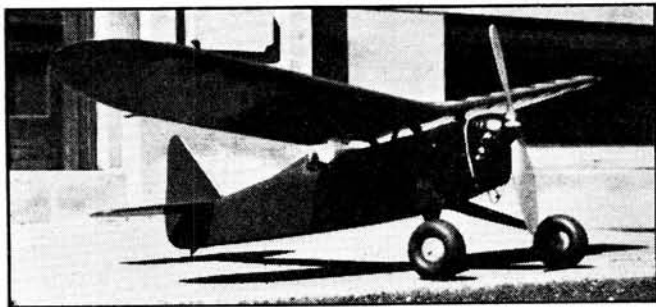




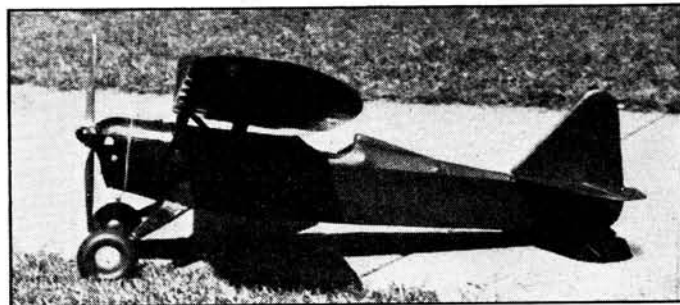
WEIGHT — 1 LB.
SPAN — 42"
LENGTH — 30"
POWER — "ELF"
SPEED — 24 MPH.
GLIDE — 10 TO 1

DESIGNED &
DRAWN BY:

Ken Willard



The trim little ship that looks like a racer.



The parasol wing and negative thrust line gives stability.

Building the Midget "Cavu"

AT A TIME when gasoline model design is showing an increasing tendency for complicated structural design, it will be a distinct relief for model builders with little experience, as well as for the expert, to find a model which is above the average in looks and performance, yet is simpler to build than the majority of rubber-powered models now on the market. The "Cavu" (airway abbreviation for ceiling and visibility unlimited) was originally designed with that purpose foremost, and the fact was also taken into consideration that a large number of model builders do not have completely equipped workshops. Only the simplest tools are required in the construction of this model; a razor blade, a pair of pliers and other simple tools being all that are necessary.

Upon completion of the model, any builder will find that he has a model which he may well be proud of, both as to looks and performance. The specifications as given are as accurate as could be determined by actual measurement with a stop-watch. The speed of 24 m.p.h. was reached with the design propeller turning over at approximately 3200 r.p.m.s., and by minor adjustments a speed of 27 m.p.h. can be reached. However, the cruising speed of 24 m.p.h. provides an excellent means for climb and radius of turn.

On its first flight, this model took off from a cinder runway without any aid whatsoever, climbed to a height of 200 feet, flew across the width of the airport, over the hangars and glided to a perfect landing in an adjoining pasture. The total length of the flight was seven minutes, of which two and one-half minutes was engine run. The flight was made at about 7:00 in the evening; obviously there were no thermals to aid the ship in its performance.

Since that time, the ship has completed 53 flights with times ranging from two to fifteen minutes, the length of each flight having been determined beforehand by the amount of gas put in the gas tank. The most gas that has been used to date was half a tank full, or approximately $\frac{1}{8}$ of an ounce, which gave the model a flight of 15 minutes and 42 seconds.

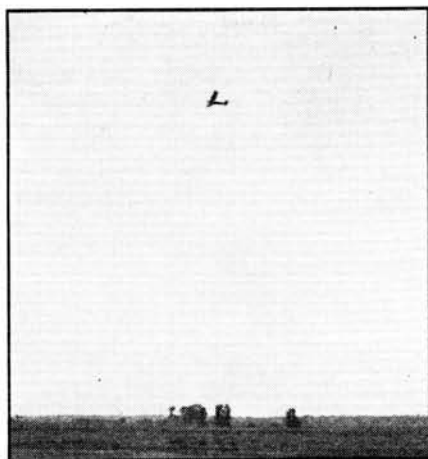
With this performance, and the ease of construction, which will be apparent by studying the drawings, combined with the convenient small size and the fact that it can be carried completely set up and ready to fly in an ordinary car, model builders

How You Can Construct a Small "Convenient" Gas Model That Will Perform Like a Large One

By KEN WILLARD

will find that, for purposes of demonstration or sport, this model is unequalled. Its simple though rugged construction makes minor repairs a matter of only an hour or so, and so far as the author can determine a model that can be seriously damaged only through striking some object head on, or being stepped on. Irregular landings (which incidentally are few and far between) caused by gusts of wind so far have no effect upon the model whatsoever.

