AIR AGE

Gas Models

A collection of 21 outstanding gas models of all classes and types — A, B, C, Control Line, Tailless — designed by America's top-ranking modelers. Also, instructive articles, charts and diagrams to aid the gas model enthusiast.

AIR AGE INC.

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This book hopes to guide the hand and imagination of those who appreciate the beauty of craftsmanship and the wonder of flight. Years of study have proportioned the planes within these covers — long and persistent application have drawn the lines true and the curves artful — spinning discouragements and soaring successes have assured fine flying qualities.

These experts who have planned and written for you, like all the expert model builders, are serving their country all over the world — on production lines and flight lines — at drafting boards and instrument boards — at tower controls and flight controls. Experience in model building and flying rocketed them into the vanguard of airpower. These are the technical warriors who are your predecessors ...

Keep 'em Flying ... and Fly!
The models presented herein were designed for, and constructed of, conventional Central American balsa wood. However, during the present emergency, it is becoming progressively more difficult to secure a good grade of balsa, and in many regions it is impossible to obtain except for strategic purposes.

Accordingly, it may be necessary to construct your gas model from other woods; in which case the drawings may be followed exactly and a model of acceptable performance will result.

An alternate solution to the problem is to select the next larger size engine. Thus, if the plans call for an "A" motor and it becomes necessary to build the model from spruce, you may use a "B" motor which will give the heavier plane performance comparable with the original model constructed of balsa.

However, for truly good performance it is wise to make the best possible use from the wood available.

The following analysis of various types of wood will help you in making your selection:

White pine is from two to three times as heavy as balsa but twice as strong. In using this wood the experienced modeler should cut down on the sizes specified on the plans by about 40% in the larger sizes (more than 1/8” sq.) but not more than 25% in the smaller sizes. Basswood has characteristics very similar to white pine but it is a harder wood.

Maple weighs about four times as much as balsa but is about eight times as strong. Large reductions in sizes (at least one-half in all cases) should be made in the plans when using this wood.

Fir, poplar and spruce are quite similar to white pine. Oak may be used but its weight of about four times balsa, accompanied by its strength of only about two or three times that of balsa, does not recommend it. Ash is an exceedingly strong wood, very hard, and weighs about three times as much as balsa.

If any of the above woods are chosen, such characteristics should be borne in mind. Also it is always well to remember that a model is only as good as its joints, and in using a smaller size of a stronger wood exercise great care in cementing the joints so that the maximum strength of the resulting structure may be utilized.
WAYS AND MEANS OF GAS MODEL SUCCESS

SUGGESTIONS FROM AN EXPERT THAT WILL HELP TO ELIMINATE YOUR CRACK-UPS AND INCREASE FLIGHT DURATION

BY JOSEPH KOVEL

Although the building and flying of airplane models, powered by rubber motors, has long been a hobby interesting enough to attract a host of enthusiastic followers, it really wasn’t until the midget gasoline motor made its bow that this activity came into its own. Those who expect to build up aviation as a career, either in the mechanical or engineering end of the game, can take advantage of the similarity between gas models and the big ships. The problems involved in the design of these models are the same as those of man-carrying ships, and it is possible to test theories and principles inexpensively yet accurately by means of the gas model.

The scientific aspect of the gas model, however, is not its only attraction. Many fellows who like to putter around with things that require a certain amount of craftsmanship, find gas model building an interesting and enjoyable pastime. “You’ll find them attending contests, not only to fly their ships, but also to discuss the latest wrinkles in the game and to exchange news and views with other “fans.”

Flying these miniature airplanes is quite a sport—and here’s a tip to track coaches. If you’re looking for first-class material, and you know of some fellows in your school who have gas models, you’ll want to buttonhole them some afternoon and invite them to try for the cross-country team. Anyone who has had the experience of chasing a fast-disappearing model over hill and dale, through forests and streams, will appreciate what wonderful training this is for cross-country running. (Ask the writer. He knows!!)

The first motor suitable for model work was designed and perfected by Bill Brown, Jr., of Philadelphia. Maxwell Bassett, also of Philadelphia, introduced the first gas model and the famous “Brown Jr.” motor. The first flight of this model, at the 1932 “Nationals” at Atlantic City, N. J., were viewed with great interest, mixed with a bit of skepticism, by the other contestants. However, when the ship took 4th place in the Wakefield event with a flight of 2 min. 55 sec., the fellows “sat up and took notice.” Bassett absolutely and completely stole the show at the 1933 “Nationals,” held at Roosevelt Field, L. I., when he captured first place with his gas model in each of the four events he entered. This performance proved conclusively that gas models were in a class by themselves, and that the models could compete against rubber-powered ships. According to the contest committee of the N.A.A., created a special event for models powered by “internal combustion engines.”

At the 1934 Eastern States meet, held at Newark Airport, N. J., there were eight entries of full-size models flying well enough to make official flights. At the 1934 “Nationals” held at Akron, Ohio, there were 19 entries, eight of them making official flights. The others were put out of action due to balky engines and to crack-ups on testflights. Up to this time, it was considered quite a feat to have the models fly properly, let alone having them do any considerable time. However, some of the more successful builders were looking ahead and began working on their designs. Their progress was very evident during the Eastern States meet held at Hadley Field, N. J. in the spring of 1935. The entries, as a whole, were more cleanly designed, and the workmanship was much improved. The best sign of improvement was the greatly reduced number of crack-ups, proving that the fellows were profiting from past experiences. The writer was fortunate enough to place first in the gas event with a time of 64 min., 40 sec., establishing a record which still stands at the time this article is written. (The general characteristics of the ship are mentioned a little farther on.) Of the 30 entries for that meet, there were about 50 models entered, many of the contestants having brought two models with them. At the 1935 “Nationals” held at St. Louis, Mo., there were approximately 60 models entered in the “internal combustion event.” Although gas models have established themselves, the activity is still in its infancy. It is growing all the while, and will continue to remain popular as long as there are people interested in airplanes and aviation.

Judging from some of the letters the writer has received, there are a great many who greatly reduced number of crack-ups, but don’t know just how to go about it.

Following are some suggestions which should be of some help. First, determine just what sort of a ship you want to build, that is, is it going to be a small light-weight model, a speed job, or a large ship. A small light ship usually takes only a short time to build, it’s easy to transport from place to place, and it can be made to perform well as far as flights go. A speed job is usually the center of attraction at a meet, and, once it’s off, a great many “boy, look at her step!” may be heard, that is if the ship flies right. But if it’s heading for a crash, you’re bound to hear “Watch out! Here she comes!”, after which the crestfallen owner sweeps up the remains—speculates on the probable cause of the crash, and plans to make his next ship better than ever. A large ship (of the record-holding type—with a 10 ft. wing span) of course offers opportunities for duplicating the construction of man-carrying planes, and for that reason, is the ideal type of model for those seriously considering aviation as a career. It is also well suited as a group project, for school clubs having a qualified “foreman” on the job to advise the fellows and inspect each piece of work before it is assembled into the ship.

After you’ve decided what type of ship you want to build, the next step is the design of the model. Unless you’ve had a great deal of experience designing and building models, it is suggested that you build a ship that has already been proven—that is if you value your work and monetary investment. If you feel that you are qualified to design your own ship, here are a few suggestions that might be of some help to you. To design a ship that is efficient, dependable, and capable of giving the maximum service, try to incorporate as many of the following features as possible. (The record model, mentioned previously, contains practically all of them.)

“Low Wing Loading” (approximately ½ lb. per sq. ft. of area). This will give the ship a low flying speed, which will tend to minimize the effects of wind, whether they be caused by faulty adjustment or by an obstacle in the way of the ship while it is in full flight or just coming in for a landing. The low flying speed also permits the model to remain in sight for a longer period of time than if it were a speed job. It also eases the job of following the ship a bit easier.

“High Power Loading” (approximately 32 lbs. per hp.). When choosing a power plant for your ship, be sure that it has enough surplus “kick” to allow the crate to climb fast when it has to. The engines on the models shown and tested on you can throttle them down very nicely when you want to, so don’t worry about over-powering your ship. Just be sure that it isn’t under-powered.

“High Thrust Line.” For purposes of stability, you want to have a high thrust line, as near the center of resistance as possible. Should the model be adjusted to fly with this arrangement, the glide will tend to be rather steep when the engine cuts out. With the thrust line right close to the center of resistance, the ship may be adjusted for the best possible glide, yet it will still be usable without disturbing all over the lot when the engine is running.

The “Center of Gravity” of the ship should be slightly under the thrust line. “The Center of Projected Lateral Area,” meaning the center of the ship as seen from a direct side view, should be as near to the C.G. as possible. This will enable the ship to fly in rough weather, without the wing unduly affected by side gusts, when other ships, with too high or too low a center of lateral area, would be blown into all sorts of hair-raising maneuvers.

“Dihedral Angle.” The wing should have a dihedral angle of about 1 inch for every foot that the wing spans. This means that the top edge of the wing is 10 ft. in span, each wing tip should be 10 inches higher than the center section of the wing. Dihedral is very necessary for the stability of the model.

Now to get down to some desirable construction features!

“Tunable Motor Unit.” This is an invention of Mr. Charles H. Grant and was used for the first time on the K.G.1 gas model which he designed. You’ll find a detachable motor unit very convenient. This
arrangement will facilitate inspection and overhaulung of the power plant. It also permits replacing an engine unit, should the motor or propeller need attention, without dropping the engine unit into the boat. A battery-box, with a spring contact arrangement, or a flashlight case modified to suit the purpose, should be included in the motor unit. When you have to renew the batteries, all you have to do then is remove the lock-pins that hold the engine unit in place, remove the engine unit, take the old batteries out, put in the new ones, and slide the motor unit into place, insert the lock-pins into their proper position, and you're set! This arrangement of having the motor unit held in place with lock-pins has proven to be a life-saver for the engine when the ship was flying crashed into the ground. A weed-eater. The only damage sustained was two wrecked fuse- lage bulkheads, at the stations through which lock-pins, which held the motor unit in place, passed through.

While we're on the subject of motor-mounts, remember to include an ignition switch that is readily accessible. There are many times you have wanted to stop the engine turning over nicely, you want to shut it off for some reason—and shut it off in a hurry! It might happen that a spectator, unaware of the fact that the prop is turning over (the darn things are practically invisible when turning over full gun), might want to point out something of special interest to someone, and thoughtlessly point his finger right into the prop arc. Then's the time you'll want a switch badly! Not only would the prop just about wreck that person's finger, causing a lot of unpleasantness, but it would also wreck itself, (if it's a wood prop) and a replacement is not recommended for two reasons. In case you should be nicked by the prop, you won't be hurt as badly as though it were a metal prop. In the second place, should the ship crash with the motor running, (or even with dead stick), a wooden prop will break, thus stopping the engine before it can damage the prop. A plastic or glass prop, the engine would tend to run longer before stopping, possibly causing damage to certain parts. A bent engine crank-shaft is the usual result of a ship, with a metal prop, cracking up with the engine running.

It is desirable to have an engine cowling that will not complicate the removal of the engine unit to any extent. You might have the two sides and bottom of the cow built permanently into the fuselage, with a movable or detachable top piece.

If the ship is going to be fairly large, it will cause you some trouble transporting it hither and yon, unless you take the trouble to do something about it. Something you might do would be to give the engine a plexiglass detachable fin, stabilizer, landing gear, wing mount (should your job be of the parasol type), and wing. It would also be a good idea to make the wing either in two or three sections. This would not only facilitate transporting the model from place to place, but would also permit substitution for damaged parts of the ship in the minimum of time—an important feature during a contest, when time is so valuable. Don't forget to include a positive action shock-absorbing system on your landing gear. Don't rely merely on the wheels to take up the shock on "hot" landings. Another important thing about the landing gear is to have it well forward. This will help prevent nosing over on landings and reduce the number of broken props and motor units. In building your ship, keep in mind the construction design. Remember that strength requires primary consideration, then lightness. Copy real plane construction as far as it can be applied to your model. Remember that the big ships are designed by expert engineers and their construction must be strong, yet light enough in order to do the job for which they have been designed.

One example of good model construction is having the complete ship covered with "skin-stressed" sheet balsa. This permits lighter internal structure, as the balsa covering really adds to the strength of the structure. If the model is paper or silk-covered, the frames are subjected to a great strain when the fabric tightens after being doped—and have to be built stronger (and heavier) to take the added stress.

NOW consider the actual construction of the ship. Whether you are building from your own or from someone else's drawings, remember that accuracy is of the utmost importance. When making your rib templates, don't be satisfied that the templates looks like the curve you are using to go, be sure that it is exactly the curve you want to use. If your template is out a lot here and there, the performance of your ship might be entirely different from what it would have been had you used the correct rib profiles. When making a jig for the fuselage sides, be careful to get the correct slope at the points where the wing and stabilizer are going to be set. A difference of a fraction of a degree might have a surprising effect on the first test hop. True, it is possible for you to make a combination of "errors" that might cause the ship to fly beautifully right from the start. However, the odds would be all against such a thing happening. Play safe, be accurate, and keep the "way" of the game, it would be advisable for you to start building a ship by making the framework for the tail unit first. This will give you the "feel" of big model construction. Build the wing frame next, taking care not to warp it, then the fuselage frame. Be very careful to make good cement joints. Remember that the ship will have to take a great deal of vibration, and, unless the joints are all perfect, there is a chance of the ship collapsing in mid-air.

When making the fuselage bulkheads, especially those on which the motor-mount will rest, take special care to make them according to plan. If they vary from the plans given, there is the risk of thrust line of your ship, the angles of the wing and stabilizer relative to the thrust line, and consequently the whole performance of the ship.

After you have the framework all made, the next step is the covering job. Start with the fuselage, followed by the stabilizer, wing, and fuselage frame. You may either cover the entire ship with sheet balsa, or cover the entire fuselage, the leading edge, center section and tips with the fin, stabilizer and wing with sheet balsa, with a light grade of silk to cover the balance of the wing and tail surfaces. Each type of covering has its advantages. The all-balsa type greatly strengthens the frames, as mentioned before, while the balsa-silk type is easier to apply and is a trifle lighter. With regard to the motor-mount—it can be built either all-metal, or, preferably, of hardwood framework covered with plywood. Should you build the latter type, use Casco glue for the joints, in combination with wire brads. It is not advisable to use model airplane cement, due to the fact that oil soaks under it and ruins the joint. When completed, give the whole motor-mount about three coats of shellac, allowing time for drying between coats.

