How to Make and Fly—

SIMPLE MODEL AEROPLANES

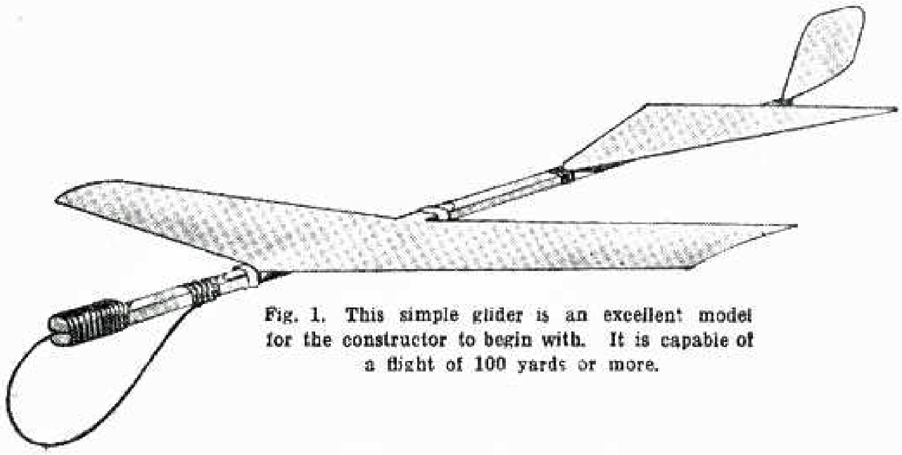

Fig. 1. This simple glider is an excellent model for the constructor to begin with. It is capable of a flight of 100 yards or more.

Three very workmanlike model aeroplanes—a very easy one to commence with, then one a little more advanced, and finally a rather ambitious but still easy-to-make plane—are pictured in detail and described in this chat by one who makes such models for a living.

THE models shown and described in this article will not only fly but fly *well*, provided that just ordinary care is taken in making them. To slap the parts together without troubling to see that the wings are symmetrical or that one side does not " lift " more than the other is simply foolishness. Avoid these two common pitfalls, and your 'plane will be a great success.

The simple glider at Fig. 1 is an excellent model to begin with. Launched from a bit of rising ground it will glide a hundred yards or more, the full distance depending on the incline.

The main spar, A, Fig. 2, is a piece of silver spruce $\frac{3}{8}$ in. square and 36 in. long. When this has been smoothed, a wire loop, 16 S.W.G. (Standard Wire Gauge), is lashed to it, at the same time binding on a piece of lead about 2 oz. in weight, as at B, Fig. 2.

silk flat on a sheet of card. Lay the rudder on top of the silk, and cut round the outline with a sharp penknife, leaving a margin of $\frac{1}{4}$ in. all round.

Smear a little tube glue, such as Seccotine, on this margin. Then, with the knife, cut into the silk all round the margin, making snicks about $\frac{1}{4}$ in. apart. This will enable the lap of silk to be turned over and stuck down without puckers.

The secret of covering tightly lays in waiting until the glue is tacky before attempting to stick the silk down, and in being sparing with the glue. The finished rudder must be free from any bends when viewed edge-on.

A hole is drilled in the main spar A, Fig. 2, 1 in. from the right end of the figure, the prong of the rudder inserted therein and then bound with thread. It

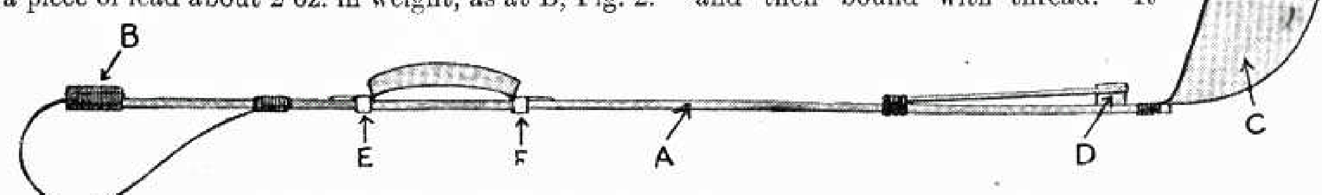

Fig. 2. A side view of Fig. 1, showing the main spar, A ; wire loop and piece of lead, B ; rudder, C ; small block, D, to raise the rear of the tail : two metal bands, E and F, to attach plane to main spar.

The rudder C, Fig. 2 and Fig. 3, made of wire (18 S.W.G.), the joint bound with floral wire and soldered, is covered with proofed silk, which can be obtained from one of the model aeroplane firms. To cover the rudder, lay a small piece of the proofed

is most important to make a firm job of this.

The triangular tail shape, Fig. 4, is made of birch $\frac{3}{8}$ in. by $\frac{1}{16}$ in., the joints being glued and nailed together. A small block of wood $\frac{3}{8}$ in. by $\frac{3}{8}$ in. by $\frac{3}{16}$ in., D, Fig. 2, is placed between the centre of the back tail spar and the main spar A, to raise the rear of the tail about $\frac{3}{16}$ in.