In other words, fellows, this model's got everything, so let's get going, and by putting in a couple of hours a day, before you



The little ship gaining altitude and heading for the open spaces.

know it she will be flying right out of your workshop.

Bill of Materials

Fuselage

Longerons, 4 pieces $\frac{3}{16}$ " sq. x 26" long.
Struts, cross braces and diagonals, 3 pieces $\frac{3}{16}$ " sq., 24" long.
Stringers, 8 pieces, $\frac{1}{8}$ " sq., 24" long.
Former material, 1 piece, $\frac{1}{16}$ " x 2" x 24".
Cockpit cover, 2 pieces, $\frac{1}{32}$ " x 2" x 4".
Engine cowl stringers, 1 piece, $\frac{1}{8}$ " sq. x 12".
Nose block, 1" x 2" x 4".
Headrest, 1 piece, $\frac{3}{4}$ " x $\frac{5}{8}$ " x $4\frac{1}{2}$ ".

Windshield, stiff celluloid, 2" x 4" cut to desired shape.
Engine mounts for Elf engine, $\frac{1}{4}$ " x $\frac{3}{8}$ " x $1\frac{1}{2}$ ", 2 pieces hard wood.
Engine mount supports, scrap balsa, $\frac{1}{8}$ ".

Gas tank cradle formed from one piece $\frac{1}{2}$ " x $\frac{3}{8}$ " x $1\frac{7}{8}$ ".
Battery box, $\frac{1}{8}$ " flat stock.

Wing

Wing ribs cut from 3 pieces, $\frac{1}{16}$ " x 2" x 24" flat stock.

Main spar, two pieces, $\frac{3}{16}$ " x $\frac{3}{4}$ " x 24".
Leading edge, 2 pieces, $\frac{1}{16}$ " sq., 24" long.
Trailing edge, 2 pieces, $\frac{1}{2}$ " x $\frac{1}{4}$ " x 16".
Center section trailing edge carved from $\frac{3}{16}$ " flat stock.

Wing tips carved from $\frac{1}{4}$ " flat stock.

Strut braces $\frac{3}{8}$ " x $\frac{1}{2}$ " x $\frac{3}{4}$ ".

Wing struts, 1 piece, $\frac{1}{2}$ " x $\frac{1}{4}$ " x 18".

Wing tip braces, 1 piece, $\frac{1}{8}$ " x $\frac{1}{4}$ " x 6".

Tail Surface

Stabilizer:

Main spar $\frac{1}{8}$ " x $\frac{1}{4}$ " x 15".

Leading edge, 2 pieces, $\frac{3}{16}$ " sq. x 7".

Ribs cut from 1 piece, $\frac{1}{16}$ " x $\frac{1}{4}$ " x 15".

Tips carved from $\frac{3}{16}$ " flat stock.

Elevators:

Main spar, 2 pieces, $\frac{1}{8}$ " x $\frac{1}{4}$ " x $7\frac{1}{2}$ ".

Trailing edge, 2 pieces, $\frac{1}{8}$ " x $\frac{1}{4}$ " x 6".

Ribs cut from 2 pieces $\frac{1}{16}$ " x $\frac{1}{4}$ " x 12".

Tips carved from $\frac{3}{16}$ " flat stock.

Inner trailing edge, 2 pieces $\frac{1}{8}$ " x $\frac{1}{4}$ " x 3".

Hinges cut from soft aluminum.

Rudder:

Main spar $\frac{1}{8}$ " x $\frac{1}{4}$ " x $7\frac{1}{2}$ ".

Leading edge, $\frac{1}{4}$ " sq. x 6".