When building the landing gear, draw full size patterns for the different parts in order to insure accuracy. If you have any wire bending to do, use a vise and mallet, especially if the wire is somewhat thick. If you've ever tried bending .080 music wire and realized what a trying job it is, you have any soldering to do and you have to use acid in the process, be sure to wash away all traces of the acid when you have completed the job, otherwise the parts joined will corrode, and consequently weaken.

Here's the just the end of the story of the building of the ship. Now about that crucial moment, the first test-hop! First, pick out a nice spot for launching your creation into the air. Choose a roomy field that has the minimum of obstructions, and is quite soft. (If it weren't for the fact that it is so hard to retrieve a ship from there, a swamp would be a very desirable spot.) Keep away from concrete runways for the first flight at least. A nose-dive into the concrete won't help the ship any. Once you've taught your craft to fly properly, use the above-mentioned runway as often as possible, as it is a distinct aid to your beautiful take-offs, but until then, be cautious!

Assemble your ship, making sure it won't come apart in the air. Check the position of the wing relative to the C.G. of the ship, then check the angular settings of both the wing and the stabilizer. Set the rudder at neutral and you're ready to go! Give the engine about two eye-droppers of full of fuel, or enough for about 1 minute running, turn the prop over; then, when the engine is turning over right, point the ship into the wind.

If you have to hand-launch the ship, leave it hard enough so that it will gain flying speed immediately. Otherwise, it may stall and you may have to re-start. If you have a clear stretch of ground from which the ship can take off by itself, so much the better. In this case, give the model just enough push to get it started on its course. The advantage of having the model take off by itself is that it remains safe and unharmed; it has a sufficient flying speed, after which it assumes its own angle of climb. When you hand-launch it (or catapult it by pushing it too hard at the take-off), there is a chance that you might stall it—rather a dangerous maneuver at the start of the flight.

Once the ship is in the air, the matter is entirely out of your hands, so relax (if
a carefully planned out repair kit. Don't wait for the day of the meet, then throw some tools, wood strips, cement, and anything else you may happen to think of into a tool box. Better consider the possible repair jobs you may have to make, then determine what tools and supplies will be necessary to make them. Pack the items so that you'll be able to get to them when you need them.

If you have a parasol job with a removable wing-mount, it might be a good idea to have an extra wing-mount or two on hand. In case of a hard landing, where the ship has been reduced to a small size for some reason, there is a terrific strain on the wing-mount, and it might buckle, absorbing the shock and saving the wing, in so doing. Any rubber straps holding parts of the ship together, or used as shock-absorbers in the landing gear, should be replaced with fresh ones every time you attend a meet. Be careful not to splash any oil on these rubber strands, as oil tends to swell and weaken rubber.

Another thing most fel lows do that they shouldn't is wait until the day of the contest before they test the power plant of the ship. This should be done much sooner. If you have to make a meet, so you'll be sure the motor will work when it has to. Check all ignition wires and be sure that there aren't any wires that are hanging by just a single strand. That strand may decide to part during an official flight—possibly on your last official flight!

It would be a good idea to have some spare ignition parts along, such as spark plugs, a spark coil and condenser, and some wire. Don't forget to bring plenty of fresh battery cells along with you. Remember to bring your own fuel with you. Don't depend on the other fellow. Your engine you need to know the make and the old saying, "What's fuel for one engine is just a lot of booby to another."

Well, that pretty nearly covers the preparation for a meet. Now for the problem of putting the ship into storage between the seasons or winter. If there are any damaged parts, replace them. Put the whole ship into A-1 condition. Disassemble the ship, wrap the wing sections and the tail units with paper, so that they will not be scratched by sharp edges. Do the same to the fuselage. If the gear is damaged, either on the landing gear or anywhere else, take the rust out with some light sandpaper and oil. Give all metal parts a protective coat of oil or light grease. Wash the gas tank of the engine unit thoroughly with pure gas. If you don't do this, the oil will gum up on the bottom of the tank, closing the gas passages and the different parts of the ship into the crate in which you transport your model from place to place, with plenty of paper between parts so that it gives a cushioning effect. Now store the crate in a place where the temperature and humidity is moderate. A cold surface will warp, while an excessively warm place will make the balsa and other wood parts of the ship rather brittle.

If you haven't a suitable carrying case in which to transport or store your ship, you can make a good one, using 1" x 2" wood strips for a frame, and covering it with plywood (the type used in packing cases for radios).

After wading this far through the article, some of you fellows might get the idea that gas-model building and flying is just a lot of serious and complicated work, full of do's, don't's, remembering and don't forget's. This isn't so! Gas-model building and flying is a thoroughly interesting, educating, and enjoyable pastime and sport. This series of articles is meant primarily to acquaint model airplane fans with the technical aspects of the gas sport. If some of you haven't as yet seen a gas-model or been to a meet, make it a point to attend a contest, even if only as a spectator. You're bound to get a laugh out of watching some fellow crank an engine time and again, without results—trying to get it running without any gas in the tank, or with the ignition switch off. The amusing part of it is that it is usually some interested bystander, innocent of any technical knowledge, who suggests the possible cause of the trouble to the baffled "expert" (Again, I'm speaking from my own personal experience)!

I would take the time to write the size of this one to tell about some of the things that happen at some of the meets. So the best thing for you do to is get in the swim. The water's fine! * * *

Progress in gas model design in the past five years has been at an amazing rate, and developments are now in the offing which would have sounded like fantasy a few years ago.

The rapid development of radio control is one of the wonders of the gas model world and until you have witnessed an exhibition of these remotely-controlled models, it is difficult to visualize the possibilities of the two sciences: aerodynamics and radio, combined into a single system. In the radio controlled model, separate controls are designed to operate the rudder, the elevator, and the engine speed. The ailerons are normally not controlled due to too revolutionary lateral stability of a well-designed model.

Control-line gas model flying threatens to outpopularize free flight models. In this method, a series of wires from the control surfaces of the airplane are led out of the fuselage and carried to the operator, normal developments in the sport away. The operator pulls or relaxes the various wires whereby causing the model to climb, dive, loop, etc. The model, of course, flies in a circle about the operator, and with an adequate quantity of fuel almost endless enjoyment in this controlled flight sport may result. Many of the fastest free-flight models reach high speeds which is determined by timing the model plus a little mathematics concerned with the calculation of the circumference of the circle. Speeds of 100 mph have been reached by specially designed models.

Remote control has been experimented with in which a noise of a specified pitch actuates the control surfaces. Automatic steering devices are now in development, the equivalent of the well-known automatic pilot used on large airplanes.
The K.G. LIVES AGAIN

How You Can Build a Modern Streamline Version of the Old Record-Breaking K.G. In Which Are Combined Super Soaring Qualities and a Skyrocket Climb

By HENRY STRUCK

PART 1

REGARDLESS of what the rules are, or will be, the basis of a winning design is stability. Probably the first model to be designed primarily for stability was the original K-G built in 1934 by Joe Kovel from complete designs and plans developed by Charles H. Grant. The success of this ship did much to popularize the sport of gas model flying.

Though it was a miniature airplane rather than a model, its size and weight were no great handicap, for under a 1/8 ounce per pound fuel rule it set a world's record of 1 hour, 4 minutes, which it still holds today under this fuel allowance rule. Slowly the K-G passed from the contest picture as the trend of design moved toward smaller, more powerful ships.

The high speed of the modern model planes puts even greater stress on the principles of stability. What could be more logical then, than to revise...the construction of the old K-G to meet the specific demands of present day contest flying? Though the new ship scarcely resembles the K-G in outward appearance, a brief examination of the three-view assembly plan will reveal that the arrangement of aerodynamic forces is identical. Every effort has been made to achieve maximum duration through effective streamlining and minimum weight, and many desirable features have been incorporated in its construction. The all balsa fuselage can be doped or varnished to resist the ravages of gas and oil and the rough handling a gas model is bound to get. The wing and tail construction offer great strength with light weight. The ship can be dismantled and reassembled with exactly the same settings by a number of "keys." The entire motor unit can be quickly removed for checking and servicing.

From its initial test the new ship performed up to all expectations. In fact in its first contest the K-G-S made the longest flight of the day, 4 minutes, 38 seconds, on a 1/2-second motor run, in spite of a scarcity of thermals, and also turned in the best three flight average.

Even more conclusive are the innumerable tests that have been made to discover its reactions under maladjustments. Left- or right-thrust merely altered the power circle, while up-thrust caused it to hang on the prop while climbing. Only slight adjustments of the rudder were needed to obtain any size gliding circle desired.

So, we are happy to present the K-G-S; stable, strong, efficient and controllable—an ideal high-power contest gas model.

Construction Notes and Material List

The plans have been carefully prepared with all essential parts shown full size.

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PLATE I

ASSEMBLY VIEWS

SPECIFICATIONS

<table>
<thead>
<tr>
<th>K-G</th>
<th>K-G-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPAN</td>
<td>120&quot;</td>
</tr>
<tr>
<td>LENGTH</td>
<td>69&quot;</td>
</tr>
<tr>
<td>AREA</td>
<td>12 SQ.</td>
</tr>
<tr>
<td>POWER</td>
<td>BOTH 1/5 H.P.</td>
</tr>
<tr>
<td>WGTY</td>
<td>108 OZ.</td>
</tr>
<tr>
<td>L'DG</td>
<td>8.5 OZ.</td>
</tr>
<tr>
<td>WOOD</td>
<td>14.5 LBS</td>
</tr>
<tr>
<td>H.P</td>
<td>H.P</td>
</tr>
</tbody>
</table>

TOP VIEW

SIDE VIEW

THREE VIEW COMPARISON
OF THE ORIGINAL K-G AND MODERN COUNTERPART
and illustrated with numerous sketches. In Part I the wings and tail assembly are to be described in the hope that a proper amount of time will be spent on them. Many builders in their rush to get out and fly their new model produce "butchered" or warped units that are often the cause of disastrous crack-ups.

Obtain the best possible balsa of the grade specified, as it will not only assure a better model, but prove a pleasure to work with.

Material List for K-G-S

1. 1/16x 2 x 36—Soft balsa
   Stabilizer leading edge cover, ribs.
2. 1/16x 3 x 36—Med. balsa
   Wing leading edge cover.
3. 1/8x 2 x 36—Soft balsa
   Bulksheads, planing.
4. 1/16x 2 x 36—Med. balsa
   Trailing edges of tips, fillets and pylon formers.
5. 1/16 x 36—Med. balsa
   Inner frame of fuselage.
6. 1/8 x 36—Med. balsa
   Leading edges.
7. 1/6 x 1/2 x 36—Med. balsa
   Cap strips.
8. 1/8 x 1/4 x 36—Med. balsa
   Leading edge spar.
9. 1/8 x 1/2 x 36—Hard balsa
   Main spars.
10. 1/8 x 1/4 x 20—Med. balsa
    Trailing edge.
11. 3/4 x 1/8 plywood
    Front bulhead.
12. 3/16 x 1/8 plywood
    Motor bulhead.
13. 24"—1/8 wire
    Landing gear.
14. 12 sheets tissue
    Covering.
15. 1/4 yard 0.002
    Fillet covering.
16. 3/32—0.040 alum.
    Motor bearers.
17. 1/32 x 3/4 bolts
    Motor mount assembly.
18. 1/8 x 0.28 x 0.040
cable
    Wing and tail hooks.
19. 24"—1/4 alum. tubing
    Rudder outline.
20. 1 pt. cement
    1 pt. clear dope.

Wing and Tail Construction

As the construction of the wing and stabilizer is identical, they will be described together. From the 1/8" to 1" drawings given on Plate II make full size layouts on which to build. The distances from the leading and trailing edges to the center line are given for each rib station. Connect these points guided by a strip of balsa held in place with pins or drawing curves.

Trace the shape of the trailing edges and tips from your layout onto 3/16" medium sheet balsa. Cement the sections together and shape to a triangular section with knife and sandpaper. Cut 1/16" deep notches in the trailing edges to receive the ribs.

Pin the trailing edges and the 3/16" square leading edges on the layout.

The ribs are shown in full size on Plate III from which they may be transferred to 1/16" sheet balsa. A, metal or cardboard template may be made of the main wing ribs to speed up cutting them out. Cement the ribs in place, so that the top of each rib is 1/16" below the top of the trailing edge, to leave a recess in which the cap strips are later fitted.

Remove the wing frame from the layout and rejoin the panels at the correct dihedral, reinforcing the corners with gussets of 1/8" sheet. Insert the leading edge spars of 1/8" x 1/4" and the main spars of 1/8" x 1/2" hard balsa. The main spars have to be tapered to 1/8" x 3/8" at the tips, in the wing and to 1/8" x 1/4" in the stabilizer. Gussets of 1/8" sheet are used to reinforce the joints.

Apply cement liberally to the leading edge and pin the 1/16" sheet balsa covering to it. Bend the sheet over the ribs, moistening the upper surface slightly to facilitate bending, and glue the balsa to every rib and the leading edge spar. Cover one panel at a time, correcting any tendency to warp, before the cement has set solidly. Fit the cap strips in place using double wide strips over the center ribs. Trim excess balsa from the leading edges and shape the framework with successively finer grades of sandpaper. (See typical airfoil construction, Plate II.)

On Plate IV the wing and tail base patterns are given in full size. Parts E and the extra pairs of A and B form the wing and tail rests incorporated in the fuselage. Next step is to set a pair of auxiliary spars of 1/8" sheet in the center section. Cement the wing base outline composed of C-1, 2 and 3 in place, notching the noses of the center ribs and the auxiliary spars so that the top of the wing base may be cemented to the bottom corner of the leading edge. At the rear, the bottom of the wing base is flush with the bottom of the trailing edge. When dry, sand the surface of the wing base perfectly flat and insert the keys of 1/4" sheet balsa between the center ribs. (See wing base detail, Plate II.)

Cement the tail base A to the sides of the stabilizer center ribs. B is part of the rudder structure and is attached after the stabilizer is covered.

Covering and Rudder

Red double-tissue covering was used on the original. Though it requires going through the motions of covering twice, it has proven lighter and stronger than bamboo paper and affords a neatly colored job without painting.

Use fresh tissue to speed up work and protect against wrinkles. The first coat is applied with the grain running chord-
wise. Cover the bottom of the wing first, being careful to dope the tissue to the bottom of every rib to preserve the airfoil section. Elsewhere it is necessary to dope the paper only to the edges of the frame. Any difficulty that may be encountered in covering around the wing or tail rests can be eliminated by wetting the troublesome spot and then the tissue will almost fall in place. Spray the covered surfaces with water and when dry apply the second coat of tissue with the grain running spanwise. Do not dope the first coat. Spray again with water and when dry brush on two coats of clear dope. Between each watering and doping operation correct any warping tendency by holding the frame in the proper position until dry.