This centre joint should be bound with thread. Cover the tail in the same way as the fin. The main plane shape, Fig. 4, is also made of birch, $\frac{3}{8}$ in. by $\frac{1}{8}$ in., for the long spars, and $\frac{3}{8}$ in. by $\frac{1}{16}$ in. for the ribs. The centre rib is $\frac{3}{8}$ in by $\frac{1}{8}$ in. and projects 1 in. on either side of the plane. The joints are glued and nailed, holes first being made for the nails with a fine bradawl or a fretwork drill.

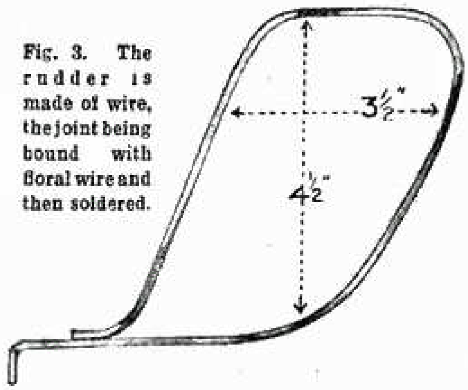

Fig. 3. The rudder is made of wire, the joint being bound with floral wire and then soldered.

The ribs should now be cambered, or curved, Fig. 5. This is done by allowing the steam from a kettle spout to play on the rib one-third of the distance from the front spar. In a short time the rib will be pliable and may be gently bent with the fingers. It is advisable to cut a curve in cardboard to use as a guide in getting the same bend to each rib.

The main spars are next bent at their centres, slightly upwards, to give what is known as a dihedral angle. Make sure that each spar is bent the same.

To cover the plane, lay out the silk on the card as before and place the plane upside down upon it. Cut the silk, leaving a margin of $\frac{3}{8}$ in. all round, and, having smeared it with tube-glue, stick it to one end-rib. Allow the glue to dry before sticking down the other end-rib.

The silk should be pulled quite taut, so that when the front and rear edges of the silk are glued to the plane spars it does not sag but keeps the curve of the ribs all along.

The plane is attached to the main spar by means of two metal bands. These should slide tightly on to the projections of the centre rib, E and F, Fig. 2. They can be made by bending a strip of tin round the spar and centre rib projections, the joints being soldered.

For any aeroplane to fly, the plane must be in a certain position in relation to the centre of gravity of the machine—that is, the point where the model balances. It is the purpose of the tin bands to enable the plane to be placed in this position. The balancing point is found by suspending the machine from a thread, the thread being attached to the main spar.