Trailing edge, 1 piece, $\frac{1}{8}$ " x $\frac{3}{8}$ " x 7".

Tip and bottom former carved from $\frac{3}{16}$ " flat stock.

Ribs cut from 1 piece $\frac{1}{16}$ " x $\frac{1}{4}$ " x 15".

Base rib $\frac{1}{4}$ " sq. x 4".

Landing Gear

Landing gear formed from $\frac{1}{16}$ " spring wire 26" long faired with $\frac{1}{16}$ " soft balsa.

$\frac{3}{4}$ " air wheels.

Tail skid formed from $\frac{1}{32}$ " spring wire or bamboo with $\frac{1}{8}$ " flat stock balsa support.

Propeller Block

Propeller block $1\frac{1}{4}$ " x $\frac{1}{2}$ " x 11".

Spinner carved from piece 1" x 1" x $\frac{5}{8}$ ".

Miscellaneous

Silk thread for binding landing gear, spark coil and condenser to cross braces.

2 pieces thin aluminum $\frac{1}{2}$ " x $\frac{1}{4}$ " for nose block attachments.

Spaghetti tubing for cockpit edge.

Entire ship covered with Japanese tissue



The author with the finished model. This shows its comparative size.

with three coats of dope, colored to suit, then finished with one thin coat of lacquer. In every case in the above list of materials, sufficient leeway has been allowed for unexpected breakage, and the builder will find that he has more than enough material if he uses reasonable care in construction.

Fuselage

The first step in construction will consist of enlarging the plans to full size. Study the drawings carefully. After the side view has been enlarged to full scale, place a sheet of wax paper over the drawing and pin the longerons in place on the drawing, then cut the struts to fit at the stations as indicated and glue them in place. Next cut the diagonal members to fit and glue them in place. Use plenty of glue to insure maximum strength. After you have finished the one side, lay it aside and allow it to dry completely while building the other side. Upon completion of the second side, leave it in place and cut out seven cross braces $2\frac{1}{8}$ inches long. Lay aside three of them, and, working rapidly, glue four of them upright; one at top of station 2, one at the top of station 5, one at the bottom of station 5 and one at the bottom of station 3. Place a drop of glue on the projecting end of these four cross braces and fit the other side down upon them, aligning the two sides and propping them with bottles or batteries, or any vertical sided object, and allow the glue to dry thoroughly. When it is dry, take the other three cross braces $2\frac{1}{8}$ inches long and glue at the top of stations 3 and 4 and the bottom of station 4. Allow them to dry thoroughly. Next pinch the two sides together at the tail and glue thoroughly, allowing the longerons to assume their own curve, making sure that they are curved equally. Hold the tail together until it dries, either with pins or with binding. Then cut and glue cross braces to fit at stations 6 and 7. Next cut a cross brace $1\frac{1}{8}$ inches long and one 1 inch long for the top and bottom at station 1. The top cross brace will be removed later and the engine will serve as the cross brace. Cut cross braces to fit at the bottom of station 2 and one to cross the fuselage where the rear landing gear wire attaches.

Now cut out the formers and glue formers 2A to 7 inclusive in their respective positions and insert the stringers. Next cover the cockpit section with the proper two pieces and, after they have dried thoroughly,

ly, cut out the cockpit hole with a sharp razor. Glue the carved pieces to the sides of station 1, as shown in the cowl detail drawing and then glue the side stringers in place. Next cut and bend the landing gear wires to shape. Bind the front wire to the cross brace at station 2 and the rear wire at the cross brace between stations 2 and 3 as shown in the side view. Then cut the balsa fairing to fit between the two wires, bind it in place and then spread glue evenly over the whole landing gear. Now glue the bottom fuselage stringers in place. Shape the tail skid with spring wire or bamboo, as preferred, and glue in place with the balsa support. Carve out the headrest, but do not put in place until the fuselage has been covered later on. Carve the nose block to shape, split in half vertically, hollow to about $\frac{1}{16}$ inch wall thickness, and on each half make the necessary cut-outs for the propeller and engine cylinder as shown in the front view. Incidentally, the drawing shows the grain as running fore and aft, but this should be corrected to run up and down as shown in the front view.