The rudder outline is formed of 1/4" O.D. aluminum tubing. This type of rudder can be easily bent to any desired setting, but cannot be knocked out of adjustment or warped by weather conditions. Flatten about 1" of the tubing, bend it over and tuck it under the leading edge of the stabilizer. Mount the rudder post B in place and cement the outline to the bottom. Set the keys of 1/8" sheet between the stabilizer center ribs and in the bottom of the rudder post. Fill in the rudder with 1/16" sheet around the stabilizer, using the outline of the center rib as a pattern. Cover with double tissue and cement small mounting hooks of .028 piano wire in place. (See tail base detail, Plate II.)

Check the alignment of the tail assembly to be sure the rudder is square and not offset in either direction.

A list of various engines which may be used, with their displacement, the minimum possible or required weight of the model and the wing loading in ounces per square foot which will result, is shown in the column at the right.

<table>
<thead>
<tr>
<th>Engine</th>
<th>Displacement</th>
<th>Minimum Required Weight</th>
<th>Wing Loading in Oz. per Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Olsson 23</td>
<td>23</td>
<td>33 oz.</td>
<td>8</td>
</tr>
<tr>
<td>*Hi-Speed Torpedo</td>
<td>30</td>
<td>33 oz.</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The next 5 engines give the best results in Class C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baby Cyclone</td>
<td>0.357</td>
<td>33 oz.</td>
<td>8</td>
</tr>
<tr>
<td>Mighty Midget</td>
<td>0.45</td>
<td>36 oz.</td>
<td>8.6</td>
</tr>
<tr>
<td>Gwin-Aero</td>
<td>0.45</td>
<td>36 oz.</td>
<td>8.6</td>
</tr>
<tr>
<td>Hurleman Aristocratic</td>
<td>0.488</td>
<td>38 oz.</td>
<td>9.1</td>
</tr>
<tr>
<td>Sky Chief</td>
<td>0.526</td>
<td>42 oz.</td>
<td>10</td>
</tr>
<tr>
<td>Dennyrite</td>
<td>0.57</td>
<td>46 oz.</td>
<td>11</td>
</tr>
<tr>
<td>Brown</td>
<td>0.6</td>
<td>48 oz.</td>
<td>11.3</td>
</tr>
<tr>
<td>O. K.</td>
<td>0.6</td>
<td>48 oz.</td>
<td>11.3</td>
</tr>
</tbody>
</table>

*Using these engines, the K-G-S is eligible for Class B competition. With others it is eligible for Class C.

If the larger engines are to be used the required minimum weight can be made up easily by using large batteries and harder wood than specified in the plans.

With the limitation of available power, aerodynamic efficiency and stability have greater bearing on the minimum performance of a gas model. The K-G-S has these desirable qualities in full measure when equipped with any of the engines illustrated above, or those of equivalent displacement.

PART 2

Fuselage Construction

The fuselage is planked. This seems such a tedious and difficult task that we can almost feel the vibration of some of you shuddering. But with a proper system quite the reverse is true, while the advantages of a planked body are obvious. To those who remain unconvinced two other courses are open. One is to use sheet balsa, which has proven to us to be as difficult as planking without producing as smooth a job. The other is to substitute stringers. If about fifteen stringers of 1/8" x 1/4" hard balsa are spaced around the bulkheads a very nice fuselage can be built. After bulkhead F-9 six of the stringers may be stopped to avoid congestion at the rear. Sheet balsa should be fitted between the stringers from F-1 to F-3 and the fuselage covered with silk.

But every modeller should turn out at least one "masterpiece," and we are sure this ship will prove well worth the effort.

Lay out the inner frame plan in full size. The longerons are perfectly straight to simplify the task of turning out a true frame on which to assemble. Construct the bottom, or plan view, first and build the peak of the triangle on it while still pinned to the work bench. The side view gives the height of the top longeron above the bottom and not the true length of the struts. These must be fitted in place. (See step I, fuselage assembly detail, Plate V.)

Cut the bulkheads, given full size on Plate VI, from 1/8" sheet and slip them on the frame. Cement in place the 3/16" sheet pylon formers D-1 and 2, sheet size on Plate V. Lay a floor of 1/8" sheet and fill the space between F-3 and 4 with 1/16" sheet walls to form a rigid box. The top of the pylon E consists of a number of 3/16" sheet sections. The outline of these coincides with that of the wing base, which was given last month on Plate IV. Form a pair of "L" shaped hooks of .040 piano wire and anchor them to the pylon formers with several coats of cement. Stiffeners of 3/16" square and a diagonal in the front pylon section are fitted to prevent the taut covering from pulling down the edges.

Pin a number of planks in place and check the bulkheads for high spots that may cause bumps in the finished job. When any offending areas have been sanded down, cement the five main planks in place. (See step II, fuselage assembly detail, Plate V.)

(Continued on page 18)
ALL BULKHEADS 1/8 SHEET

POSITION PYLON FLOOR

F-1 SHOWN BY SOLID LINES, 1/16 PLWOOD

F-2 SHOWN BY BROKEN LINES

PATTERNS FULL SIZE
The K.G. Lives Again
(Continued from page 14)

Install the motor mount retainers formed of bicycle spokes, and reinforce the space between F-2 and 3 with a spreader of 1/4" sheet. (See motor mount retainer detail, Plate V.)

Continue planking the fuselage with 1/8" x 1/16" soft balsa strips. Fit each plank at the rear of the fuselage by holding it in place and marking accurately before cutting the taper. (See fitting planks, Plate V.) Bevel one edge slightly with coarse sandpaper to take care of the sharp curve of the bottom of the bulkhead. Use plenty of cement and pin each plank tightly against its neighbor and there will be no apparent seams after the body has been sanded. Trim any overhanging planks flush with the face of F-2 and cement F-1 of 1/16" plywood in position.

Using a very sharp knife, carve the "squareness" and the cement skins from the surface. Hold the blade at a shallow angle and take only long thin "peelings." Then smooth the surface with coarse sandpaper and gradually use finer grades, finishing with 6-nought and polishing with 10-nought. Apply about four coats of clear dope, sanding with 10-nought between each. A good finishing method is to cover the fuselage with bands of tissue about 4" wide, applied with the grain running around the body. Sand and dope as before.

Cut an opening in the fuselage and mount the flight timer. The one illustrated was converted from an autokinol camera timer. The heavy case has been removed and a sheet of .010 brass substituted. Be sure it fits snugly at the bottom or the moving arm may disengage from the driving gear. However any other type timer may be installed with a little ingenuity and will work quite as well. Run two leads to a pair of "jacks" made from large face brass bushings mounted in F-1. (See timer conversion, Plate VIII.)

Cement the tail post B to the rear of the fuselage, so that the tail rest A will give the stabilizer negative incidence of 1/4" as compared to the top of the wing mount. These parts are the same as the tail base given on Plate IV last month. Cut the fin outline from 3/16" sheet and attach a small tail wheel by an .040 wire fork. Brace the tail base with short 1/8" x 3/8" uprights to prevent sagging when covered. Cement a narrow beading of 1/16" plywood to the fuselage, to set the edges of the tail base, fin and pylon fillets.

Now to cover the pylon with silk. This is a new trick that produces a beautiful job. First cut a section of silk of ample size and wet it thoroughly. (A) Immediately lay it in place, spreading it roughly into position. You will find the wet material sticks to the frame. (B) Now apply heavy dope over the silk in the area between F-3 and 4. Pull it vertically out using pins to hold it if necessary. (C) Then draw in each end, pulling lengthwise, dipping and pinning the silk in place in a similar manner. When the water has evaporated apply two or three more coats of dope on the silk from the bottom, being loose when the pins are removed and the surface doped. While doing this run a razor blade over the silk at the bottom, along the beading strip and refinish the planking with several coats of dope, sanding between each. The tail fairings are done in the same manner. Try to pull the silk as evenly as possible on each side to assure a symmetrical cross section. However if one side does have less "hollow" than the other, a band of extra coats of dope brushed on lengthwise will increase the curve. Avoid doping the silk to any of the pylon struts or formers, or the smoothness of the silk will be spoiled. Do not be disturbed by small wrinkles as silk absorbs them amazingly when doped, and even jagged tears can be repaired by merely laying on a patch and doping several times. (See step III, fuselage assembly details, Plate V.)

Motor Unit

Cut the motor bulkhead, shown full size on Plate VII, from 1/8" plywood. Cement and brad a plug of 3/8" x 5/8" base, which fits snugly into F-1, to the bulkhead. Glue the battery trough of 1/16" hard sheet plexiglass to the motor box in the center of the plug. A square of 1/8" sheet reenforces the joint. Short lengths of 1/16" sheet form a box in which the coil is housed. Use several coats of cement on all joints.

Trace the full size motor mount pattern onto 3/4" sheet aluminum and cut out with a jeweler's saw or tin snips. Clamp the blanks together in a vise and file them to exact shape. Bend the blanks to shape over a hardwood block, by tapping with a mallet, or a block of hardwood and a hammer. Be sure to make one left and one right. Drill all the holes with the exception of those for the motor. Cut three blanks of .020 sheet aluminum and bend fittings Z around 1/8" diameter wire. Form the landing gear of 1/8" diameter piano wire, measuring each bend to assure symmetry.

Slide the motor mounts and the fittings on the landing gear. Attach them to the bulkhead with 3/32" bolts. The top landing gear fitting bolt also holds a 3/8" wide brace strip of .020 sheet aluminum. This is bent down and glued to the bottom sides of the battery trough.

The battery box is a 1/16" sheet trough with ends of 1/8" sheet cemented solidly in place. Terminals of .020 sheet brass are fitted, one of which is formed into a spring to insure good contact. A pair of 2-1/2" wheels are retained on the axles by washers soldered on both sides.

Slip the motor unit into the fuselage and clamp it in place by tightening down a pair of bicycle spoke nipples on the protruding bicycle spokes. An inverted Brown motor was used in the original but any other engine can be accommodated by drilling the mounting holes to suit the crankcase. Drill one hole and bolt the engine in place, checking carefully to make certain the thrust line is not offset. Then drill the remaining holes and complete the mounting of the motor.

Remove the motor unit and install the wiring. The ignition hook up recommended on Plate VIII will operate on the boosters while the timer switch is open, helping to conserve the small batteries.

Cowling

The cowl is planked on two formers, G-1 and 2, connected by four 3/16" square spacers. Add the nose piece of 1/2" balsa and round smoothly. Cut the cowl near the top and hinge the two parts. A small rubber band at the rear snaps the top shut after the engine has been adjusted. A pair of .028 piano wire clips attach the cowling to the motor mounts. (See Plate VIII.)

Before operating the engine apply a coat of spar varnish to the fuselage, cowling and motor unit to oil proof the structure.

Flying the K-G-S

Attach the tail unit with small rubber bands and slip the motor unit in place. Balance the model by sliding the batteries till the center of gravity is established 5" from the front of the pylon. Mount the wing with about six or eight strands of 1/4" rubber and proceed to get the "feel" of the ship by gliding it from low altitudes into tall grass or weeds if possible. Then find a more open area and make numerous glides to discover any circling tendency. Adjust the rudder to produce an almost straight glide, with possibly a slight curve to the right to avoid a long chase after the engine cuts.

When satisfied start the engine and get it running smoothly at about half speed. Set the timer for ten seconds. With such a short motor run it will be best to hand-launch the ship if no smooth take-off spot is available. Even under this power the K-G-S will climb swiftly and demonstrate its glide. Of course finer adjustments will be needed. The only way to find them is to fly the ship as often as possible. Adjust the model to make circles of about 150 to 200 feet while gliding by bending the rudder; increasing the negative incidence of the stabilizer if the glide seems a bit steep. Under power the best climb, without a dip at the top as the engine cuts, is obtained by right crosswind on the large side, to get higher than those of the glide. The power flight can be easily adjusted by placing thin wedges between the motor bulkhead and the fuselage face to offset the thrust line.

Though your ship may lead you a merry chase under even half-power, you can be sure a pair of .028 piano wire clips will help the full run of twenty seconds and open the engine wide. The K-G-S has come back—"and how!"
FOKKER D-8 CONTEST SCALE

A Realistic Gas Model of a Famous World War Fighter That Performs Like a Contest Plane—

By EARL STAHL

Excellence. So superior was the performance of this ship that it would have been a tremendous blow to the Allied air forces had any great number been completed before the war’s end.

In selecting a design for a flying scale gas model one can scarcely find a better subject than the Fokker D-8; for here is a plane with aerodynamic proportions similar to the majority of contest models. A very short nose combined with a long tail moment arm, tail surfaces of proper proportions and parasol wing of generous size, all contribute to the model’s stability. In construction the D-8 is extremely simple and practical and anyone who has built rubber or gas models with success should experience little difficulty in duplicating it.

Our model Fokker D-8 was designed to fly successfully with any Class B engine; however even the smaller Class C power plants should prove satisfactory. The wing span is 57” and the weight with intermediate size batteries is 28 ounces. This makes the wing loading about eight and one-half ounces per sq. ft. An inverted Ohlsson “23” swinging a 12” propeller was used to power the original model.

The climb is fast and steep

The engine is neatly cowled

The author with completed model, ready for a flight

How does it fly? Well, test flights were conducted high in the snow-covered mountains of Pennsylvania with the temperature uncomfortably below freezing. With the regular 20-second engine run, flights of one and one-half minutes were made, which is certainly not bad for a scale model. Entirely unassisted the little ship lifts from the runway after a short run and eases into a fast circling climb. Under power the circles are to the left and at the top of the climb it “rolls-out” into a flat, level glide

(Continued on page 25)

The uncovered framework shows strength and simplicity

Carefully detailed, it closely resembles the full-scale plane
12" prop

fairing strips 1/8" sq. balsa

4 1/8" Balsa Wheels

engine unit removes here

LANDING GEAR STRUTS

front 3/32"

6 1/4" 4 1/4"

rear 1/16"

7"

10 7/8"

SIDE VIEW

SCALE

0 1 2 3 4 5 6

balsa block to prevent wing sliding
tapering strips under stabilizer for correct incidence

CABANE DETAIL

side  
front  
4 1/4"
10 1/4
CABANE STRUTS
4 1/4"
1/16" diam. wire
center
3 5/8"
rear  
4 1/4"

.O40 wire hook soldered to cabane 

4 req'd

7 8 9

8 1/4

1/8" sheet 2 req'd

F1

FOKKER D-8
BY EARL STAHL
SCALE 1/3"=1"
to the right. Under more favorable flying conditions it should give an even better account of itself, since it attains enough altitude to take full advantage of rising currents.