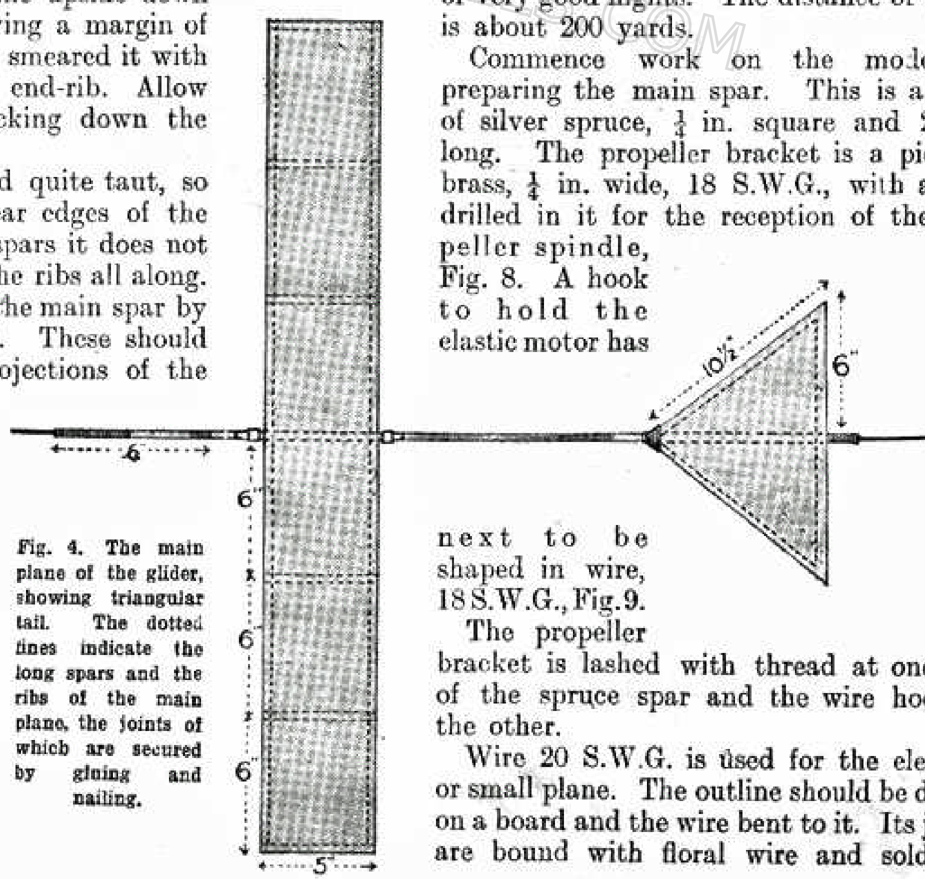

Fig. 4. The main plane of the glider, showing triangular tail. The dotted lines indicate the long spars and the ribs of the main plane, the joints of which are secured by gluing and nailing.

Mark the position with a pencil. Now place the plane on the spar so that its leading edge is about $1\frac{3}{4}$ in. in advance of the mark.

The model is now completed, and ready for flight. Having located a convenient spot to "take off" from, launch the model gently into the wind. The machine should be held horizontally and not pointed upwards. If the nose rises sharply and the flight is undulating, move the plane back; should the model go straight to earth, move the plane forward.

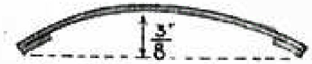

Fig. 5. This shows how the ribs of the main plane are to be cambered, or curved.

As this machine is very sensitive to adjustment the plane should be moved only a little at a time before trying again. Correct any tendency to turn by slightly bending the rudder.

Fig. 6, our second model, is known as a single pusher canard. It flies with the small plane leading, and has the propeller at the rear.

It is a very easy machine to build and is capable of very good flights. The distance of travel is about 200 yards.

Commence work on the model by preparing the main spar. This is a piece of silver spruce, $\frac{1}{4}$ in. square and 24 in. long. The propeller bracket is a piece of brass, $\frac{1}{4}$ in. wide, 18 S.W.G., with a hole drilled in it for the reception of the propeller spindle, Fig. 8. A hook to hold the elastic motor has next to be shaped in wire, 18 S.W.G., Fig. 9.

The propeller bracket is lashed with thread at one end of the spruce spar and the wire hook at the other.

Wire 20 S.W.G. is used for the elevator or small plane. The outline should be drawn on a board and the wire bent to it. Its joints are bound with floral wire and soldered.

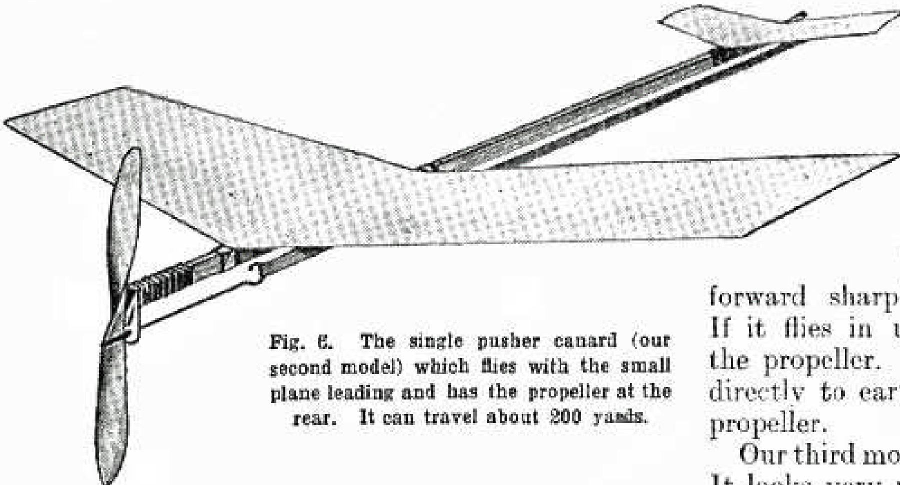

Fig. 6. The single pusher canard (our second model) which flies with the small plane leading and has the propeller at the rear. It can travel about 200 yards.

The centre wire is bent so as to raise the front edge about $\frac{3}{16}$ in. Camber and dihedral angle are to be the same as in the case of the glider plane.

Cover the frame with proofed silk and lash the ends of the centre wire to the main spar. Fig. 10 shows the finished elevator.

The large plane is made of birch, $\frac{1}{4}$ in. by $\frac{3}{32}$ in. for the long spars and centre rib. Pieces of birch $\frac{1}{4}$ in. by $\frac{1}{16}$ in. are used for the other ribs. The large plane is made in the same fashion as the plane of our first model. Note that the centre rib projects, for securing to the main spar with two metal bands, B and C, Fig. 7.

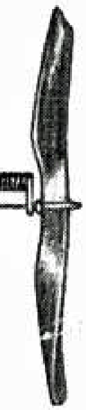

Fig. 7. Side view of the single pusher canard. A is the main spar, made of silver spruce, $\frac{1}{4}$ in. square, and 24 in. long. B and C are metal bands, for securing the centre rib of the large plane to the main spar.