Now cut out formers 1 and 2 and glue the cowl stringers in place as shown in the cowl detail and cover with the 1/32 of an inch stock; then, as shown in the drawing, cut the top of the nose block off and glue it to the cowl. Cut the hole in the top of the cowl for access to the gas tank when in position, and the cowl is complete. Next cut out and place the gas tank cradle as shown. Then fit the engine mounts, using a beveled joint at station 1 and the diagonal, glue in place and reinforce with flat stock as shown in the cowl detail. This engine mount is for use with the Elf engine, but may be varied slightly to accommodate other engines of similar weight and power. Remove the cross brace at the top of station 1 and place the motor in position. Shape the engine mount blocks and drill them at the forward end to fit the particular motor which is used. Note that in the side view the propeller is shown with a down thrust from a zero stabilizer angle. This down thrust angle as measured from a zero stabilizer setting should be approximately $1\frac{1}{2}$ degrees. It may be accomplished by either placing the engine mounts in at this

angle or by inserting washers between the engine frame and the mounts at the rear mounting holes.

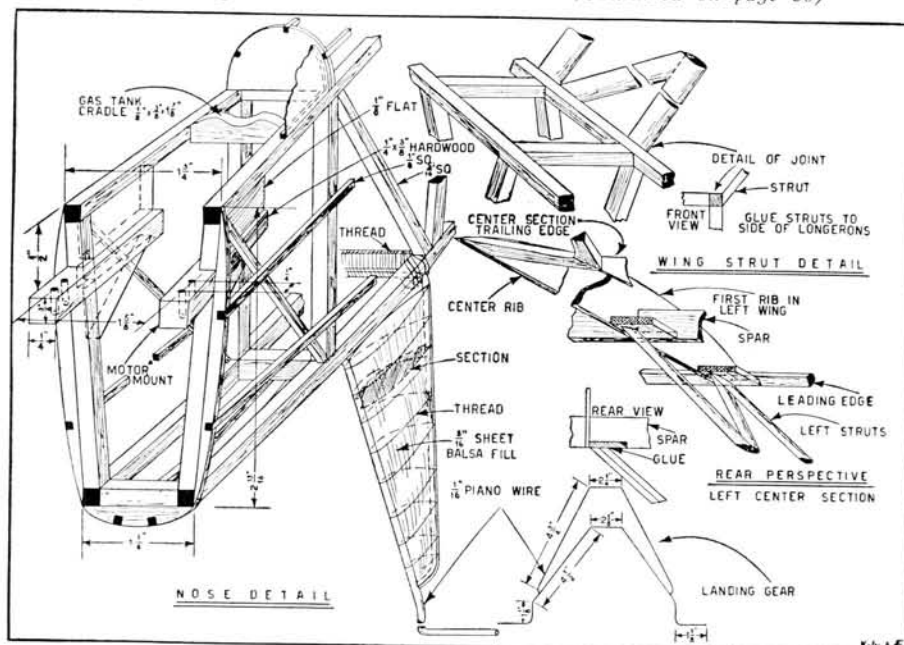
Now build the battery box with the one side closed only by the spring wire as shown, which will press the batteries against the copper sheet at the other side and maintain a good contact. A rubber band will serve to hold the batteries firmly in place while in flight. Solder the wire leads to the spark coil and then place the spark coil as shown and bind to the cross brace at the bottom of station 4. Bind the condenser to the cross brace at the top of station 2 bringing the leads through the former alongside the longerons to the timer. Wire the components of the engine in accordance with the standard wiring diagram as provided by the manufacturer.

Place the lower portion of the nose block in position and glue the small pieces of aluminum provided midway along station 1. Drill a small hole in one end which projects over station 1 and with small screws hold the lower portion of the nose block in place. Glue the spaghetti tubing to the edge of the cockpit, cut out and attach the windshield and the fuselage is ready for covering.