Before construction can be started, it will be necessary to enlarge some of the plans to full size; with the exception of the full size fuselage formers and wing ribs most parts are shown one-third full scale. Obtain a large sheet of ordinary wrapping paper and make them to actual size. A pair of draftsman's dividers will simplify the task since it will only require "stepping-off" each dimension three times.

When duplicating the side view of the fuselage, the top line of the upper longeron should be used as the reference line since it is straight. In duplicating curved parts such as the rudder, draw squares of the indicated size and then draw the curved line through the corresponding positions. Now for the actual construction.

**Fuselage**

The fuselage is of standard construction. Build two side frames using ROCK HARD 3/16" sq. balsa for the longerons and cross pieces. Build one side atop the other to insure that they will be identical. When the sides are dry, remove them from the plan and turn them up-side-down over the top view. Pin them the proper distance apart and cement cross pieces to place, being careful to keep the whole structure lined up evenly.

Fuselage formers come next. Make complete paper formers and cut them from 1/8" sheet balsa. Two each of formers 1S, 2S and 3S are required. Cement the formers to their respective places. The fairing strips are medium grade 1/8" sq. balsa. It will be noted that many of the formers lack notches so when this is the case, the fairings are cemented directly to the sides as shown. The cockpit is made of 1/6" sheet. Cement several strips together so the stock will be wide enough and then cut out the center to the shape indicated. The cockpit piece is then fitted accurately into the space between formers No. 4 and No. 5 and cemented fast.

The tapering strips that give the stabilizer its correct incidence are shown on the plan. They are 3/16" wide and taper from 3/32" to zero. Two are required and they are glued to the fuselage with the 3/32" end at the rear.

**Landing Gear**

Landing gear struts are formed to the size and shape shown. 3/32" diameter music wire is used for the front strut while 1/16" diameter wire is used for the rear. A vise is very helpful for bending the wire but heavy pliers can be used if necessary. Bend the struts accurately and note how the rear one is bent so that on the cockpit the front strut when completed will be in line. The struts are solidly attached to the fuselage structure—the spring of the wire being sufficient to absorb the shock of landings. Use strong thread or light twine for the purpose of binding the struts to the cross pieces and longerons, and then apply several coats of cement. The 3/16" sq. diagonal ones shown on the plan are cemented to place once the landing gear is attached. Join the two landing struts with soda straws. No. 2 will work if the pipe is cut from extremely hard 1/8" sheet balsa; cut the several notches so they will fit accurately over the cross members of the fuselage and landing gear wires. Cement these to the bottom longerons and uprights to strengthen the fuselage.

Fairings on the landing gear struts are supplied soft striped "scaling" the plans to actual size. A pair of draftsmen's dividers will simplify the task since it will only require "stepping-off" each dimension three times.

Because of the unusual size and shape of the wheels it will be necessary to make each of them from three discs of very hard 1/4" sheet balsa that have been laminated together. If the builder has access to a lathe it will help, but the wheels can be shaped accurately with a sharp knife and some sandpaper. Bushings of some sort must be used to permit free and accurate turning. If the wheels are covered with silk they will be greatly strengthened.

**Wing Mount**

While construction of the wing mount is not difficult, it must be made with the greatest of accuracy. The three cabane struts are shown in detail and all are made from 1/16" diameter music wire. Make sure full size sketches of each strut and then use them for patterns to aid in shaping. Note the side view of each strut to determine how the ends are bent. Attach the front and center members to their respective positions on the fuselage; strong thread is used to attach them to the longerons. Ends are adjusted to meet accurately and then they are soldered together.

Attach the rear struts. Next select two pieces of 1/4" sq. white pine for the wing rests; neatly attach the pine pieces to the struts with thread wrappings. Once the wing rests are in place they should be checked for correct incidence. If the top of each pine strip is exactly parallel to the top fuselage longeron, it is correct; but if it is not, it must be cut down until the proper adjustment made to make it exactly right.

This is very important. Apply several coats of cement to all thread bindings and joints once the wing mount is properly aligned.

As shown on the side plan, triangular shaped reinforcements are used to strengthen the upper longeron at the wing mount. Cut these gussets from medium grade 1/8" sheet balsa and then cement them to place at stations No. 1 and No. 3. To strengthen the fairing strips to which the false struts are later lightly attached, it will be necessary to glue triangular shaped 1/8" thick strengtheners to the back of the first bulkhead as shown on the plan for the fuselage loft. After the wing is completed the tops of the wing rests are fitted with pieces of balsa strip so they will conform to the curvature of the wing's under surface. The cabane strut fairings, small blocks to prevent wing sliding, false struts, etc., are completed later.

**Engine Unit**

A removable engine unit is featured. Obtain a 6" x 6" piece of 1/8" birch plywood for the engine bulkhead; it should be free from warps. Half the size bulkhead is shown on the plans. Use a jig saw to cut the piece to shape. As shown by broken lines on the plan, 3/16" sq. strips of balsa are fitted to the back so the bulkhead will fit snugly to the fuselage front.

Aluminum motor mounts are used. A pattern is given which will enable the builder to make them from aluminum. Most of the model supply houses carry mounts that will prove satisfactory. These should, however, be modified so the front mounting hole will be 2-5/16" from the back.

Several of the mounting holes are shown on the engine bulkhead pattern. The position of these holes is correct; this is an inverted Ohlsson "23," but if you expect to use any other engine or mount the Ohlsson upright, the location of the various holes must be changed. The important thing to remember is to keep the line of thrust exactly where it is shown on the plan.

Because of the very short field it is necessary to mount the engine close to the fire wall. For this reason a hole must be made in the bulkhead into which the intake tube can be fitted. Naturally this makes it impossible to choke the engine as usual; on the original model we simply primed it through the extension with an eye dropper and this method proved to be quite satisfactory. Depending on the engine used, it may be necessary to fit a piece of rubber tubing over the intake and then extend it out the fuselage side to facilitate operation.

With the exception of the first few glides and power flights, a cowling has been used at all times. The engine runs well within the cowling and it keeps the oil off the ship. Without it the model loses its snappy appearance and it seems to fly better when the cover is in place. An aluminum cowling is used on the plane shown in the photos and after many flights it remained undamaged and in excellent condition. This was made from a 5-1/2" diameter aluminum cowling as stocked by the model supply houses. The bottom was split and the metal was stretched enough to make it fit to the engine bulkhead. Then, using shears, the bottom edges were trimmed to shape as indicated.

Use of a cowling will naturally require that extensions be added to the needle valve, gas tank and possibly the spark control. Depending on the engine used, these items must be worked out to suit each individual case. Four small hooks bent from .040 music wire are cemented to the front of the engine bulkhead so rubber bands can be wrapped about them and the wing and landing gear struts to hold the engine unit in place.

**Wing**

Begin constructing the wing by cutting the ribs from 1/16" sheet balsa. Two of each type are required. Ribs No. 1-B is identical to No. 1 except that the area between the spars is removed; No. 1-C has the trailing edge removed to extent indicated by the broken lines. Sand all ribs smooth and cut notches for spars—with the exception of the 1/8" square upper spar; all others are 1/8" x 1/4".
Assemble the wing in three parts: Two outer panels and center section. Taper the 1/4" x 3/4" trailing edge pieces and pin them over the plan. Use pins or brads to hold ribs in place and then attach the 1/4" square leading edge. Select hard 1/8" x 1/4" stock for the spars but only cement lower ones to place. The tip pieces are cut from 1/4" sheet. When assembling the center section, it will be necessary to cut the curved pieces, where the wing is cut away, from 1/4" sheet. The short piece extending beyond the 1-C ribs is 1/2" x 3/8".

Before joining the three parts, the ends of the leading and trailing edges are cut to their exact length. Now pin the center section to the work bench or other level surface; then elevate the tips of the outer panels to the extent of 4°. Accurately join the various members and cement thoroughly. Add upper spars and then cut dihedral reinforcements from very hard 1/8" sheet. Fit these accurately between the spars and ribs No. 1 and No. 2. The several parts of ribs 1-B are next cemented to place. Recamnet all joints for accuracy. Cut and sand the leading edge and tips to final shape and go over the entire wing structure with fine sandpaper, to remove all roughness, so a neat covering job can be made.

Four wing hooks are bent to shape shown, from .040 wire. These are attached to the wing structure at a distance apart so they will fit snug against the outside of the wing rests. Hold hooks in place by sewing right through the dihedral reinforcement and then around the spars and hooks. Apply several coats of cement.

Tail Surfaces

Construction of the tail surfaces is so easy that very few instructions are required. The rudder plan is shown on the side view; enlarge both the stabilizer and rudder plan to full scale and assemble the parts directly over these plans. The rounded outlines of the rudder are cut from 1/4" sheet as are the stabilizer tips. Leading edges of each are 1/4" square and the ribs are 1/16" x 1/4" strips. Give all joints several applications of cement to help prevent warping and when dry, cut and sandpaper to finished shape.

Covering

Our model of the Fokker D-8 was covered with both silk and Silkspan. Silk is the finest covering material for gas planes because of its great strength, light weight and attractive appearance; the only drawback is cost. Because the fuselage is subject to so much punishment, we covered this part with silk; the wings and tail surfaces were covered with light Silkspan. Use thin cement for adhesive and cover the model in the conventional manner. When covering the undersurface of the wing, be careful to stick the covering to all of the spars and ribs to preserve the airfoil's shape. Shrink the covering with water and then apply one or two coats of clear dope.

The smaller details should be completed before the model is colored. As explained before, the cabane and landing gear struts are made of strips of soft 1/10" x 3/16" balsa which are attached by wrapping of tissue or silk strips. But before this is done, the four small hooks illustrated below the cabane strut details are soldered to the wing struts. The fourth strut on each side of the wing mount is a false strut, placed there for scale appearance only. Since this strut carries none of the stress, it should be made from soft 3/32" x 1/4" cut streamline and then lightly cemented to place. The wing mount without this strut is sufficiently sturdy yet it is also flexible enough to absorb more punishment without damage, than a rigid mount.

After the model has been flown for sometime it may be necessary to repair or replace these two struts, but that is certainly easier than repairing the whole mount or even the wing. Four small blocks are cemented to the pine wing rests and streamlines by strips of sliding: use soft balsa so they will break off in the event of an accident and thus protect the wing from serious damage. Typical on all Fokker war planes was the small wing between the wheels. This can easily be reproduced but is not recommended when flying the model since it would probably "trip it" every time it lands.

Color of the model shown in the photos is flaming red-orange; this is especially striking with black trim. If possible spray the colored dope on to the covered surfaces; thin the dope and apply two coats. Decorations can be painted on, using masking tape for a neat job, or they can be cut from black tissue and doped to place. Paint tires, tail skid, inside of cow, etc., black.

Now let's put the parts together to see how she looks. Wheels are held to place by washers soldered to the axles—place a washer at both sides of the wheels so they will turn freely. The stabilizer is cemented in place over the incidence strips and rudder is cemented on next. Off-set the rudder a bit so the model will slide to the right. Check and recheck for correct alignment.

Some builders may not like the idea of permanently attaching the tail surfaces and in this case it will be all right to make them removable, provided some method is devised to make adjustment easier. Bight the engine mounts to the engine bulkhead with a 1/16" thick washer between the top of the mount and the bulkhead to give the engine the required amount of negative thrust. If a metal cowling is being used, it should be mounted, by small wood screws, to several small balsa blocks, which are cemented to the firewall. The engine unit is held to the fuselage by four small rubber bands wrapped about the hooks on the cowling and about the front wing and landing gear struts. Set the proposed parts, the rudder in its position by wrapping with small rubber bands around the hooks.

Well, there she is—vertisficient isn't it?

Ignition

To install the ignition system it will be necessary to remove the engine unit. Details of the battery box for four small size cells are given. Use the finest grade stranded wire available for wiring, and solder all connections. Broken lines on the side view show the approximate position of the various parts. On the test ship the coil was attached by adhesive tape to a piece of balsa 1/8" x 1" x 3", cemented to the right side of the fuselage structure. The timer was mounted conveniently in the cockpit and the battery box was permanently attached to the left side of the fuselage just forward of the cockpit. Determine the battery and correct position by changing them until the plane is in a level position when held under the center wing spar. The condenser is attached to the engine mount. Now install fresh batteries and your Fokker D-8 is ready to fly.

Flying

First flight tests should be hand glides. Turn the propeller to horizontal and launch the plane at four or five feet of altitude. It should make a steady, smooth glide to the ground but, in the event it stalls or glides too steeply, the batteries will have to be shifted.

Once your D-8 glides well, start the engine and make it run as slowly as possible without danger of stopping. Set the timer for 12 to 15 seconds and hand launch. Observe the flight carefully, making necessary corrections before the next trial. Make all adjustments to favor the glide and then off-set the thrust line to make the power flight as desired. Right or left thrust will control the amount of circle while under power and if it has a tendency to mush or stall, increase the negative thrust a slight amount. While it was unnecessary on the test model, a small aluminum tab can be attached to the rudder to help adjust the circles. Good luck to you!
ARMY "GRASSHOPPER"

A flying model Taylorcraft O-57 that provides thrills of the full scale plane.

by SIDNEY STRUHL

The Taylorcraft O-57, and other light planes now used by the U.S. Army Air Corps, are known affectionately as "grasshoppers." They have been found to possess excellent characteristics needed for all-around general purpose military aircraft; as useful in the air as the "jeep" and "peep" are on the ground.

The term "grasshopper" probably grew out of the Taylorcraft's ability to take-off and alight in very small and difficult landing fields. Their work is very diversified, ranging from artillery spotting and observation work to delivering war material and serving as taxis.

Aside from a complete radio outfit and several more flight instruments, the Army's version of the Taylorcraft is identical to the commercial one. And to show the Army's faith in these small light planes, orders are constantly being increased for "grasshoppers."

For a flying scale gas model the Taylorcraft leaves little to be desired. The design proportions are excellent for producing stable and smooth flights. And the construction of this type of airplane is so simple that even if this is your very first gas model you should find no difficulty whatsoever.

The flight characteristics are just about perfect. With an Ohlsson 19 in the nose the flight is very similar to the full size job. Along steady climb and when the motor cuts, well, the glide is as good as you'll find on any contest field. But when you install a big motor in the nose, such as a Forster 29, then the CLIMB is as good as any you'll see on the field. The size is just right too. The ship will take any of the larger size Class "A" motors and all Class "B" motors. A class "C" version may be obtained by enlarging the model 1-1/2 times which would net you a six-foot job.

All-in-all I think we can safely say that this little job is a scale model that can hold its own against any other and will give a good showing of itself in an endurance contest and to top everything else, is extremely easy to build.

Now what do you say if we get busy and build ourselves a model of this here airplane just to see if I ain't right.