The propeller is prepared from a piece of birch $\frac{1}{16}$ in. thick and 1 in. wide, cut to the shape of Fig. 12. A piece of 18 S.W.G. iron wire is used for the spindle (bird-cage wire does very well), it being bent round the propeller as shown at Fig. 13.

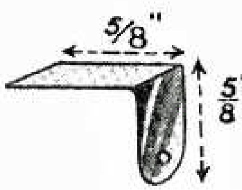

Fig. 8. The propeller bracket, with hole to take propeller spindle.

To bend the propeller, hold the blades in the steam from a kettle spout till the wood is pliable and gently bend with the fingers. Fig. 14 shows the shape of the finished propeller. It should be finished with a coat of varnish, otherwise it is liable to go out of shape.

Six strands of $\frac{3}{16}$ in. flat strip rubber are required for the motor. This should not be stretched when put on.

The approximate position for the plane is for the leading edge to be 7 in. from the propeller bracket.

To fly the model, wind the elastic a double row of knots by turning the propeller in a clockwise direction. Hold the propeller with the right hand and support the front with the left. Throw forward sharply, keeping the model horizontal. If it flies in undulations, move the plane nearer the propeller. If the model does not rise, but goes directly to earth, move the plane away from the propeller.

Our third model, Fig. 15, is a little more ambitious. It looks very much like the real thing, the elastic of the "motor" being enclosed in the body of the 'plane. The length of flight is about 150 yards.

The front piece, Fig. 16, is the first job. It is made from a piece of $\frac{3}{8}$-in.-thick satin walnut. Silver spruce, $\frac{3}{16}$ in. square, is used for the long pieces of the body and for the struts or distance pieces. The long pieces of the body are secured in the slots of the front piece by nailing and gluing.

Fig. 17 gives a side view of the model. Fig. 18 is a plan view. The end piece A, shown there, is birch, $\frac{3}{8}$ in. by $\frac{1}{4}$ in. The rubber hook and skid, made from one piece of 18 S.W.G. wire, is secured in the end piece, Fig. 19, before it is fixed into place in the body. The joint of this end piece must be bound with thread. It is important that this be made a strong job, it having to withstand the pull and twist of the elastic motor.

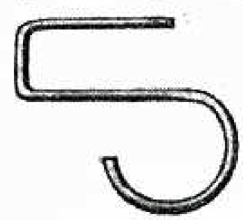

Fig. 9. This hook, shaped in wire, is to hold the elastic motor of the single pusher canard.

Having secured the front and rear pieces, mark the positions of the short body struts and fix them by nailing, first putting a spot of glue on the strut ends, Fig. 20.

Now bend from 16 S.W.G. steel wire the two V-shapes that form the chassis struts, Fig. 21. The looped ends are lashed to the bottom members

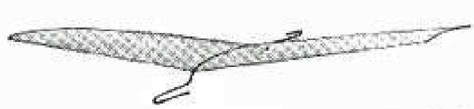

Fig. 10. The finished elevator, with hooks for securing to the main spar.

of the body, and the axle, made of 16 S.W.G. wire, is secured in the V's by binding with floral wire and then soldering.

The wheels can be made of $\frac{3}{16}$ in. thick three-ply wood, a piece of tube forming the hub. The hub is secured to the wheel by soldering a washer on either side. Fig. 22 shows the method of fixing. The wheels are secured on the axle by turning up the axle ends.

The nose-piece of the model, B, Fig. 17, is made next, of $\frac{3}{8}$ in. thick satin walnut. This is fixed in position in the same way as the wheel hubs. The use of the tube is for the propeller spindle to run in, and it should take a 16 G. cycle spoke with an easy fit.