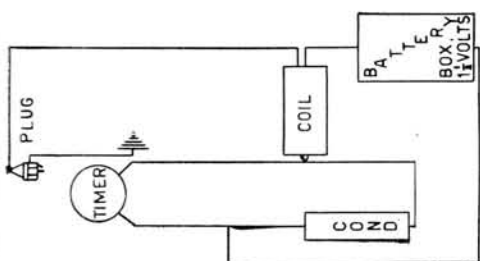
Wing

Although it is not absolutely necessary that the plan view of the wing be enlarged to full scale, unless the builder has already had considerable experience in building wings, it is suggested that the plan be enlarged and the wing be constructed right on the plan. Complete the plan of the left panel to correspond to the right panel and build each panel separately, leaving sufficient length on the spar and leading edge at the center section to overlap and be securely joined later on. Cut out the ribs as shown in the full scale drawing, notching each rib to receive the leading edge and main spar and trimming the trailing end to fit the trailing edge as shown. Cut the spar material to the proper length and mark the rib positions on the spar, then slip the ribs on the spar, aligning them carefully, and glue in place securely. While this is drying, round off and shape one

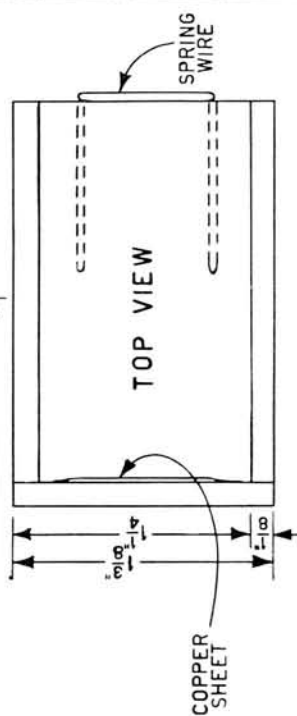
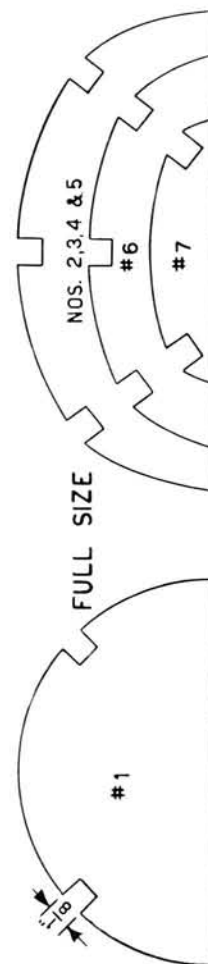
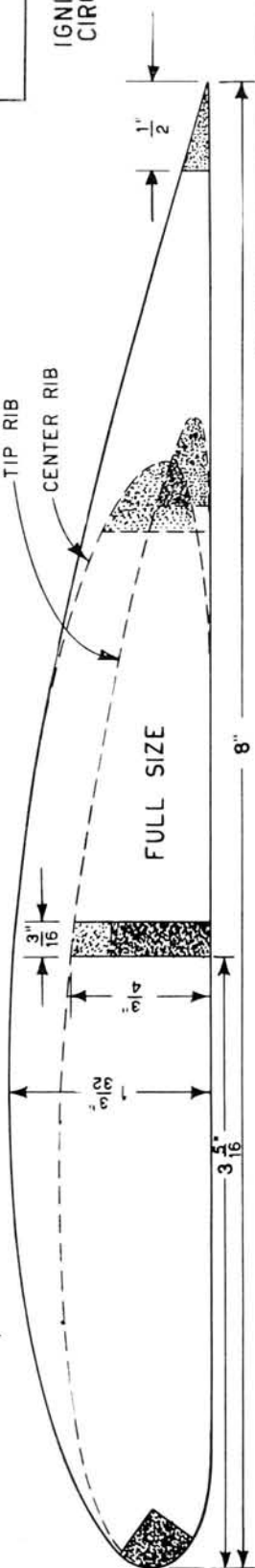
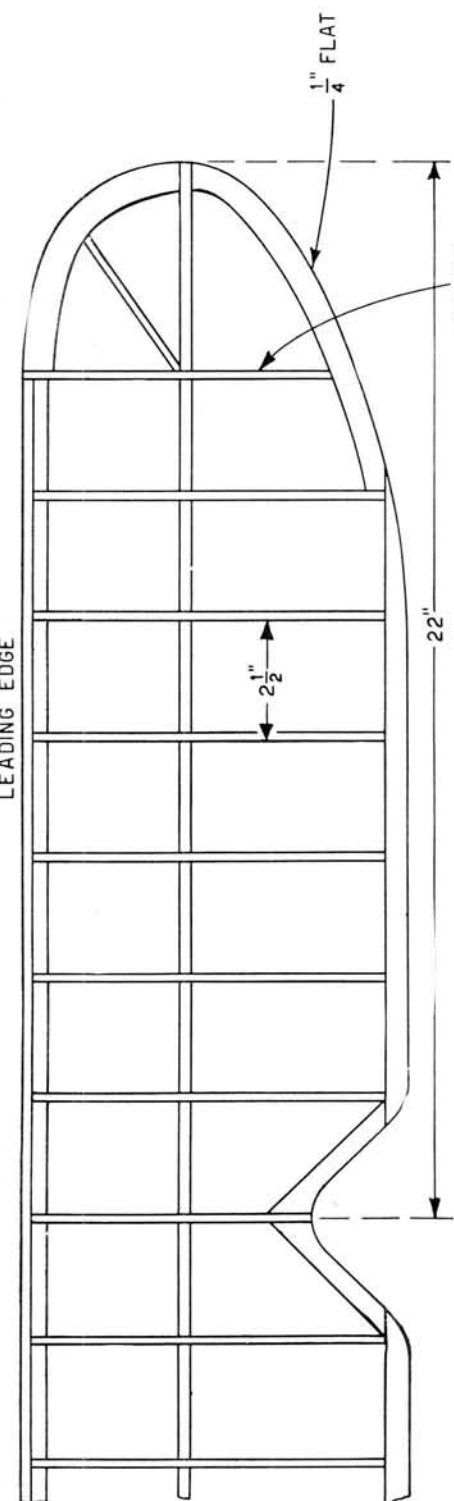
(Continued on page 38)



