindle. The gear may now be lashed to the spar with good strong thread, as at A, Fig. 8.

The hooks to hold the elastic at the rear end of the model, B, Fig. 8, are made from one piece of No. 18 S.W.G. steel wire. A hole is then drilled through the spar $5\frac{1}{2}$ ins. from the end to take the wire, the under-piece of which also serves for the skid, B, Fig. 8. Two washers, one on each side, are slipped on and soldered to prevent the combined hooks and skid from sliding about. A small screw-eye is screwed into the spar to take the hook, C, Fig. 8, and to assist the wire to withstand the pull of the elastic.

The wire frame for the wheeled under-carriage, or chassis, is next made, of No. 18 S.W.G. steel wire. Fig. 8 gives the measurements. It consists of two wire V's and an axle. The wires are bent to shape, and an eye formed on each leg by means of a small pair of round-nosed pliers. Two pieces of tin (as used for the gear bracket) are to be cut, measuring 1 in. by $\frac{3}{8}$ in. These are bent round the chassis V's as shown at Fig. 9, and are to secure the under-carriage to the spar. This is done by lashing them tightly to the spar, making sure that the longer V is at the front. The axle, which is of No. 18 S.W.G.

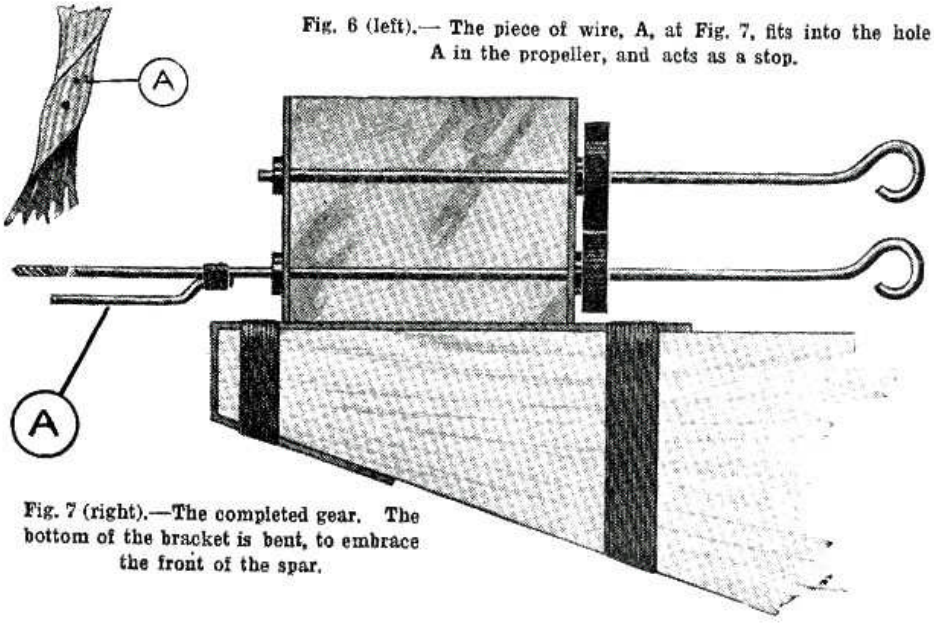


Fig. 6 (left).— The piece of wire, A, at Fig. 7, fits into the hole A in the propeller, and acts as a stop.

Fig. 7 (right).—The completed gear. The bottom of the bracket is bent, to embrace the front of the spar.