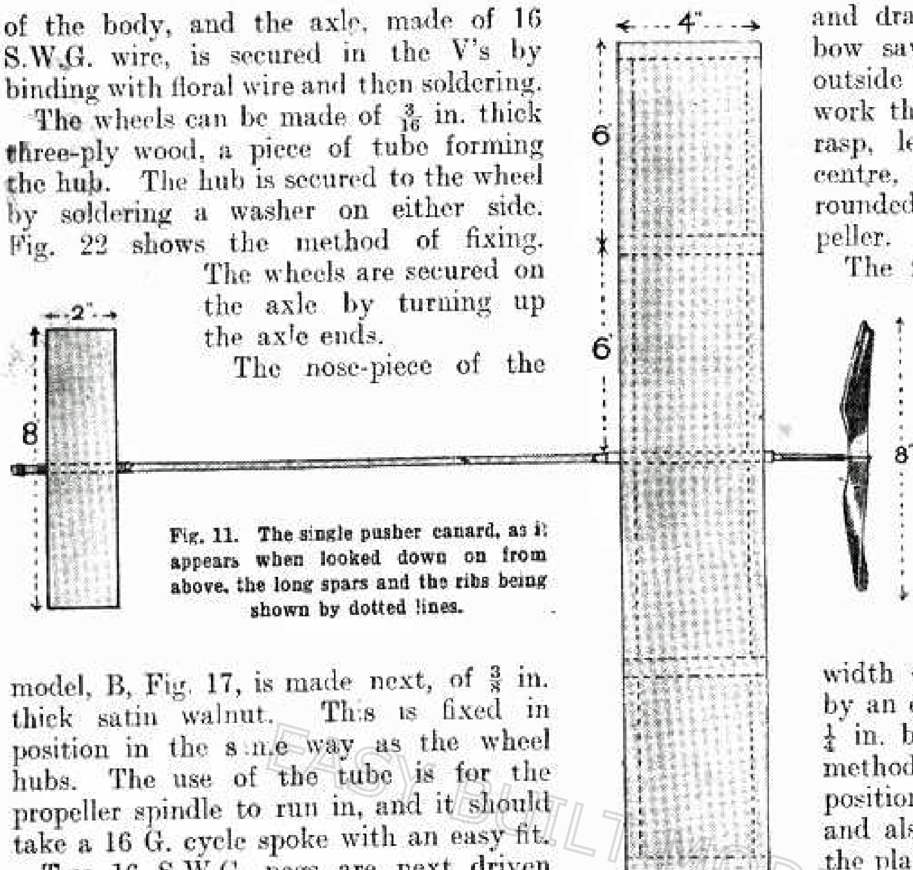

Fig. 11. The single pusher canard, as it appears when looked down on from above, the long spars and the ribs being shown by dotted lines.

Two 16 S.W.G. pegs are next driven into the nose-piece, and two holes drilled in the front piece of the body to take them, Fig. 16. The idea is to allow the nose to be easily detached from the body; the pull of the rubber motor is quite sufficient to keep it in place.


Fig. 12. The propeller, cut from a piece of birch, as it appears before being twisted.

Now make the propeller spindle from a 16 G. cycle spoke, the hook being bent after it has been slipped into the tube. Fig. 23 shows the nose and propeller spindle. The clutch is 18 S.W.G. wire, bound with floral wire and strongly soldered.

The body, or to give it the correct name, the fuselage, may now be covered. Jap silk is the best material to use. Stick it down in four pieces (first damping the silk), covering the top of the fuselage first, the two sides, then the bottom. The top is covered only as far as the strut B, Fig. 18. When dry, the covering should be given a couple of coats of "dope," sold specially for the purpose of proofing and tightening the silk.

The propeller is carved from a block of white wood or satin walnut, 10 in. long by $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. First drill the centre and draw the outline, Fig. 24. With a bow saw or chisel cut away the wood outside the shaded parts. Proceed to work the blank into shape with a wood rasp, leaving it fairly thick near the centre, and finish with glasspaper. The rounded edge is to be the front of the propeller. Fig. 25 shows the finished article.

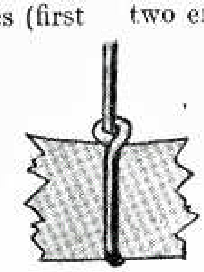
Fig. 13. A piece of iron wire is bent round the propeller to act as a spindle.

The frame of the plane is constructed of birch, $\frac{3}{8}$ in. by $\frac{1}{8}$ in. for the long pieces, $\frac{3}{8}$ in. by $\frac{1}{16}$ in. for all the ribs, except the end ones, which are $\frac{1}{2}$ in. by $\frac{1}{16}$ in. The frame of the plane should present no difficulty, it being made and covered after the same fashion as the planes of the two models already described, not forgetting the camber and dihedral angle.

The span is 3 ft. and the width $4\frac{1}{2}$ in. It is secured to the body by an elastic band, a piece of strip rubber $\frac{1}{4}$ in. by $\frac{1}{32}$ in. serving admirably. This method of attachment allows the correct position of the plane to be easily found, and also lessens the force of shocks when the plane lands.

The tail is made of 20 S.W.G. steel wire, excepting the wire C, Fig. 18, which is 18 S.W.G. Make a drawing of the tail on a piece of board, then bend the wire to it. You will be able to do this better if some short nails are knocked at intervals into the board on the outline drawn, allowing a little for the thickness of the wire, so that it rests on the pencil lines.


Fig. 14. The finished propeller, after the blades have been steamed and twisted.

Having made the outside shape by bending it around the guide nails, and soldered in position the wire C, Fig. 26, remove it from the board. Now prepare the centre wires A and B, Fig. 26, which is really one piece of wire bent into a V-shape. The two ends are hooked and the apex bent to a right angle. The V-shape is soldered in position on the other part of the tail. The object of the hooks and the bent end C is to enable the tail to be attached to the body

This is done by putting a small screw-eye into each of the top body members, just behind the strut B, Fig. 18, a small wood screw securing the back of the tail. Fig. 17 makes the method clear. The rear edges must be bent slightly up.