LEADING EDGE



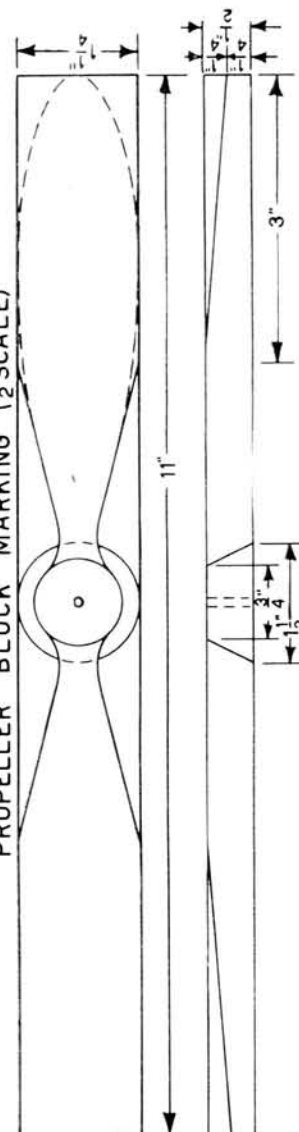
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technique as developed by sailplane pilots. The wind beats against their wings instead of the wings beating against the wind as in flapping flight and the wings are flexible so that a constant propelling or "sculling" force is exerted without effort on the part of the bird. This effect is not obtained with the relatively stiff wings of the sailplane or with the balsa contest gliders. Many attempts have been made of course, to use flexible wings on sailplanes but a workable combination has not yet been found. Perhaps we now have a proper scientific approach in the balsa glider and we may be able to introduce flexibility without losing the excellent gliding qualities already developed.

In order that we may appreciate the propelling power inherent in the natural wind as utilized by soaring birds, let us examine the record made by Zahm some years ago showing the vertical and horizontal variations of direction during a period of only ten seconds. We see that the wind deviates both ways over twenty degrees from a straight line so that a bird facing the apparent wind is really "quartering" at all times if its wings are flexible, the body of the bird travelling straight or with slight undulations while the wings given under the varying pressures and produce definite thrust in the direction of flight.

This peculiar advantage of flexible wings is realized by the soaring bird in addition to other properties of moving air which are utilized both by the birds and by man-made sailplanes and balsa contest gliders. For the benefit of new students of soaring flight these effects will be briefly summarized.