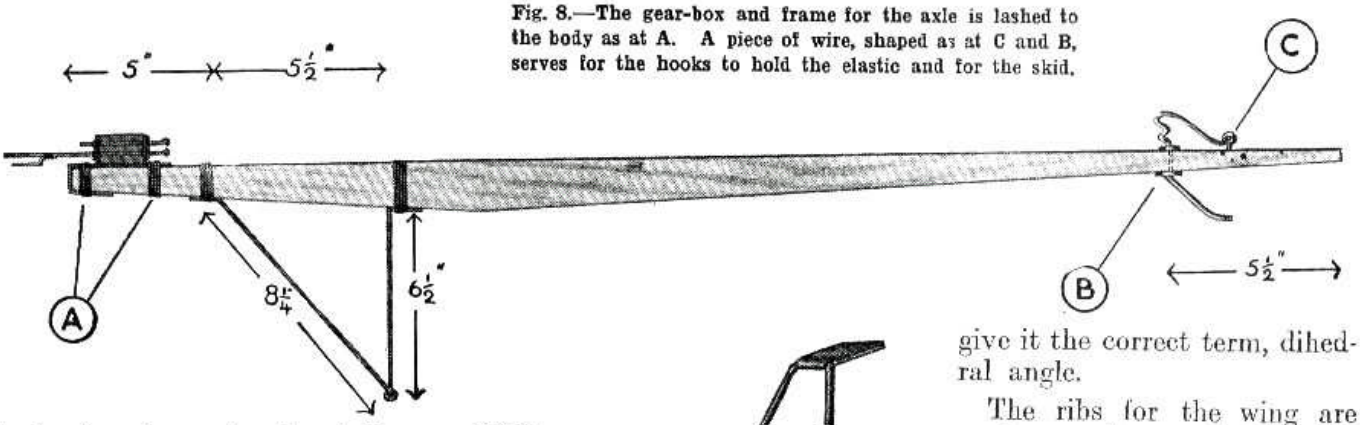


Fig. 8.—The gear-box and frame for the axle is lashed to the body as at A. A piece of wire, shaped as at C and B, serves for the hooks to hold the elastic and for the skid.

steel wire, is next placed in position by threading it through the eyes and strongly soldering it there. The distance between the eyes should be such that the wheels are about 6 ins. apart.

The wheels are 2½ ins. in diameter and are made of 1/16 in. three-ply wood. The hubs are made from two pieces of brass tube ½ in. long. A hole is made for the reception of the tube in each wheel and a washer is soldered on each side of it, Fig. 10. They are slipped on to the axle and a washer soldered on, or the ends of the axle turned up, to secure them.

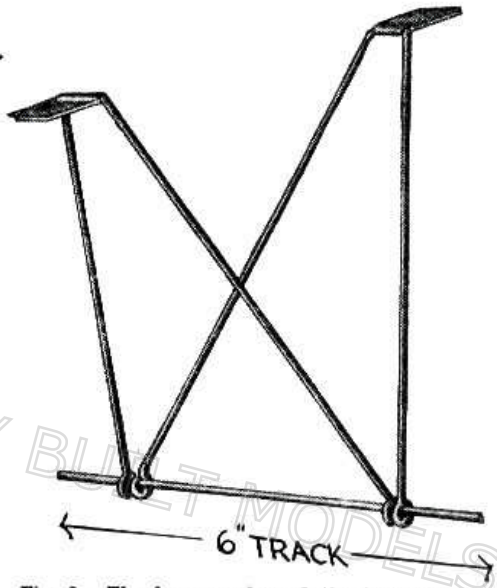


Fig. 9.—The frame, axle and the brackets for binding to the spar.

The next job is the plane, or wing. The long spars are of birch, 3/16 in. by ⅛ in., and should be made slightly half round in section, Fig. 12, the object being to reduce weight and wind resistance. It can be easily done by scraping the wood with a piece of broken glass. The front spar, which is the leading edge of the wing, is bent slightly back; the bending being done by holding the part to be bent in the steam issuing from the spout of a kettle of boiling water until it is pliable. It is then easily bent to the necessary angle. At the same time as it is bent back the front spar must also be bent up, an upward bend also being put in the rear spar. It is most important that exactly the same amount of bend should be put in each spar. Fig. 1 conveys the idea of the bending, or to give it the correct term, dihedral angle.

The ribs for the wing are next cut, from 3/16 in. by 3/32 in. birch. Each of these ribs is curved, the greatest depth being ½ in. for the centre ribs, decreasing to ¼ in. for the end ones. The greatest depth occurs one-third from the front of the rib. Fig. 13 will make this plain. Now mark the rib positions on the plane spars, and fix the ribs by means of small pins, a hole being first drilled and then a little glue put between spar and rib. The tips of the wings are rounded, the round being made of bamboo, planed ⅛ in. square. This material is very easily bent with the aid of a steaming kettle. Both the ends of the birch spars are tapered, and also the ends of the bamboo tips, to make a neat job of the joining of the bamboo to the other part of the wing. The join is completed by binding with thread and well gluing, Fig. 14.

The attachment of the wing to the spar, or body, is managed with the aid of two pieces of No. 18 S.W.G. wire. Both lengths are bent to the shape and size shown at Fig. 15. They are lashed with thread to the wing spars at the points A, B and C; B, of course, being the centre of the wing.