All the stages in the construction of our third model are shown on this page. The completed aeroplane is seen on the opposite page.

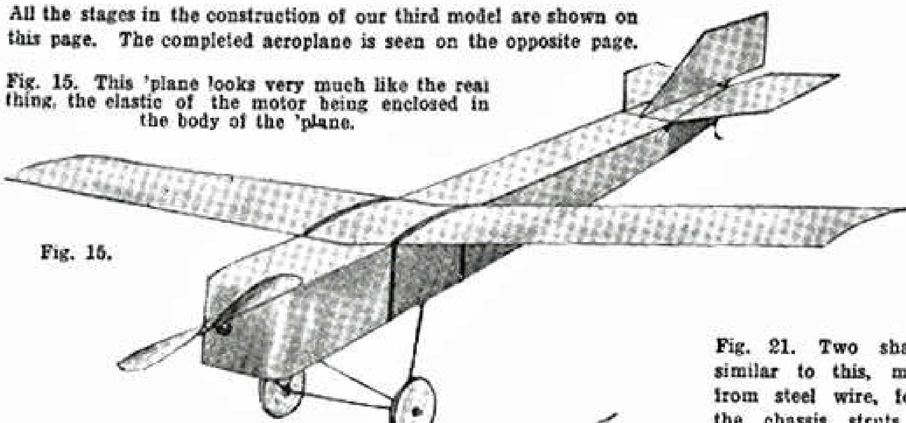

Fig. 15. This 'plane looks very much like the real thing, the elastic of the motor being enclosed in the body of the 'plane.

Fig. 15.

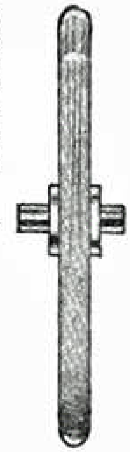

Fig. 22. The wheels are made of $\frac{3}{16}$ in. thick three-ply wood, a piece of tube forming the hub. The latter is secured to the wheel by soldering a washer on either side.

Fig. 22.

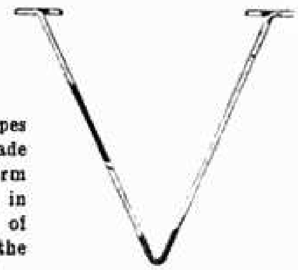

Fig. 21. Two shapes similar to this, made from steel wire, form the chassis struts, in the lower angle of which the axle of the wheels is secured.

Fig. 21.

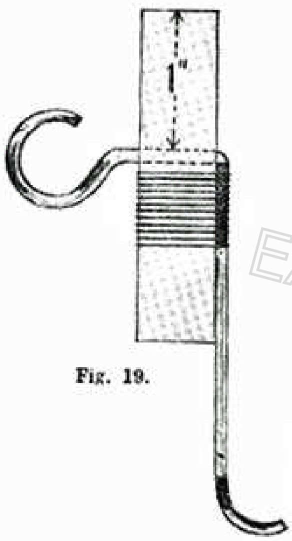

Fig. 19.

Fig. 19. How the rubber hook and skid (in one piece) is secured in the end piece (shown on extreme right of Fig. 17) before it is fixed into place in the body.

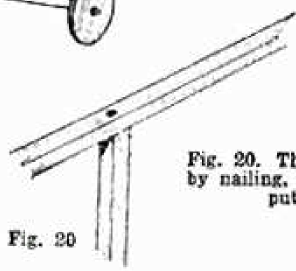

Fig. 20

Fig. 20. The short body struts are fixed by nailing, a spot of glue first being put on the strut ends.

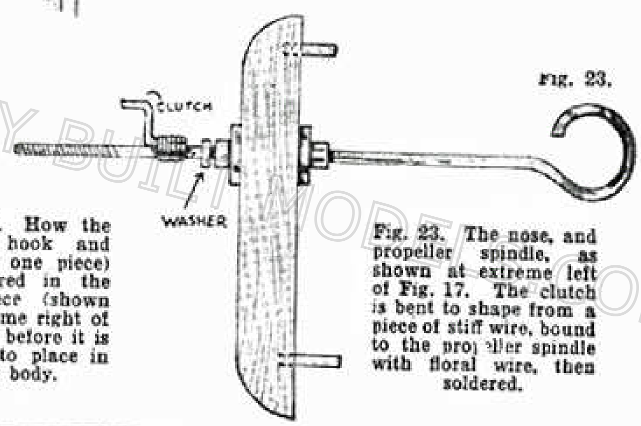

Fig. 23.

Fig. 23. The nose, and propeller spindle, as shown at extreme left of Fig. 17. The clutch is bent to shape from a piece of stiff wire, bound to the propeller spindle with floral wire, then soldered.