The "Lilienthal Slope" is a natural upslant of the wind amounting to about four degrees resulting probably from the friction of the air over the earth near the surface. A velocity gradient results, the wind speed increasing steadily up to an altitude of about five hundred feet.

Circling flight wherein the bird rises upwind and descends downwind as is generally the observed case introduces the "Rayleigh Effect" described by Lord Rayleigh and investigated mathematically as well as practically by Idrac in his extended studies of the flight of the albatross, a bird similar to the frigate-bird of Florida but much larger. The "Rayleigh Effect" proves definitely that potential support is obtained by the bird circling in this fashion and if the wind velocity is sufficient (about fifteen miles per hour) this effect alone is enough to account for sustentation.

Finally, in addition to rising currents caused by thermal and other forces, we have an elaborate pattern of dynamic soaring flight possibilities where the bird or sailplane weaves its way in and out of wind currents of different directions and velocities storing and using energy to advantage in ways fairly well known and demonstrated.

Our study of soaring flight is far from complete. We must improve the contest glider and give it flexible wings—then do the same thing with large sailplanes. We cannot say that the superior flight of the soaring birds, here in Florida for example, is due to exceptional soaring conditions because gliding and soaring models perform no better here than they do up north where

we have no true soaring birds. We cannot blame the birds or the air—the fault rests with us and our soaring machines.

How to Build the Arrow Speedster

(Continued from page 9)

Flying

Since the model has a closed rear hook only 12, 16 or 24 strands can be used. Closer variation in power can be had by using odd sizes of rubber such as 7/64" or 3/32". Here is the procedure to put the rubber in. Cut off a length of rubber according to the number of strands to be used. Tie the two ends making it into a loop. Fold the rubber into half as many strands as the intended number. Get a piece of thin cord about 20 inches long and tie a small screw to one end of it. The screw serves merely as a weight. Now hold the body perpendicular and drop the screw in and over the rear hook. Next turn the body in the opposite direction, letting the string loop over the rear hook and also the screw drop out in the front. Tie one end of the rubber and the string together. Pulling the free end of the string will double the rubber over the rear hook. Untie the string while holding on to both ends of the rubber and hook it to the prop shaft. For the rear hook arrangement here, my thanks to young Buster Kaiser who was the first to be caught by the speed model craze.

Do not be alarmed by the extremely short rubber line. Even using 24 strands, more than 200 turns can be stored with the aid of a winder. This amount will zip the plane over 120 feet away.

Make sure that the thrust line is straight every way. The tail surfaces are not to be warped or adjusted in any case. Diving or climbing tendency is remedied by changing the wing incidence.

Avoid hitting the bare spots and soft landings!

Building the Midget "Cavu"

(Continued from page 18)

corner of the ⅝ inch square leading edge material, and, as soon as the ribs have dried thoroughly to the spar, glue the leading edge in position.

Next shape the trailing edge material to the proper form and glue in place. While this is drying, carve the tip outline from the ¼ inch flat stock to conform to the drawing, glue in place and reinforce the forward piece with the diagonal brace as indicated. To join the two panels, cut the overlapping ends of the main spar and leading edge at an angle so that when fitted together the wing will show 3 inches dihedral at each tip. Lay one panel flat on your table and glue the center section of the main spar and leading edges together propping the wing tip of the other panel 6 inches up from the flat surface of the table. Allow this to dry, then bind the center section of the spar and leading edge with the silk thread and again coat with glue. Then carve the trailing edge cut-outs and glue them in the proper position. To complete the construction, the wing strut reinforcements are glued securely in place and the

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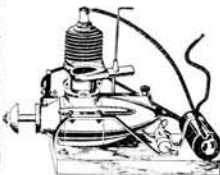
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entire unit is sanded with fine sandpaper.

From the three view drawing, project the wing struts to their true length, carve each to a streamlined shape and trim the lower ends to fit flat against the side of the top longeron and the upper ends to fit flat against the strut bracings in the wing structure. Glue the struts in place on the fuselage, lay the completed wing on the struts and complete the final trimming of the struts to give the wing a one degree angle of incidence with respect to a zero stabilizer setting. Do not glue the wing in place until after both wing and fuselage have been covered.