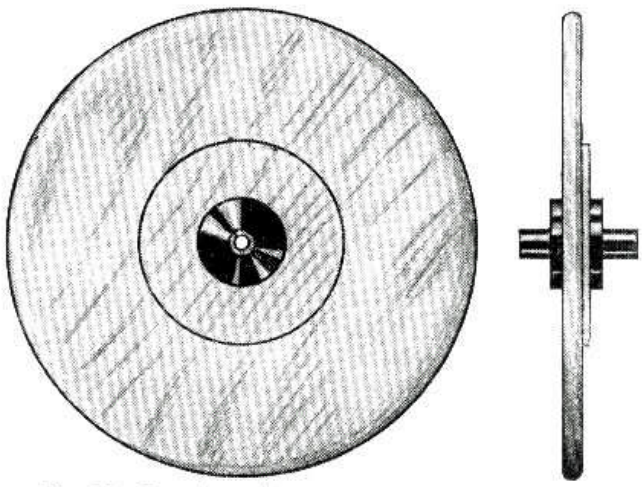


Fig. 10.—Two typewriting erasers will serve for wheels.

The tail plane is made of No. 18 S.W.G. wire and ¼ in. by 3/32 in. birch, the latter being made half round, as with the wing spars. The wire shape is made of a single length of wire starting at A, Fig. 11, and finishing at B

The joints A and B are bound with tinned floral wire and soldered, and the birch piece placed in position and bound and soldered at C, D, E and F, taking care not to burn the wood with the soldering iron. Two wire hooks are next made of No. 20 S.W.G. wire. These are to attach the tail to the spar. One of them

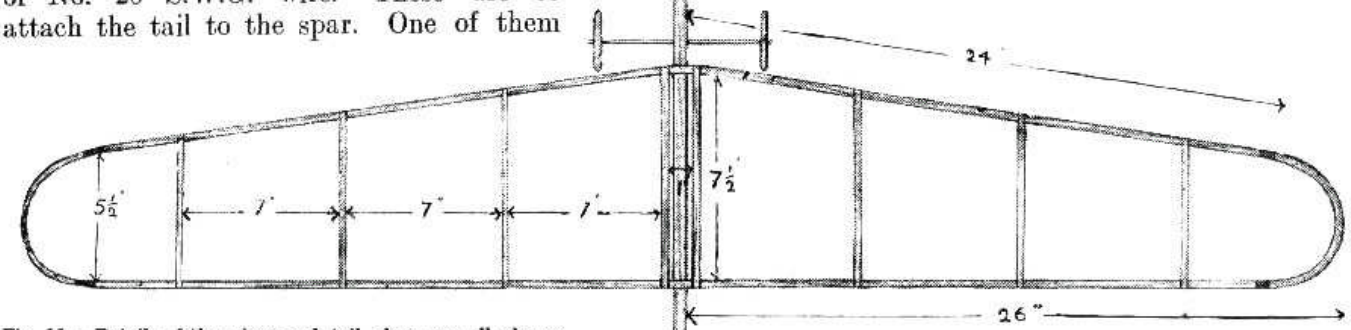


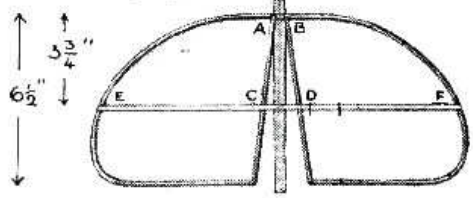
Fig. 11.—Details of the wings and tail plane are all shown in this diagram.

is bound with thread at the centre of the birch piece and the other on the front centre of the wire part. Both these hooks are

Fig. 13.—The angle at which the ribs of the wings are to be bent must be observed carefully.

bound on the under-side of the tail, Fig. 16.

The rudder, or fin, is made from a single length of No. 20 S.W.G. wire, starting at A and finishing at B, Fig. 17. The piece E is of No. 18 S.W.G., and has an eye, F, formed on its end. The joints should now all be bound with floral wire and soldered. You will perhaps find it easier when making these wire parts to draw the outline of them on a board, drive in some small nails on the outline, and then bend the wire round them.