Fuselage

First of all it will be necessary to make full size drawings of the fuselage, wing and tail group. Most of the dimensions are given in the plans but sizes may be obtained by enlarging three times from Plates 1 and 2 as the given scale is 1/3" to the 1". All parts shown on Plates 3 and 4 are full size.

Lay the plans upon a smooth working surface such as a flat piece of pine board or other soft material so that pins may be pushed into it with ease.

Construct the fuselage by first making two identical sides. Pin 3/16" square strips of balsa onto the plans wherever you see it grafted. This constitutes the basic...
STEP 1: MAKE FULL SIZE DRAWING OF THE FUSELAGE AND LAY ON A FLAT WORKING SURFACE.

STEP 2: BUILD TWO FUSELAGE SIDES DIRECTLY ON THE PLANS.

STEP 3: MAKE WIDTH OF NOSE TO FIT MOTOR.

SHAPE THE NOSE FROM SOFT Balsa BLOCKS AND THEN HOLLOW-OUT TO FIT MOTOR.

ENLARGE PLATES 1.82 THREE TIMES TO OBTAIN FULL SIZE PLANS.

WING OUTLINE

SCALE: 1/8" = 1"

HOLD WING STRUTS IN PLACE WITH DRESS SNAPE DUMMY CYLINDERS TO THE NOSE FOR SCALE EFFECT.

1/16" 3/4" STRINGERS

1/8" SO. FAIRING STRINGERS

THE BASIC FRAMEWORK OF THE FUSELAGE IS BUILT FROM 3/16" SQUARE Balsa STRIPS AND IS SHOWN ON THE PLANS IN GRAIN.

LANDING GEAR IS ALL OF 1/16" MUSIC WIRE.

ANY CLASS "B" OR LARGE CLASS "A" ENGINE MAY BE USED IN THIS MODEL, FLYING WEIGHT DEPENDS ON THE SIZE MOTOR EMPLOYED.
fuselage frame or basic foundation. Build one side and allow the cement to set. After the cement has set, do not remove from the plans, but build the other side directly upon the first side. Thusly you are assured of two identical sides. Remove the two sides from the plans and join together starting first from the rear and center portion and working toward each other. Make sure the two sides are curved the same amount and in line otherwise your model will have a tendency to keep flying in the direction it is pointed.

Cut all the necessary fuselage bulkheads from 1/16" sheet balsa as shown in Plate 4 and cement in proper locations. Make the motor mounts from 1/4"x3/8" strips of bass wood. Anchor it firmly with cross members and fill in around the mounts with 3/16" sheet balsa and loads of glue. The nose and cowling is made from balsa blocks cut to the required shape and crosssection. Five blocks are necessary, one for the top cowling, two for the sides, one for the bottom and one for the front. These blocks will vary in size depending on the size and type of motor you use. If it is necessary to alter the size of the nose to fit your motor it will not affect the model much at all as long as you keep the general shape, crosssection and thrust line.

Cut the blocks roughly to shape and then glue in place. Final shaping and sanding is done after the motor is mounted. Use blocks of very soft and light texture and you will not have to hollow out too much. Make a portion of the top cowling removable so that you can gain access to service and adjust your engine. For the sake of appearance you should mount your engine inverted.

Two F2 pieces are cut from 3/16" sheet balsa and cemented in place. F1 is carved from a small balsa block to fit under the leading edge of the center section and is cemented to the fuselage as shown in the plans. This forms somewhat of a cradle for the wing to rest upon.

The landing gear is now made and installed. All dimensions are given in the plans. Use a good quality 1/16" steel music wire. Install the landing gear in the proper location and bind in place with heavy thread and cement to the fuselage longitudinals and cross members. Bind the three struts together at the axle point with thin flexible wire and then apply enough solder to make a very solid joint. Now add all the 3/16" sheet balsa gussets all around the landing gear-fuselage connection as shown in the plans for extra strength. Fill in the landing gear struts as shown with very hard 3/16" sheet balsa. Cut and trim this fill-in to a symmetrical crosssection.

It is advisable to use 2-1/2" diameter air wheels. Use air wheels rather than sponge or wood wheels to obtain the best shock absorbing action. A lump of solder at the end of the axle will keep the wheels in place. The tail wheel is a 1" diameter spounge rubber wheel. Bend the struts from 1/16" diameter steel music wire.

Cut three bottom fairing stringers from 1/8" sheet balsa and cement in place. Add the 1/8" round hardwood dowel to act as rubber hooks to retain the wing and tail group in place.

Tail Group

The rudder and stabilizer are very simple to construct and you should find no difficulty with them. A full size drawing is needed to work upon.

Cut all the necessary curved parts from 3/16" sheet balsa as shown in Plate 3.

Pin the stabilizer's leading edge and center spar of 1/4" square balsa directly on the plans. Trim the 3/16" x 1/2" trailing edge to the correct shape and crosssection and pin in place on the plans. Now cement the 1/8" x 1/4" ribs in place. Add the stabilizer tips in place. Note that the stabilizer is made in one piece, the 1/4" sq. center spar running the whole span of the stabilizer, 18-1/2".

The rudder is made in the exact same manner as the stabilizer. The tip, R1, and trailing edge are placed in the center of the spar and ribs to form a symmetrical section, however. Check stabilizer and rudder for warps.

The rudder and stabilizer are cemented together after they are covered and form a separate unit, detachable from the fuselage. It is held in place to the fuselage by strands of rubber wrapped around 1/8" dowels.

Wing

Although the wing is very easy to construct, care must be taken to avoid any warps. First make a full size drawing of both halves of the wing.

Cut the wing tips from 1/4" sheet balsa as shown in Plate 3. Cut the required wing ribs medium 1/16" sheet balsa.

Trim the 1/4" x 3/4" trailing edge to shape and pin in place on the plans. Pin the 3/16" x 3/8" rear spar and the 3/16" x 5/8" front spar in place. Insert the ribs in their proper locations and cement. Now add the leading edge of 1/4" square balsa. Note that the leading edge is set on edge. Cement the wing tips in place. The 1/8" sheet balsa wing strut base may now be added in place.

Install 2-1/4" dihedral in each wing tip. Note that the center section is flat. Gussets and braces should be added at the dihedral joint for extra strength. Check the wing for any warps.

Cut the wing struts to size from 1/8" sheet hard balsa. Two are required.

Covering

It is advisable to use colored Silkspan for covering rather than color doping the model. Choose a regulation Army color. Use heavy clear dope as an adhesive. Sand the frameworks lightly to remove any flaws and ridges that might mar a neat covering job.

Cover the fuselage first using one piece for each side and bottom. Several pieces are required on the turrlet-back. The cowling and similar wood parts such as landing gear struts are tissue covered. Use a separate piece of paper for the top and bottom of each section of the wing and tail surfaces. Once all parts are covered lightly spray them with water to tighten the paper. Then apply two or three coats of clear dope with a brush. Cover the cabin with heavy sheet celluloid.

All items such as cowling details, insignia, control surface outlines, etc., are made from colored paper. The wing struts are colored with black dope. The wing struts are held in place on the fuselage and wing by small bamboo pins pushed through the wood. These shear off in case of collision. The wing struts are installed in place only after the wing has been strapped in place to the fuselage with rubber strips.

Flying

After completion of the Taylorcraft check the model surfaces for warps. The Taylorcraft wings and tail are constructed solidly enough to resist warping, but if warps do occur take them out. Initial flights of the original model proved airworthiness, and by carefully making flight adjustments championship performance will result. The wing is set at plus two degrees and the stabilizer at zero. There is no down or side thrust required for the motor.

Glide the ship several times putting more or less incidence into the stabilizer. Remember that careful slow adjustments save much time and effort later.

Set the timer between 10 and 20 seconds for the first flight and use very low power. Launch the 0-57 and watch the flight very carefully. Under power your Taylorcraft should climb in approximately 100 foot circles to the right. When the motor cuts, it should gradually turn to the right and glide in two hundred foot circles. Each model may have individual flight characteristics but all jobs such as this one should climb to the right under power, and glide to the left. If the ship reverts well on the first flight, fly it again with the same power and motor pin. The ship should be flown about ten times, gradually increasing the power to the maximum.

If you have followed instructions, and are not afraid to open your engine wide, you now have a perfectly flying scale gas model that will reward you many hours of satisfaction, and which is, more, an excellent chance to win in the next local contest, whether it is an endurance or scale event.
Light and efficient with a rapid climb

The "ANSWER" For Gas Fans

Build This Dual Purpose National Record Holder– It Can Be flown in Either Class A or B Contests

By GORDON MURRAY

THERE are many questions in the mind of every potential builder of a Class A or B gas model. How big shall his ship be? Which class will it fall under? What airfoil shall be used? Shall it be streamlined?

The questions could go on for a fortnight, but in these paragraphs we present "THE ANSWER," which will give the perplexed builder a solution to his main problems in one of the most consistent, best performing little planes in the gas model field today.

When the 1940 gas model rules were announced by the Academy of Model Aeronautics they gave a definite "break" to the Class A builder in that they erased the flown-on-wing area. Therefore, it was theoretically possible for a builder to construct a plane for EITHER Class A or B, the simple change of a motor making the ship available in either class. In "The Answer" the builder will find such a ship, use an engine of 0 to 1.50 cu. in., displacement in Class A or a 20 to 30 cu. in. displacement engine in Class B and be a winner in either class.

Performance? The first day "The Answer" was flown it gave evidence of superior performance. It was entered in the Class A-B meet of the Metropolitan Model Airplane Council and despite the lack of thermals the little ship turned in an average of 1:50 to take top honors. Under daily flying conditions, with better weather, it has several times done over five minutes.

The design of the ship has proven extremely adaptable to various classes. When "scaled up" 1½ times The Answer proved to be fully as fine a performer as a Class C ship, establishing an officially-timed average of 8:36 with a Dennymite.

Building "The Answer"

First, the plans must be "scaled up" to actual size. All plans on Plate 1 have been drawn quarter-scale so the builder must enlarge these plans four times. The model builder with plenty of cash may use expensive drawing paper for this, but the plans done on a sheet of brown paper (from the butcher shop) are just as workable and usually do not adhere so closely to the cement used. The wing and tail are elliptical in shape. The standard method of laying out an ellipse may be used, or the 1" squares may be drawn and the builder may then form the outline by following Plate 1.

The Wing

The wing used on The Answer is conceded to be the secret of the entire ship. It combines high lift with a maximum of efficiency. Say what you will, it has been proved to the satisfaction of the most critical builder that this wing really "has the stuff." Once you've built one, you too will be intrigued with the possibilities and will probably be trying this type of wing on other models.

The construction of the wing is shown on Plate 3, and is really very simple. The first step is to cut the outline from soft quarter-inch sheet balsa. Four sheets, 2 inches wide and 36" long will suffice for this step. You will note that the leading and trailing edges are in one piece, joints coming at the tip and at the center section.

Cement the sections together and let dry thoroughly. Next cut wing rib tem-

The ship in flight shows great stability

The author and the plane with sparless wings
SCALE 1/4" = 1'

10° Propeller

CUT FROM 3/8' Balsa

2 1/8' Airwheels.

TYPICAL WINGSECTION

SHEET Balsa OUTLINE

1/4' SHEET Balsa OUTLINE

WEDGE

3/8' DOWEL

2 1/2' WIRE

1 1/16' BALSA FILLER

LEADING EDGE 3/16' SQ.

SPAR & RIBS 3/8' X 5/8'

CUT TRAILING EDGE FROM 1/4' SHEET Balsa.

"THE ANSWER"
CLASS A & B GAS MODEL
WING AREA 310 SQ. IN

DESIGNED BY - GORDON MURRAY
MOTOR MOUNT FOR BANTAM
CHANGE SIZE TO SUIT MOTOR USED.

1/4 BALSAL OUTLINE.
WING CONSTRUCTION

1/16 BALSAL FORMERS

1/16 SHEET

WING RIBS - MAKE 36
plates from the pattern on Plate 2. These may be cut from any scrap sheets but should be at least 1/8" thick. Place one of these sheets on the table, another nine inches out on the wing and another four inches from the tip. This step is shown clearly on Plate 3. The one-third/two-third line on the template is matched with the corresponding line on the wing plan, and these templates are pinned in position over the plan.

To achieve best results next soak the wing outline in hot water and bend it over the jig, using pins and cement to hold it in shape. Although the wing templates will not be used in the finished wing, cement the wing to them in the forming step. They may be easily removed later. The assembly should be allowed to dry thoroughly.

The wing ribs are cut from 1/16" medium sheet balsa using a wing rib template cut from 1/16" plywood to form both the top and bottom curves. On the sheet of 1/16" balsa, which is being cut, the ribs, draw a vertical line about 4 inches from the end of the sheet. Place the template on the balsa sheet, matching the one-third/two-third line on the template with the line you have already drawn. Cut the top curve of the rib, move the template on the wing rib and cut the bottom curve. Move template down another 1/4" and cut another rib. This process is repeated until all 36 ribs are cut.

Place the ribs on top of the outline, upside down, making sure that the one-third/two-third line corresponds to that on the plans. Hold each rib in place and cut off at the leading and trailing edges until it is of proper size. Turn the rib over and cement into place. This process is carried out for the entire wing.

Repeat the entire process to complete the other half of the wing. When both halves are complete, they should be joined. Referring to the center section to form 3 inches of dihedral at each tip. Cement this joint thoroughly, applying several coats.

Sand the leading and trailing edges to a streamline shape as shown on the typical wing section, Plate 1. Cover the center joint with a strip of 1" gauze, top and bottom and cement thoroughly.

As a final step, cement one of the wing rib templates at the intersection of the two halves on the bottom, to act as a stiffener. Trim this section on the bottom as shown on the lateral view of the fuselage.

Cover the bottom of the wing first with light bamboo paper using cement as an adhesive. Be sure to cement the paper to each rib. Covering the top is it necessary to apply cement sparingly to the leading and trailing edges. Water dope the entire wing when covered and after drying apply three coats of dope to the wing, top and bottom. You will find that the wing warps up slightly. From this point on keep doping the TOP of the wing giving it sufficient coats until it warps up giving a dihedral of 5" on each tip.

The Fuselage

In building the fuselage, construct both sides over the plans. Note that 3/16" square medium balsa is used for longons and uprights, except where noted. See Plate 2 for construction of the motor mount. The motor mount bearings are of pine; cemented directly to the top longeron and are made to form a single piece as an integral piece of the construction. When the two sides are completed, invert the sides on the top view of the plan and cement the cross braces in place. Cut the bottom cross braces and complete the bottom of the ship to the dimensions shown on the bottom view. The formers are shown in full size on plate 3. These should now be cemented in place. The cabin, of 3/16" square balsa, is now built on the fuselage and when this is completed the 1/8" square stringers are cemented in place from the cabin top to the tail, as shown.