Tail Surface

The construction of the tail surface is extremely simple; merely enlarge the drawing to full scale and glue the respective elements in position as shown. Construct the rudder and vertical fin as one complete unit, the horizontal stabilizer as one complete unit, and each elevator separately. The elevators are joined to the stabilizer by the simple aluminum hinge as shown in the full scale drawing, which is merely forced into the balsa and glued in place.

While the tail surface units are drying, mark the propeller block as shown and carve your propeller. Different propellers can be used with different engines. This particular design will give a 6 inch pitch propeller and the Elf engine turns it over at approximately 3200 r.p.m.s.

Covering and Assembling

The model is covered with ordinary Japanese tissue throughout, which, after being put on the framework, is sprayed with water, allowed to dry and then given three coats of pigmented dope. The color and trimming is, of course, to individual taste. The original model was colored a brilliant international orange, trimmed with black. For a high gloss finish, give the covering a final thin coat of lacquer. To assemble the model, glue the lower end of the rudder spar to station 8. Minor adjustments in rudder setting may be accomplished by inserting a pin in the leading edge through the stabilizer leading edge. Now when all the units are in place, including two battery cells in the battery box, check the balance of the fuselage by suspending from the diagonal wing strut. The fuselage should balance in flying attitude very close to station 3. Cut away the covering on the wing from the wing strut braces and glue the wing in place and the model is ready for the test flight.

Testing and Flying

The ship is easy to test because of its very convenient size and preliminary tests can even be run in the back yard. They consist of a series of successful pushes on the tail; each of increasing force until the model leaves the ground and glides for a short distance. Note carefully whether the model has a tendency to climb too steeply and then squash to the ground, or whether with even a moderately hard push it merely runs along the ground with the tail high. The ship should, with a push, approximately 18 m.p.h., leave the ground about 3 feet from your hand and climb from the momentum to about 4 feet, nose down smoothly and surely and glide in to hit squarely on both

wheels. For heaven's sake, be sure when you make this test that there isn't a fence 50 feet in front or else there will be some minor repairs. With these glide tests to start, we next proceed to the primary power tests.

Tie a string around the center section of the wing and have about 10 feet trailing; start the engine, and when it is running smoothly retard the spark until the engine is not delivering quite full power. Get behind the model, holding on to the string, and then run with it and allow the model to take off under its own power. Watch carefully for any tendency to stall or go into a steep bank in either direction. The take off should be steady and in a straight line. Make any necessary adjustments to the rudder and elevators until this is accomplished, then remove the string, put in a couple of drops of gas, offer a prayer to the model builders' god and let it go.

With reasonable care in construction and primary testing, it should climb to about 100 feet and fly for about three minutes and show a good, steady, but not too flat, glide when the engine cuts. After your first complete free flight has been accomplished and possibly some minor adjustments made, you will find that the performance is extremely consistent and will vary only at your own desire through changing the control surfaces.

You and Your Job

(Continued from page 15)

Frequently bad humor and gruffness are not directly the cause of business worry but perhaps it may be of personal nature. Usually the worst fault of any superior is caustic sarcasm which is expressed with a venomous attitude. This habit frequently can be found to obsess every one of us from time to time unless we guard against its outbreak. The good executive never lets invective get the best of his good humor. Men in executive positions invariably do not last long in a position of responsibility if they persist in the use of invective. Therefore the best policy in dealing with these types of individuals is to be firm and endeavor to overlook this shortcoming in human nature. Arbitration or contrariness gains little in this instance.

Perhaps one thing more than anything else that vexes the chief of some department is to have to constantly remind his immediate subordinates of some violation or infraction of the company policy. This policy is promulgated by the management of the concern and must be religiously followed. These rules have to be established because from time to time, certain employees habitually are prone to further their own interests by some infraction of company policy. The purpose of most company rules is to establish a code of fairness among the various workmen.

Another vital point to consider is the desirability of executing whatever work is assigned to you in accordance with the accepted and conventional practice. When entering the employ of a new firm this often imposes on the individual some period of transition from one method to another. The method of execution is unimportant when compared to the result. Some persons find it difficult to step into line in this respect,