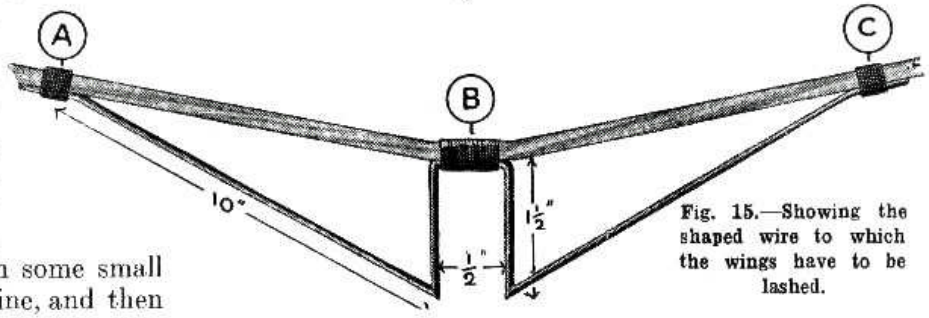


Fig. 15.—Showing the shaped wire to which the wings have to be lashed.

To cover the surfaces, procure sufficient proofed aero silk (ordinary Jap silk is useless unless proofed) and cut a piece for the large wing. Lay this piece on a sheet of cardboard and place the wing-frame upside down on it. Now trim the silk to the shape of the wing with a sharp knife, leaving a margin of ¼ in. all round it. Smear a little tube-glue on one of the bamboo wing-tips and also on the silk at that end. Next, with the knife, snick into the silk all round the wing-tip, making cuts about ¼ in. apart. This will enable the margin of silk to be turned over and stuck down without puckers forming.

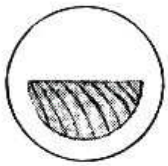


Fig. 12 (*left*).—The birch wood for the long spars is shaped as shown.

Wait until the glue gets "tacky" before turning the silk over and sticking it down. Having got one

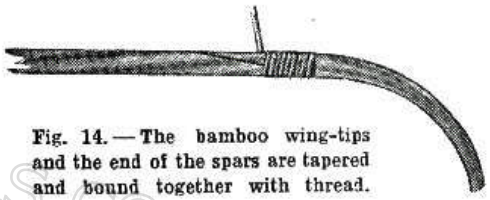


Fig. 14.—The bamboo wing-tips and the end of the spars are tapered and bound together with thread.

of the wing-tips stuck and the glue set, proceed in the same fashion with the other end. The silk must first be pulled taut, so that when the front and rear edges of the silk are glued to the plane spars the silk does not sag between each rib, but keeps the curve of the ribs all along. When the glue is quite set at the tips, turn over and stick down the margin of silk along the front and back plane spars, sticking the front spar first. The tail and rudder are covered in the same manner.

The propeller is carved from a piece of satin walnut 12 ins. by 1¼ ins. by ½ in. Drill a hole in the centre to take the gear spindle and draw the outline of the propeller as shown at Fig. 18. Now cut away the waste wood. Work this "blank" into shape

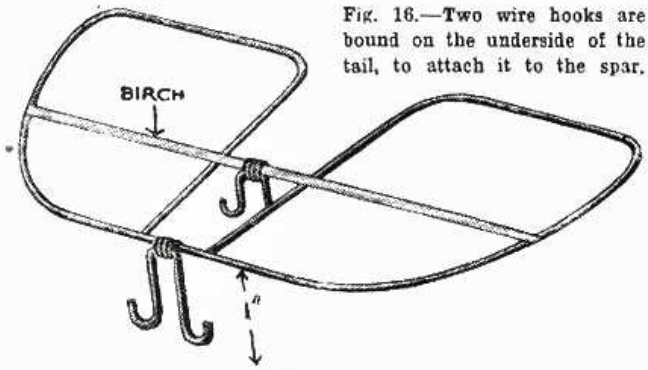


Fig. 16.—Two wire hooks are bound on the underside of the tail, to attach it to the spar.

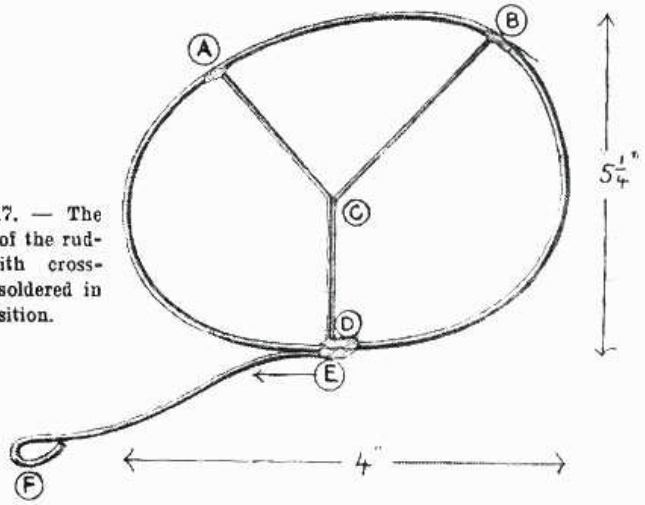


Fig. 17. — The frame of the rudder with cross-pieces soldered in position.

with a wood-rasp, leaving it fairly thick near the centre. Finish the propeller with glass-paper. Fig. 19 shows the finished article.