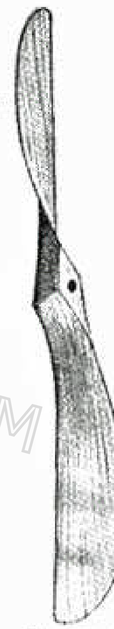

Fig. 25.

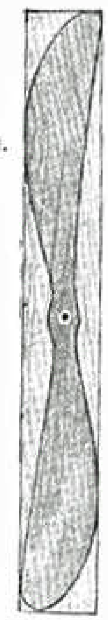

Fig. 24.

Fig. 24. The propeller marked out on a block of wood and with centre drilled, and, Fig. 25, shaped from the blank.

Fig. 26.

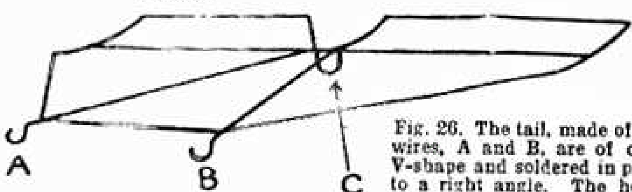

Fig. 26. The tail, made of steel wire. The centre wires, A and B, are of one piece bent into a V-shape and soldered in place: the apex is bent to a right angle. The hooks, and bent end C, enable the tail to be attached to the body of the 'plane.

Fig. 16.

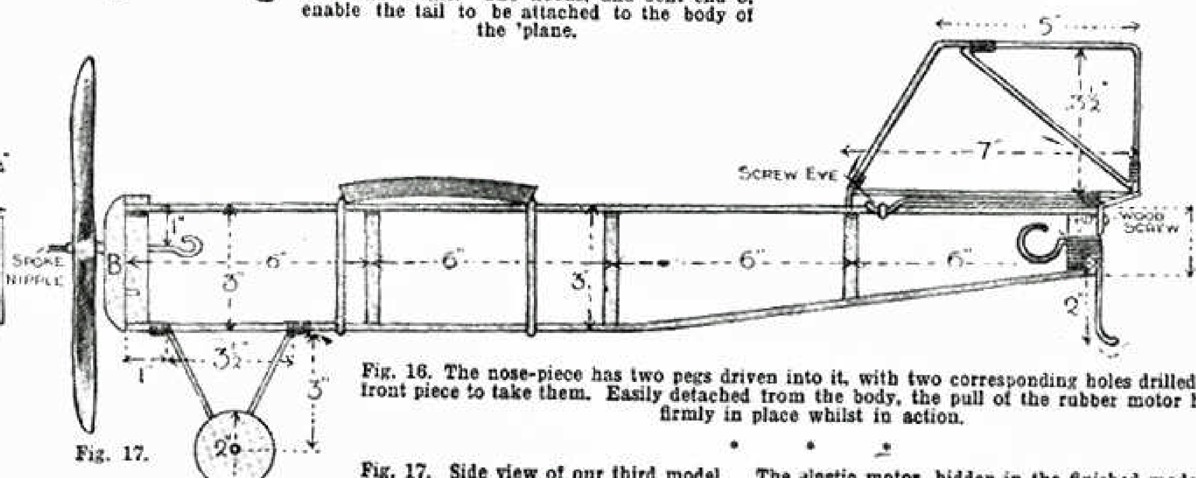

Fig. 17.

Fig. 16. The nose-piece has two pegs driven into it, with two corresponding holes drilled in the front piece to take them. Easily detached from the body, the pull of the rubber motor holds it firmly in place whilst in action.

* * *

Fig. 17. Side view of our third model. The elastic motor, hidden in the finished model, runs parallel with and just above the dotted line shown along the length of the body.

The fin or rudder is next made, of 20 S.W.G. steel wire. All joints of both tail and fin are bound with floral wire and soldered. To secure the fin, a hole is drilled in the centre of the body strut B, and also in the end piece A, Fig. 18. These holes are to receive the prongs of the fin and they should make a tight fit.

The motor for the model is ¼ in. flat strip rubber. This should be measured to length to form a skein of ten strands. The end of the skein is to be dropped through the hole in the front piece, first removing the tail and fin and standing the model on its end. The end of the skein is then easily got at and slipped over the hook at the rear of the model.

The other end of the skein is put on the hook of the propeller spindle. There should be just enough tension on the rubber to keep the nose of the model in place. Now assemble the plane tail and fin and put on the propeller. The correct position for the plane is found in the same manner as that described for our first model.

This plane is able to rise from the ground, and should be placed facing the wind. A fairly smooth surface for it to take off from is necessary. If the machine does not fly at first, adjust in the manner described for the glider.

Though these three models are proved fliers and will fly extremely well if made according to the instructions given, do not expect them to fly properly at the very first attempt. They require to be "tuned" up to get the best results, the position of the large plane especially being a most important factor.