The construction of the nose is shown on plate 2. Note the position of the two firewalls. The first one is of 2-ply (two layers) of 1/16" sheet balsa. The second, which supports the landing gear, is of 1/8" birch plywood. The sides of the nose, cemented to the 3/16" sheet, are cemented to the motor bearing and the first of the two firewalls. Between the sides of the nose, cement a block of soft balsa. Cut this piece inside to accommodate the depth of the motor used. When this assembly is thoroughly dry, "butcher" the assembly until it conforms to the outlines of the nose shown on the plans. A sand block (a piece of 2"x3"x wood with sandpaper wrapped around it) may be used in this "butchering" process. After sanding to outline cover with several coats of cement, sanding between coats until a smooth finish is obtained. The landing gear, of 3/32", wire, is bound and cemented to the second firewall.

The underslung, which is really a continuation of the rudder, is made with the fuselage. Formers 7 and 8 are cemented in position and the curve section, of 1/8" sheet balsa, is cemented in place. Be sure this assembly "lines up" with the rest of the construction. Sand the entire fuselage down before covering. The underslung, of course, should be sanded to airfoil edge.

Cover the fuselage with silk, which should be wet before application and applied when still damp. Apply the silk first, then cement to the longeron. The cement goes through the pores of the silk and adheres to the wood. When dry, give the fuselage 5 to 8 coats of clear dope before painting. The dowels of 1/8" birch may be cut after the covering has been completed, being cemented as shown.

Tail Assembly

The trailing edge is cut from 1/4" soft sheet balsa. It is placed over the plans and pinned in position. The leading edge of 3/16" square hard balsa should be soaked in water and pinned in position. The spar, and ribs, of balsa, 3/32", are then cut and inserted as shown on the plans. Cement securely at all points and when dry use a pen-knife or sand-block to cut the ribs down to meet the leading and trailing edges, which are sanded to airfoil section.

The rudder outline is cut from soft 1/4" sheet balsa. Ribs and spar are of 1/4" by 1/8" stock. When the assembly has been completed sand to airfoil section.

Cover the elevator and rudder separately, with light bamboo paper. When each unit is covered, water dope, let dry and give several coats of clear dope. It is best to complete the painting of this assembly before cementing the rudder to the stabilizer.

Motor Mounts

The motor mounts proper are bolted to the inside of the motor bearings. Note that only one bolt is used for each, this being sufficient for Class A or B motors. Hold down and cement the motor with the use of a "nut".

The nuts for the bolt which holds the motor are cemented to the bottom of the mounts to aid in removing the motor at a later date. The mounts are shown inserted.

Wiring

The position of the battery box, timer and coil are shown in the fuselage by dotted lines. Any standard wiring diagram may be used.

Adjustments

The plane, when completely assembled, will balance at forty to fifty per cent behind the leading edge, depending upon the motor used. Test glide the ship on a calm day. Be sure and point the nose slightly down when gliding, otherwise it may go up from the, hand, stale and dive in. If the ship dives, insert pieces of 1/16" sheet balsa under the trailing edge of the stabilizer. If it stalls put the balsa pieces under the leading edge of the stabilizer. Do not make adjustments on the wing.

Test glides adjusted the ship should show a flat, slow glide slightly toward the left. When you feel these adjustments have been made, a flight under power may be tried.

Flying

When heading for the flying field don't forget to take along a generous supply of tools, spare parts and fuel mixture, particularly the latter for there's nothing like having a perfect series of flights cut short by a lack of fuel.

For the first test flight, caution is the principle rule. Although glide tests are fairly accurate and corrections made for glide errors will normally take care of possible power on errors, it is best to set the timer for a fairly short run, say 10 to 15 seconds. The run should be made at low rpm, too. If the glide adjustments are correct, the ship should climb in lazy circles turning to the left. This latter direction holds true for the glide, too. This left turn effectually eliminates that well known tendency when the power is cut, so evident in straight 1/4" and 1/8" models. This little maneuver will cost altitude, and maybe even plenty of time in a contest. This job should turn out to be just what its name implies: "The Answer."
THE WINGED YANKEE
A high performance Class A gas model that is easy to build and operate

by SAL TAIBI

The Winged Yankee ready to fly; with parasailed wing for steep climb

DESIGNED and built around the Bantam, this little plane has turned in many fine flights and has both beauty and flyability. Because of its small size it can be flown in limited areas now available in and around the large cities; also it can be transported on a bike, train, bus or other means of transportation.

The structure is designed to be light but extremely strong, yet to use a minimum of balsa and other materials, since the materials are getting harder to obtain as time goes on.

Well let’s get busy: start with the fuselage. The usual tools and some hard 1/8” sq. balsa are needed. Make a full size layout of the fuselage sides and top. Lay out the fuselage sides one on top the other and fill in the cross braces; be sure to use hard balsa so there will be no sag in the construction.

When dry assemble the sides putting in only the top braces, then pull the bottom together and cement the shorter bottom pieces in place, then cement all the longer ones together in the rear as shown in the perspective view. Note that the front uprights are 1/8” x 1/2”. Now add the front bulkheads of 1/8” sheet to the front of the fuselage. The front bulkheads and all other fuselage parts are full size on the plans.

Now add the wing mount, wing braces and wing saddle in place. Cement two pieces of 3/32” sheet balsa cross-grained together to form the wing saddle. Cement the top stringer in place and add the bulkheads in rear of the wing mount, as shown. At station No. 5 a small piece of 1/8” sheet balsa is fitted in to take the tail end of the ignition rack.

Now add the 1/8” sq. medium soft stringers in place. Using the front bulkhead as a pattern cut a reinforcing bulkhead of 1/16” plywood. Cut out the inside as shown and cement it to the front former. Using the same outline cut out a firewall of 1/8” plywood. Drill holes in both the plywood bulkheads to take the dowels used to key the motor unit to the fuselage. Cement the blocks and motor bearings in place on the firewall; when dry carve and shape the blocks to size. It may be necessary to make minor changes for other makes of motors, but these changes are slight, not more than a 1/16” wider or narrower according to the engine.

Assemble the motor and ignition units to the ignition track. Tie in place with rubber bands. Wire as shown in the diagram on the motor instructions. Cement the landing gear in place and attach the wheels by soldering a washer on each side.

Cut out all the wing ribs, tips and cut the spars to length. Lay out a full size plan of the wing and assemble it on a flat surface. Make a right and a left wing panel. When dry carve and sand leading and trailing edges to the airfoil contour. Carve the tips to a neat streamline shape, rounded on the leading edge and tapering back to a thin edge as it joins the trailing edge. Cement the wing panels together and cut the tips as shown, raising them to the dihedral angle shown on the drawings. When dry cement dihedral reinforcements in place and sand the entire structure smooth.

On a full size layout of the stabilizer, cut out the outlines and pin them to the plans. Then cut the spar to length and glue in place. Ribs are now added; spar and ribs are formed from 1/8” x 3/8” balsa.

When dry carve to a rough airfoil shape and sand to a neat thin airfoil. Be careful to avoid warping.

The rudder is built on the same system. Sand it to a smooth streamline shape. Shape the bottom rudder to fit the fuselage.

Now go over the model, checking for alignment. Sand all the framework to assure a smooth wrinkleless covering. Add scraps of balsa to the top of the wing saddle to fit the airfoil shape and sand until wing fits snugly. Cement piece of 1/16” wire at the front and rear of the wing saddle; this provides anchorages for the rubber bands that hold the wing on the fuselage. Cement hooks to the motor unit and fuselage. Cement a dowel in place in the fuselage at the stabilizer leading edge and a wire hook along the sub-rudder trailing edge.

Now you are ready to cover the model. The fuselage of the original model was covered with silk but gas model Silkspan will do if silk is not obtainable. Work very carefully when attaching the covering to the wing mount, pull out all the little wrinkles. To make the silk or Silkspan fit around curves use it slightly damp. Cover the wing in the conventional manner and spray with water to pull out any little wrinkles in the covering. When dry give the model about three coats of dope, sanding in between with 100-0 sandpaper. Give the model a last coat of dope; do not sand the last coat of dope.

The original model was all white natural color, trimmed with blue dope. Use masking tape to obtain smooth curves when color doping. Give the motor mounts two or three extra coats of color dope to protect them against the gas and oil.

Let your model dry a day or so and then prepare it for flight.

Install new penlite batteries. Attach a piece of fishline to the timer arm and check for spark. Set the motor a few degrees to the left and the rudder tab slightly to the right; now begin to test glide the model. If it stalls push the coil and batteries forward, if it dives reverse the procedure. After a smooth right glide is obtained the model is ready for test flying. Start the motor and set it at about half power, adjust the timer for about fifteen seconds and then release it. Watch it carefully, noting if the circle in the climb and glide are correct. If it looks satisfactory send it up for another flight; keep doing so, each flight adding a little more power until the model snaps up in a tight left spiral and rolls out into a smooth right glide. Many test flights will get you acquainted with your ship and will help you to get the most out of it in a contest. Good Luck!
Rudder & Star, build rough sand to shape.

Rudder & star unit is removable hold in place with rubber bands.

Scratch stringer center using joint.

Scale same as plate 1

Plate 2
FULL SIZE

TOP STRINGER 3/8" SHT

JOIN

WING SADDLE 3/32" SHT

CUT 2 LIKE THIS 1/2 CROSS GRAIN

TYPICAL STAB. RIB

WING MOUNT 3/16" SHT

FRONT FORMER 1/8" SHT

FORMER "B" 1/16" PLYWOOD TO THIS OUTLINE.

LANDING GEAR POSITION

FORMER "B" 1/16" PLYWOOD CUT OUT CENTER AS SHOWN.
THE G. E. "CABINETTE" TAKES WING

A little class A gas job with a big performance—Easy to build and fly

by FRANK EHLING

With a short hop and a bound—this little ship is in the air, standing on its tail climbing skyward. A few seconds later it is a speck in the sky. Be careful to time the motor for less than twenty seconds or you will spend more time looking for the ship than it takes to build a new one.

After many fine flights on a recent trip to the flying field, the timer stuck and allowed the motor to run about twenty seconds. The plane kept climbing till it no longer could be seen, so we went home, sorry that we made that flight but gratified to know how easily this little ship can place among contest winners.

One week later a car drove up and out came a young man with the lost model, the only damage, a small hole in the wing covering. When offered compensation for returning the ship he replied, "All I want is to see that ship perform."

Soon the wing was patched and we started for the flying field. This fellow had never seen a gas model fly and he stood breathless when the ship took off into a steep climb. After a few flights he was a confirmed model fan, and wanted to build a plane like it. A recent letter from him tells that he was successful—his plane has made many fine flights.

This model fulfills the need of a realistic looking plane that will give a good account of itself when flown in any kind of weather.

The wing is raised on a high cabin for stability. The cut-out in its leading edge allows the wing to be placed nearer the propeller, thus giving the ship a shorter nose moment arm and added stability.

The plans are shown half size. Any measurement not given can be determined by merely doubling the size shown. The whole plan should be drawn up first; this is easily done with a pair of dividers and ruler. If you prefer, the plans can be enlarged for a class B ship. One of this size has been built and is constantly turning in good flights.

Start the construction by assembling the fuselage sides. The longerons and struts are pinned in place over the full size drawing, placing the pins on both sides of the members but not through them. After the joints are cemented and dry remove the side assembly from the plan. Make both sides in a similar manner.

Assemble the two sides by cementing the firewall and the stern post in place; the latter is the rearmost upright member of the fuselage shown on the plans. Hold the joints together with pins while they dry. Next the cross members, top and bottom, can be put in place; also the cabin structure which is built up with formers and a keel that runs from its rear to the front of the fin. While the glue of the joints is drying make sure the
SPACE TO FIT MOTOR

1/8" SHEET

RIBS ARE 1/16" THICK
CENTER RIB 1/4" SQ.
SPAR 1/8" X 1/4"

LEADING EDGE 1/4" SQ.

TRAILING EDGE 1/8" X 1/4"

LANDING GEAR CLAMPS OF 1/32" BRASS

SHEET COVERING 1/32"

1/2" LEADING EDGE 3/16" X 3/16" SET ON EDGE

ALL RIBS ARE 1/16" THICK
1/8" SQ. TOP AND BOTTOM

1/8" SQ TOP AND BOTTOM

BAMBOO 1/16" SQ.

SCALE - ONE HALF FULL SIZE

TRAILING EDGE 3/16" X 1/2"

CEMENT WELL

LEADING EDGE 3/16" SQ. SET ON EDGE

CENTER SECTION SHEETED TOP AND BOTTOM

PLATE - 2 - BY F.V.B.E.
When all of this is completed cover the center section and then the leading edge with 1/32" sheet balsa. Sand the whole wing carefully and add a little more cement to all joints that may need it.

The wing is now ready for covering. This is done by cutting the paper with a 3/8" margin all around. Apply to the wing starting at the center and progressively cementing it to each rib as you proceed outward toward the tip. The paper should be drawn tightly from center to tip. Then the leading and trailing edges may be cemented down and the excessive paper trimmed around the edges.

The stabilizer construction is similar to the wing and is likewise covered.

The rudder is cut from a balsa sheet and sanded to a streamline cross-section. It is best to dope and finish this part before it is cemented in the assembly.

The sub-rudder, beneath the fuselage, is made the same as the fin above, except that a wire tail skid is cemented to its lower edge. When these are completed cement them in place on the plane. Now carefully check over all your work and if completed to your satisfaction apply clear dope to all surfaces. While the dope is still wet check the wing and tail surfaces for warp, holding them in the correct position until the dope dries.

The plane may be made very colorful and impressive-looking by trimming it with colored dope.

Flying this little plane is "as easy as eating." First glide it, being sure it has correct balance and turns to the right in about a 30 ft. circle. This may be regulated by warping the rudder slightly to the right. Test the model by starting the motor and hand-launching it very gently into the wind. Do not push it—actually the wind should lift the model from your grasp.

This procedure allows the model to assume normal flight angle when starting. Adjust the model until flights are satisfactory. Be sure however that in the test flights the motor runs only for 4 or 5 seconds; after this real flights can be made with longer motor runs.
A Miniature Pursuit Model You Can Control and Maneuver Like a Full Size Plane—From the Ground—And It Can't Fly Away

By WILLIAM B. SCHWAB

AFTER returning from one of our week-end gas model contests a few years ago, in which we lost our ship, someone made the remark: "Why didn't you tie a string to it?" Of course we laughed.