To assemble the model, slip the plane on to the spar, the wire U's on the wing embracing it and a piece of elastic passed through these wires and tied to secure the wings to the spars. The tail is attached and secured in the same fashion, elastic bands being passed under the spar and slipped on to the hooks. The rudder is secured by means of a small wood screw; the screw passing through the eye F, Fig. 17, and into the spar. Make sure that the screw holds the rudder quite tightly. A hole is drilled in the propeller for the reception of the clutch wire A., Fig. 6, and secured on the spindle with a spoke nipple.

The motor consists of two skeins of ¼ in. flat strip elastic; one skein of 4 strands to each spindle. If the model is on the heavy side it may be necessary to use six strands to each. The rubber should be lubricated with the preparation sold at aeroplane model shops for the purpose. Many more turns are obtainable by its use.

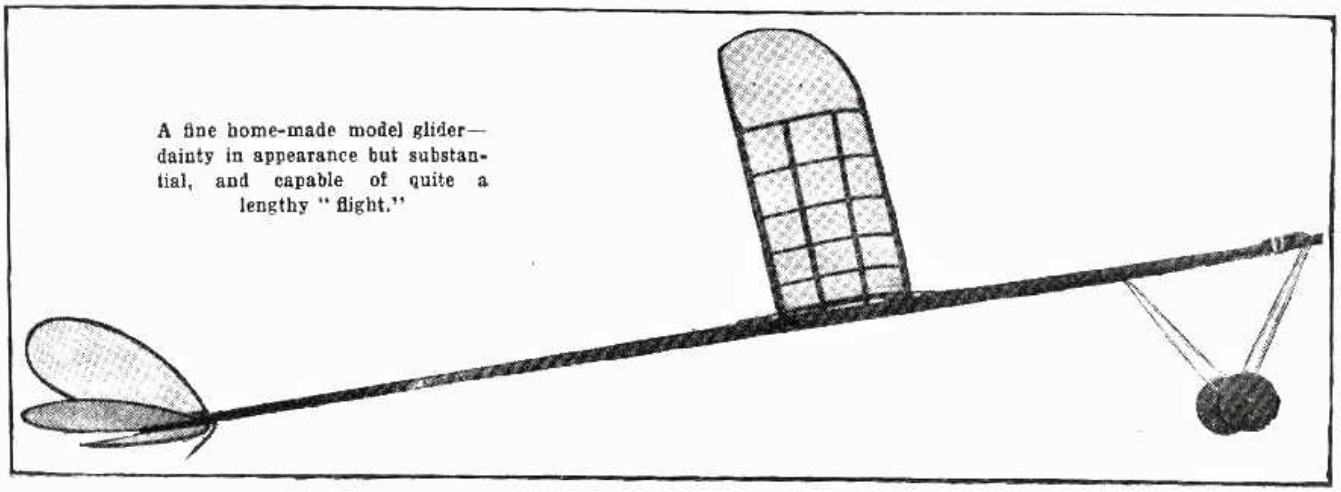
The approximate position for the wing is such that the complete model balances when rested on a knife edge at a point central with the width of the wing.

To fly the model wind the elastic until it has a double row of knots. Hold the propeller with the left hand and the spar with the right. Throw forward very gently, keeping the model horizontal. If it flies in undulations, move the wing *away* from the propeller; but if it does not rise, and goes quickly to earth, move the wing *towards* the propeller. The wing should be moved only ¼ in. at a time before trying again.

This machine is quite capable of rising from the ground when placed *facing* the wind.

Fig. 18.—The propeller is carved out of a piece of satin walnut, and a hole bored in the centre to take the gear spindle.

Fig. 19.—The finished propeller. The centre is kept thick, while the sides are shaped thin with a wood-rasp and glass-paper.



A fine home-made model glider—dainty in appearance but substantial, and capable of quite a lengthy "flight."