Finally, the length of flight can be greatly increased and the life of the rubber lengthened if the latter is smeared with a special rubber lubricant sold for the purpose.

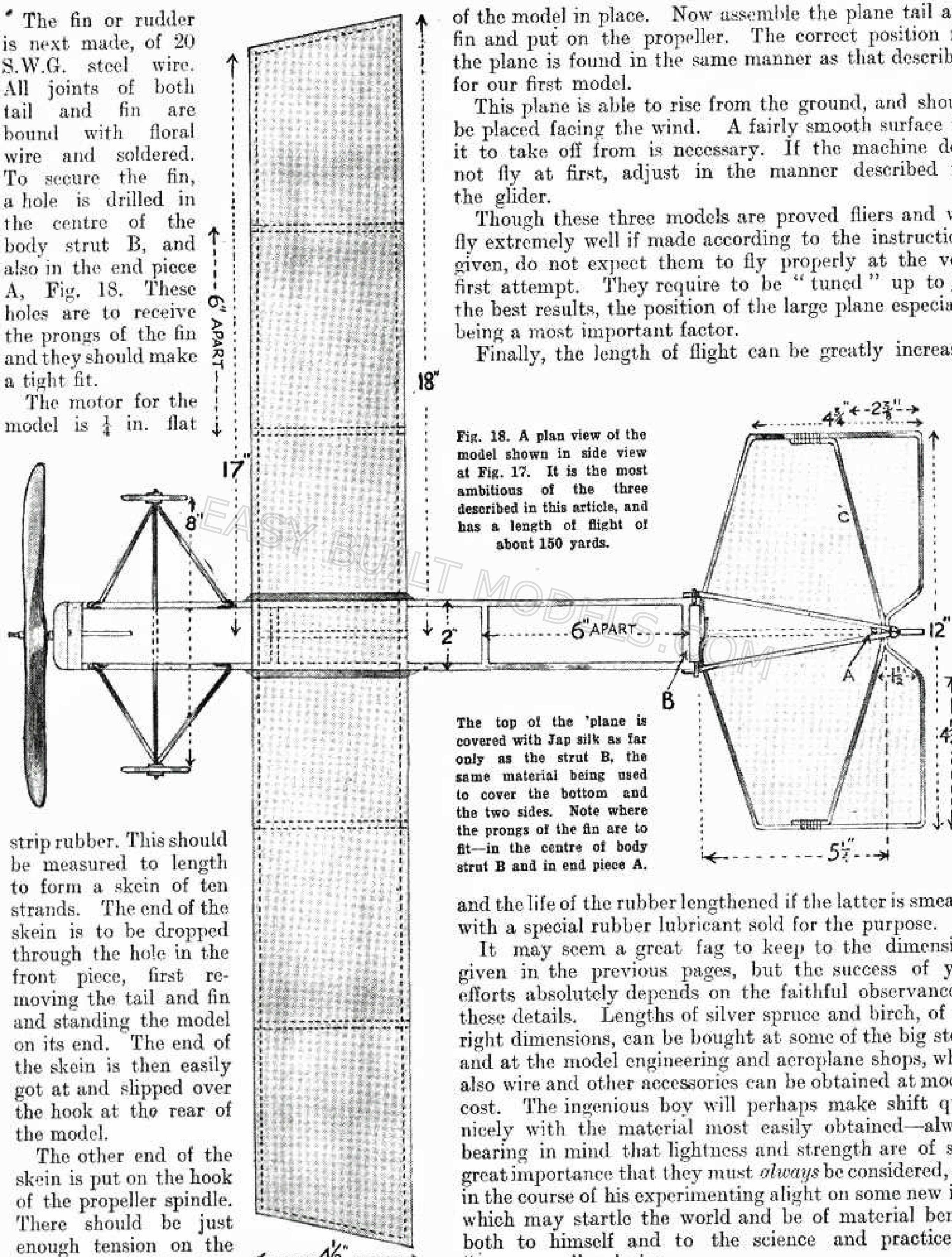

Fig. 18. A plan view of the model shown in side view at Fig. 17. It is the most ambitious of the three described in this article, and has a length of flight of about 150 yards.

The top of the 'plane is covered with Jap silk as far only as the strut B, the same material being used to cover the bottom and the two sides. Note where the prongs of the fin are to fit—in the centre of body strut B and in end piece A.

It may seem a great fag to keep to the dimensions given in the previous pages, but the success of your efforts absolutely depends on the faithful observance of these details. Lengths of silver spruce and birch, of the right dimensions, can be bought at some of the big stores and at the model engineering and aeroplane shops, where also wire and other accessories can be obtained at modest cost. The ingenious boy will perhaps make shift quite nicely with the material most easily obtained—always bearing in mind that lightness and strength are of such great importance that they must *always* be considered, and in the course of his experimenting alight on some new idea which may startle the world and be of material benefit both to himself and to the science and practice of "grown-up" aviation.