However, some time later we began thinking about it, wondering if such a way of flying a gas model wouldn't be possible—flying in a circle. Just for the fun of it, we took one of our old crates and connected a string to the wing tip, one-third from the leading edge. A tab was glued to the rudder and wing to make the ship tend to pull away from the operator or turn sharply to the left, the ship flying in a clockwise direction. We connected it up, started the motor and let it run at half throttle. Surprising as it was, the ship left the ground and flew in perfect circles at about five feet altitude. When the motor cut we could keep the ship in the air long enough to bring it in and set it down next to the booster batteries and gas, by pulling on the string and "kiting" it in the air.

We kept flying for many months in this manner, until one fine day the motor was opened up just a little too much. The ship took off and began to climb to a good fifty feet, and the end of the string. We didn't want to lose the ship, because of a full tank of gas; and then too we didn't have automatic timers at that time. So we held on. Well, the ship went up—the string tightened—down went one wing tip—well, the rest of the ship followed.

After several weeks rebuilding we did away with the old stabs and built new ones, with movable elevators. Wow! what a thrill we had in store for us. After weeks of experiments we succeeded in using two strings for up- and down-control of the flippers; these same two strings also supported the ship while flying in circles. These strings were connected to a small joy-stick about a foot in length. The stick was made so we could strap it under our belt, leaving us free to walk about, and our hands free for controlling, much the same as in a real ship. With this system the ship, about thirty feet away, flying around the operator in circles, could be controlled perfectly. We could actually set the ship on the ground with the motor running and using the stick,
Controlled Lightning
(Continued from page 49)
raise the tail up in flying position, pull her back and take off exactly as in a real airplane; climbing and diving the ship within a few inches of the ground and pulling her out without stalling or crashing in.

When flying Remote Control you don't have to chase your crated miles every flight. You don't need the great wide open space. You don't have to worry about thermals, or crashing into trees, buildings, telegraph wires, cars, etc. If you want to go out flying some evening just take a walk over to your nearest school-yard, someone's big lawn, or some nearby lake, hook her up and take off. Fly day or night with small night-flying lights. Even when you have adverse weather, you can fly indoors in your armory or public hall; just as long as you have ample room for the circling ship. We can truthfully say that almost any ship that will fly free can be adapted for remote control. At the time of this writing we have just completed a new ship which we boast will out-speed any gasoline-powered model airplane in the country! The ship has a wing spread of 34" and is powered with an Ohlsson "60" swinging a 14" prop.

Hydro Remote Control: A low-wing buggy has been rigged up with pontoons; it flies beautifully. When flying this type of model, the operator stands on the shore line, the ship is started from the shore and sent straight out. The ship is given 180° of the 360° to get off before it comes around and flies over land. This is more than enough take-off area; for with the flipper controls, you can almost stall the ship off the water into a 90° climb and level it out. The only thing to watch for is the engine cutting out over land. We had this happen quite a few times. Our big mistake was pulling back on the stick when trying to lengthen the glide. In every case instead of a better glide, the tail section would drop and slow the ship down and, as a result would drop faster. We have just recently learned on water keep this in mind; keep the ship high enough and don't stall. Another thing: don't get the control lines wet; if you do, you'll have loss of control. If you can, try to secure fine flexible wire for control lines, when flying over water, instead of fishing line.

If any of you modelers have ships that are out-of-date and not quite up to present contest models, you can, within a few hours of work, adapt it with controls; or if you prefer, you can equip the one you now have for controlled flight, and later remove the controls for free flight. We doubt very much, though, if once you've flown your ship with your own hands, controlling its every movement in the air and nursing it down into perfect three-point landings, you'll ever want to go back to free flight.

In order to adapt controls for your own ship, just use, in proportion, the amount of area needed in your ship's controls compared with the size ship described. Metal tabs can be attached to the left wing panel and the rudder, set to bank and turn the ship to the left. The movable elevator can be made the desired thickness, and connected with silk hinges to the present stab. Connect the upper part of your ship in the same manner as shown in the drawings.

The drawings that are submitted are for those who want a real top-notch performer, one which has been tested over a period of months and has all the "bugs" eliminated. The ship was originally designed by the famous Corben Super Ace, redesigned for simplicity and contest work and still have that "look like the real thing." If any of you want a ship that will really perform, for contests or for Remote Control, it's it:

Tail Section

After scaling up the drawings, use a good hard piece of 3/16" square for the bottom stab spar; the leading edge of medium 3/16" x 1/4" stock and the trailing edge, hard 1/4" x 1/2". Top spars for the stab are of 1/8" square. The ribs, shown full size, are of 1/16" sheet. The movable elevator section of 3/16" sheet is hinged to the trailing edge piece with six pieces of double thickness silk about 1/2" x 1"; three pieces on each side of the horn. Glue the outer hinges on top the elevator section and on bottom of the stab.

The next two inner hinges: Glue the rib's to the bottom of elevator section and to the top of horn. The two outer ones. The two inner hinges are the same as the two outer ones. Inlay the top and bottom between the two center ribs of the stab with 1/16" sheet. The rudder outline is made of 1/8" sheet and ribs of 1/8" squares. Cut in the rudder tab and adjust to full left rudder and cement. The elevator section length is optional, the longer the horn the less sensitive the ship's action. On this particular ship the horn is one inch in length.

Fuselage

Start the fuselage construction by first building up the sides. Longeron and upper braces are made of hard 1/8" squares. Make both sides, one on top of the other for accuracy. After this frame is thoroughly dry, carefully separate the two sides with a sharp razor. Turn the frames up-side-down over the top view drawings and cement in your cross bracing. When dry, glue each from one plans center on bulkheads, adding necessary longeron and stringers, and in-stall 1/8" diameter wing dowl mounts. The dowsls can be brazed by adding small triangular pieces of celluloid to the top. Install the 1/16" sheet plywood between top longerons where designated; this plywood platform supports the entire weight of the ship so cement in well.

Drill holes for the two bolts in the plywood one inch apart and 1/4" away from the longeron. The two bolts are put in place with 1/16" inside diameter washers soldered to the head of each bolt. These washers will serve as guides for the single-control wire which leads from the elevator horn. Two small washers are then soldered to the control wire, 1/32" apart, halfway between the two guide washers. After the horn is bolted on the elevator and the entire tail section covered and glued to the fuselage, hold the elevator in neutral position, bend and cut the control wire to fit elevator horn; being sure elevator is level and the small washers that are soldered to the control wire are half-way between the guide washers, to insure the same amount of up- and down-control on the flippers.

Opposite the two guide washers two eyelets are cemented one inch apart, 1/4" above the longeron, in the sheet wood covering. For control line use two 30-foot lengths of good grade fishing cord with about 15 lb. test-pull. Take two feet of this cord, determine the center and tie the center between the two small washers which are soldered to the control wire. Run each end through the eyelets out of the fuselage. When connecting up the control cords from the joy stick to the ship, run the cords first through the wing cord-guides, then tie them to the present cords from the fuselage, being sure the bows (not knots) won't get caught in the guides when either one of the cords is pulled.

Complete the fuselage by planking the entire top section; that is, all the bulkheads, using one continuous sheet covering from the front of the fuselage to the rear of the cockpit. Use soft 1/16" sheet. Inlay hard 1/8" sheet wood in the bottom and side nose sections and install motor mount hooks. Next cut out bulkhead B from 1/16" ply, and glue in place. Cut bulkhead A, bolt in place metal motor mounts and landing gear. The ships of this type are very sensitive; ship bulkhead B to prevent shimmym of bulkhead A and motor. We offer a suggestion here: Unless you have an exceptionally smooth place from which to take off and land, equip the ship with exceptionally large wheels.

We found that 3" wheels enable us to take off and land on grass lawns under full power without nosing over.

Ignition Unit

The ignition unit is entirely optional. On this particular ship a simple ignition stick is fastened to the free-walls and coil and heavy-duty battery strapped thereon; the heavy battery doing away with boosters. No automatic timer is used, the current broken by the points being fully retarded on the Ohlsson "23."

Wing

Ribs and wing tips are shown full size. All ribs are medium hard 1/16" sheet. Leading edge, 3/16" square; spars, 1/8" x 1/4"; trailing edges, 1/8" x 1/2". Wing tips W-1 and W-2 are from 1/4" sheet, Y-1 from 1/8" sheet.

Dihedral: Lay the wing panel flat on the work bench and raise opposite panel 4°. Inlay center section of wing with 1/16" sheet on top and bottom. Install control line guides through wing spars, sixth rib from the tip. These guides can be bent from a straight pin and glued in place.

Covering

We urgently recommend using silk for covering throughout the entire ship, due to abuse model will receive. The ship explained here is about six months old and has had well over 700 flights! Use about five coats of clear dope before color. When doping the wing hold it in a warped position until the dope is dry; do this for each coating.

Joy-Stick

The belly plate is made of 1/4" plywood, 6" x 8" inches. The joy-stick support stick, made of 1/2" dowel, is screwed to the belly plate and braced up with hardwood guzzets. Slot out the front of the support stick to receive the joy-stick. Cut the joy-stick to shape and drill in five holes,
one for the pivoting point and the others for control lines. You can use either the two outer control-line holes or the two that are close together, depending on how much control action you want. When in use the belly plate is strapped to the operator with his pant's belt. When not in use the plate will serve as something to wrap the control lines on.

Test Flying

Make your first test hops on a calm day, or better still indoors. Have a smooth place from which to take off and land; keep the control lines from dragging on the ground, specially when the ship is released for take off. Have someone hold the model up in flying position, holding the elevators perfectly level and the joystick perfectly straight. Then connect up your control springs, being sure that the tension on both strings is the same. Set the model on the ground so the ship is at a ninety degree angle to the line.

It is necessary that the motor be operated almost all the time to keep perfect tension on the control lines, so be very careful and DON'T OVER CONTROL. Nine out of ten persons who have tried flying Remote Control over-control the ship every time. On the take off don’t let your assistant push the ship, let it go unassisted. If you do, the ship will either be pushed towards, or away from, you too much—resulting in loss of control each time. On the take off, keep the stick forward until you’ve reached the ship’s flying speed, then pull back slowly for the take off. The minute the ship leaves the ground move the stick slightly forward, to prevent stalling (not too much). Then proceed to “feel” the model out; see how she responds to the touch of the stick.

Once you’ve acquired that you can dive and climb her to the limit. Be sure and not let the ship climb more than a forty-five degree angle; that is, the angle of the string from you to the ship should not be more than forty-five degrees. After a few flights you can just about tell when the motor will quit. Try and have the ship several feet off the ground when the motor stops, this way you can get the nose down into a good fast glide and level it off for a perfect three-point landing. After you have acquainted yourself with your ship you won’t have to worry about flying in windy weather.

Here are a few pointers on windy weather flying: Always take off with the wind, because by the time the ship leaves the ground it will be flying cross-wind and the control lines will be taut; perfect control will be had while climbing into the wind. Once the ship comes cross-wind again take a few steps backwards in order to keep the lines taut; otherwise you’ll lose control.

Recently we perfected a method by which we could regulate the speed of the engine; making it possible to throttle down and land, open’er up again and take off, header hop, or strafing the motor in flight. Here’s how:

Use an old Brown Jr. choke nut and slip it over the end of your air intake tube; drill holes into the tube the same size as in the choke nut. If you want, make another choke nut from a piece of brass tubing about 1/2" long, drilling and closing one end off by soldering a piece of sheet brass to it. Be sure the choke nut turns very freely on the air intake tube. Solder a piece of 3/34 wire across the rear of the nut, to act as an arm to close and open the air. Solder a fine spring to the one end of the wire arm, to bring the choke nut back to a closed position. To the other end connect ordinary sewing thread for the control line: run this thread through the necessary pulleys, made from straight pins, bringing it out from the fuselage between the two elevator control lines. An extra throttle control arm can be screwed to the joy-stick support stick.

During the past years, at practically every gas event, every horde of model builders wanting to compete in gas racing, but the great possibility of smashing up ships in speed trials prohibited competition in this type of flying. Speed gas models are now a reality. Contests can easily be had with Remote Control. A definite diameter for the circling ship can be set up and times calibrated. Speed contests of this sort may be run off more easily than those we now have with rubber powered ships; it would be impossible for the ship to fly out-of-bounds as rubber powered ships do so often. When flying gas speed, a definite diameter circle could be set up, with a certain number of laps to be flown.

New designs of speed ships may be built up, wing airfoil sections experimented with, engines and propellers tested; all making keen competition between contestants. The possibilities of advancing and incorporating new ideas, such as flaps, retractable landing gears and all other things that a real speed ship has, can easily be worked out with the use of control lines, opening an entirely new, untouched field for the model builder to experiment with.

Many, many happy landings.
HERE we present a most unusual gas model—a truly scale version for either Class A or Class B motors of the United States Army's new eyes: The Curtiss O-52 observation ship.

The Curtiss O-52 is the Army's latest flying "greenhouse" used extensively for observation and reconnaissance work, artillery spotting, and on photographic missions. The crew consists of two: the pilot and observer. Naturally the ship's performance and other details are Army secrets, but it is said the O-52 is considered one of the most efficient aircraft of its type in the world.

After glancing at the pictures of the Curtiss O-52 you can readily tell that this type of plane would make the ideal scale gas model. And believe us it does!

The general setup of the whole plane lends itself to a very stable model. The high wing, ample dihedral, large tail surface area, well placed thrust line, and a rather nice setup of all forces such as the center of gravity and center of lateral area, etc., all combine to present a very pleasing picture of what the well-flying gas model is sporting this year.

Certain structural features are well-noted, too. The landing gear placed well forward insures fine landings and prevents broken propellers. The fuselage design allows us to employ the well-known "crutch construction" that simplifies fuselage construction to a great degree.

The O-52's construction may appear rather difficult at first glance, but after a little study of the plans you will realize that this model is amazingly easy to build. We have tried to keep construction easy enough for the beginner who is trying his hand at a gas model for the first time.

Of course one of the big features of our Curtiss scale gas model is the fact that we are employing the new Grant wing slots. There are several reasons why we decided to use these new slots in the wings. The model has a rather high wing loading which means that flights will be quite fast; naturally you don't want a sensitive model; therefore the wing slots. Although the tail surfaces were designed with plenty of area, the fuselage moment arm is rather short. When the wing slots are used they eliminate the need for a long moment to produce a stable flying model. Slots also go a long way in producing a long, flat and very slow glide. All of these facts and claims about wing slots have been proved (Continued on page 60)

It is not only realistic, with its gas engine and scale proportions, but wing slots make it one of the most reliable performers ever built. These features combined with simple sturdy construction provide many flying hours without crackups.
Steps of Procedure in the Construction of the Fuselage

Construction steps 1-8 are performed on a flat working surface over full-size drawings of the main and the sub fuselage crutch.

1. Sub-crutch is constructed from 1/8" x 1/4" strips of Hard Balsa.

2. Views not to scale.

3. Bulkheads A, B, C are not shown in step 3 for clarity.

4. Construct the main fuselage crutch from 1/4" sq balsa strips.

5. Now connect the sub-crotch with the main crutch. Obtain dimensions from side view drawings to get actual height.

6. Remainder of stringer not shown for clarity.

Cowl Hatch Detail

Hatch is removable.

Hatch is held in place by dress snaps.

Cut sections from cowl to fit motor.

Any motor of .19 to .29 cu.in. displacement may be used in this model of the Curtiss O-52.

Landing Gear Detail

Landing gear is mounted to use ply-wood cut to the shape of "D" with stringer and several coats of cement.

Scale

Landing gear is not to scale to fit wheel.
NOTE THAT TAIL IS REMOVABLE.

INSTALL LANDING GEAR AND THEN COVER WITH WET SILKSPAN COVER CASING WITH CELLULOIDE.

BUILD THE STABILIZER IN ONE PIECE.

CROSSSECTION OF WING SLOT IS NOTED IN FULL SIZE DRAWING OF WING RIB.

VIEW SHOWING HOW DIHEDRAL IS USED TO FAIR THE CELLULOIDE CENTER SECTION INTO THE FUSELAGE CASING.

WING SPAN

LENGTH OVERALL

WIND SPAN

MOTOR

SCALE - PLATE 182, 1/3" PLATE 384, 1/8".

30-1/2" CLASS "A" OR "B"

PLATES 1, 82.
Bulkheads A, B, and C are cut from 3/8" sheet balsa.

Bulkheads E to I are cut from 1/8" sheet balsa.

Curtiss-052  Sydney R. Struhl.

Center section rib - 2 required  1/16" sheet

All parts shown full size

Plate 3
Gas Model Army Scout

(Continued from page 55)

by the designer, Charles H. Grant.

The model is large enough to take either a large Class A or B motor. The author used an Ohlsson 19 to power his O-52 and there was enough power to pull his model quite high on a twenty second motor run. Evidence of the flying ability of the model is that although it was always flown just before sundown when most of the thermals had died down, flights of several minutes were common and are now taken as customary.

The author has tried to adhere to true scale throughout and only very minor changes were made to insure stable flights. It is suggested that you fly without the single wing strut shown in the front view; the extra drag is not compensated by the appearance. If you wish to use the strut use dress snaps to keep it in place.

You will note that the plans are drawn to a very convenient scale of 1/3” to the inch. Therefore all you have to do to obtain full size drawings is to enlarge the magazine plans three times. To make your task still easier we have supplied full size drawings of the fuselage bulkheads, wing ribs, tips and other important parts.

Well, that’s enough talk about the Curtiss O-52. Now how about bucking down and see just how fine a job you can make of it?

FUSELAGE—The fuselage is constructed with the use of a main crutch and a sub-crutch. The main crutch is shown in the fuselage top view. This is made from 1/4” sq. strips of balsa. Note that the hardwood motor mounts are attached to the main crutch. Fill in around the motor mounts with 1/4” soft sheet balsa. While cement is drying on the main crutch make the sub-crutch. This is made from 1/8” x 1/4” strips and cemented firmly together. Cut the piece S-C from 1/4” sheet and cement to the front of the sub-crutch.

Now connect sub-crutch to main crutch as shown in the fuselage sketches with 1/8” x 1/4” uprights. Be sure to keep dimensions correct as given in the side view.

Finish the top of the fuselage as shown. Lay the two 1/8” square fairing stringers on each side of the fuselage as shown. Cut all fuselage bulkheads as given in Plate 3 and cement them all in their proper locations.

Bend the single-strut landing gear strut from 3/32” steel music wire to design shown and attach it to a 1/16” thick piece of plywood cut to the shape of lower section of bulkhead D. Cement this to the bulkhead with several coats of cement. Add the lower 1/8” square stringers to the bulkheads. Note that the very bottom stringer is 1/8” x 1/4” rather than 1/8” square. Attach a small tail wheel to the 1/8” x 1/4” stringer with several coats of cement and bind with thread.

Fill in between bulkheads C and D with 1/8” soft sheet balsa. Note that bulkhead D’ is not cemented to D; and sandpaper perfectly smooth to simulate the cowling. Insert lengths of 1/8” hardwood dowel to wrap rubber straps on to keep the wing and tail section in place. Cut all necessary holes in the cowling to accommodate your individual motor. No battery box and coil position is given in the plans because these are placed along the main fuselage crutch at points that will balance the model at about the 50% wing chord mark. Note that bulkhead J’ is cemented to the center section of the wing and not to the fuselage; this forms the fuselage fairing into the wing.

Cut the stringers between D and D’ and along the top of the main crutch through A, B and C to obtain the removable cowling. Each individual motor requires different holes for adjustments and cooling.

WING—The wing is constructed in one piece. You should experience no difficulty in making the wing for it is of the simplest construction.

As was mentioned above we employ the Grant type wing slots. Heretofore this type of wing slot was constructed by the complicated sheet-box method which many builders found difficult to make. Our method is much simpler, we merely use two pieces of sheet balsa of the necessary thickness and carve the required crossection in them. Cover the wing in the usual manner; cut the covering away from the slot openings on the top of the balsa of the wings and presto, the slots are finished. Simple?

It is wise to construct the wing over a full size drawing of the wing plan. All dimensions are given on Plate 2. Cut the required number of each rib pattern from medium hard 1/16” sheet balsa. Note that the ribs accommodating the wing slot are made in two pieces.

Since the airfoil used is of the flat bottom type (modified Clark Y for ease of installing the wing slot) all members may be pinned directly to the plans. Naturally you will have to blob up the leading edge to meet the rib leading edge. Insert pins and cement firmly. Cut wing tips from 1/4” sheet to patterns—given full size in the plans—and install in their proper locations. Carve the wing slot members to required crossection as described above and cement in place, making sure you get an even, smooth contour on the wing surfaces. If there are any bumps, shave and sandpaper them off, otherwise you will
spoil the efficiency of the wing airfoil.

Now install the necessary dihedral in each wing tip, noting that there is a flat center section that fits onto the fuselage sub-crib. Check for any warps in the wing; cement all joints; it might be a good idea to re-enforce the dihedral joint with gussets and other balsa members. Use loads of cement at this section.

The real ship has a single strut to brace the wing. The author found there was a great difference in performance with and without the strut, so he recommends that it be left off because it isn't needed for strength. If you prefer to use it, details may be found in the front view drawing.

TAIL SURFACES—Tail surfaces are very simple to construct and no difficulty should be found here.

Pin all members directly on full size rudder and stabilizer drawings. Cut the tips from the full size patterns given in the plans and cement in place. Cut the tail block from 1/4" sheet and note it is cemented to the bottom of the rudder and not to the fuselage.

Send a slight airfoil section into the tail surfaces. Assemble the tail group as follows: cut the small section from the fuselage rear as shown in the plans; cement stabilizer to the very bottom of this section so that there is 0° incidence, using the thrust line as a base line. Now cement the rudder into position onto the top of the fuselage section. Add 1/8" hardwood dowels to wrap the rubber strands upon in the proper positions.

COVERING—The author covered his Curtiss O-52 with gas type Silkepans and then doped it silver. Of course you can use any combination you want but it is suggested that you stick to some type of military coloring.

Tail and wing are covered in the usual manner. Use heavy dope as adhesive; it is necessary to dope only the extremities of these surfaces. It is best to cover the fuselage with wet Silkepans since it is much easier to apply this to the compound curves of the fuselage when it is wet.

Spray the entire covering with water to tighten the covering. Now brush on two or three coats of clear dope. Sand any fuzz with 10-O sandpaper before applying color dope. The author brushed three coats of very thin silver dope, about the consistency of water. This was just enough to give it a solid coloring without adding unnecessary weight.

Control surfaces are shown by strips of black paper doped to the correct positions. Add official U.S. Army insignia which can be purchased at your local model store. The cowling may be painted a contrasting color such as blue or red. Outline the windows with strips of black paper doped to the celluloid cabin.

FLYING—Testing the Curtiss O-52 model should be comparatively easy if you take the necessary precautions and show a little care because it really is a very stable ship. With the incidence required in its proper location and the model free from warps, the ship is glided into the wind, preferably over tall grass. If your model is on the heavy side, remember it will require a stronger heave to make it reach flying speed. It should be test-glided until it glides far and flat.

Keep test-gliding until proper glide is obtained, adjusting the rudder so the ship turns to the right in the glide in a large shallow circle.

You are now ready to test your model under power. Use short motor runs and gradually increase the motor speed on each succeeding flight until you have all the bugs ironed out. Note how the model behaves, which way it turns under power, climbing angle, glide, and its direction—and of course make all necessary corrections.

With the above adjustments the model should jump from the ground or from your hand a few feet forward, gathering lots of flying speed, and then zoom for the sky in a left or right banking attitude until the motor cuts off; then it should roll out into its excellent glide.

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HAVE YOU DISCOVERED CRINOLINE?

By ELBERT J. WEATHERS

THIS article has been written to advise the gas model fraternity of the many virtues which come from the use of crinoline in gas model construction.

What is crinoline? Almost any woman can tell you, as it is widely used in connection with dressmaking. It looks like starched cheesecloth, and as far as is known, it was first used for gas models by a San Diego gas model enthusiast who introduced it to the writer and who in turn now passes it on to all gas jobbers who are looking for the ultimate in strength in turning out their ships.

Crinoline, when used to cover nose blocks, wing spars, wing trailing edges, etc., makes such parts extremely strong. It has the quality of working exceedingly well over compound curves, such as found on a nose block. A piece can be applied over such a curve so that it contracts or expands in any direction as required.

To apply it, use model cement of rather thick consistency. Spread the cement over the wood and lay on the crinoline, rubbing it out flat. Go over the outside of it with cement on the finger, spreading it around and flowing it into the mesh. The cement softens the starch in the crinoline and when dry the unit which has been covered becomes as solid and as hard as stone. To cite a specific example, a one-wheel landing gear gas model built by the writer was first planked on the bottom, from the nose block to the rear of the wheel installation. (Landing wheel hung directly from fuselage bottom.) Soft balsa was used for this. It was then covered with crinoline, using an ample quantity of cement to adhere it. Cloth was then applied over the crinoline as the outer covering, followed by several coats of clear dope. This section, which comes in for plenty of abuse when the plane sits down in rugged country, has proved to be so hard and tough that nothing has harmed it to date, there being merely several slight scratches on the surface. It applied to the trailing edges of wings (using strips twice the width of the member, to complete a stretch with one piece) they become very hard and resistant to pulling up or down when covering has become taut. A gas model nose block of the removable type, which is made more on the order of a cowl, finishing with a thin balsa shell, can rarely be used in actual flight due to its delicacy. However, when covered inside and out with crinoline, it becomes sturdy enough to stand the severest of crackups.

Many other outlets for it for providing additional strength in your gas jobs are awaiting your application. It might be mentioned also that a gas model propeller covered with it becomes a prop that just won't "say die."

Crinoline can be obtained at any department store where cloth of all types is sold. It costs only about 15c per yard, making it a trivial item indeed in this respect. Yours for longer-lived gas model aircraft equipped with crinoline, which reinforces balsa as steel reinforces concrete.
The finished plane is light and has large wing area

By CHESTER LANZO

rudder and elevator, crash-proof wing landing gear, flexible wire wing mount to eliminate wing breakage and to produce greater stability. All of the excess frills and baggage are entirely eliminated, thus producing a straight-forward and simple but efficient design. Quoting one of the best model builders in the country, “Super-streamlining has a tendency to induce complicated and heavy structures.”

Constructing the Plane

Start out with the intentions of spending two or more weeks of hard but enjoyable work on the construction of this model.

Its specifications are: Wing span, 8 feet; wing cord, 14 inches; wing loading, 8 ounces per square foot.

The author, at right, waits to have his record breaking ship “gassed up”
A Single Blade Free-wheeling Prop

BY DONALD MERTENS

It is comparatively recent that the single blade propeller has been used on full sized aircraft. However, a large number of model builders have known of the advantages of this type of prop for quite some time. Many of them have discovered its advantages by accident. At least this is the way the author discovered that it was very efficient and superior to the two bladed type. Once when flying a plane, it crashed and broke off one blade of the propeller. The break occurred near the hub; the plane being undamaged and a few turns being left in the motor, it was again launched merely to see what the effect of the one bladed propeller would be upon the performance of the ship. It created a great surprise when the model climbed much better than before the break took place. There was of course a terrific amount of vibration which at the time was thought could not be overcome, so nothing was done about it.

On one other occasion, a lad who broke his propeller and not possessing a spare one flew his model with half a propeller in the contest and lo—he won first place. Many modellers who witnessed the flight considered it a freak one, but some gave the strange phenomena serious thought. To the author the solution of the single bladed propeller idea offered a challenge and a great deal of experimenting was carried on over a period of time in order to develop a simple and positive method in order to make a satisfactory single blade propeller. Finally, the type of propeller and the method shown in this article was evolved. Of the two types, the one in which the stoke bolt is used as a counter balancing weight proved to be most satisfactory and efficient.

A block is required which is only 5/8 as long as the ordinary two bladed propeller. Other dimensions, such as the block width and diameters, should be the same. Carve the single blade as you would any two bladed propeller. When cutting out the hub, be sure it is made according to the sketch. You may use either type of balance shown. If the stoke bolt balance is to be used, select a bolt of sufficient size and length to balance the blade. Then drill a hole into the hub extension 1/16 of an inch smaller in diameter than the bolt, being sure the hole has the proper depth. Then screw the bolt into the hole and cement it into place. Next drill the hole for the retaining wire which may be part of the free-wheeling mechanism, insert the wire and cement it in place.

If the lead balance type of propeller is preferred, procure a piece of lead and cut it to the proper size and length. Then solder it on the wire as shown in the sketches. Bend the wire and screw it to the propeller hub by cementing and binding it in place. Careful study of the sketches will disclose construction details of the counter balance weight and free-wheeling devices.
How to Build A Universal One Wheeler

A Gas Model That Will be a Consistent Winner in Any Contest. It Recently Won a Contest at Miller Field, Staten Island, N.Y., by Making a Flight of Seven Minutes With a Thirty Second Engine Run. It Has a Very Flat Glide

SOMETHING new in gas model aviation—a one-wheeler gas model that will accommodate most any motor on the market. To date the ship has been flown with a Trojan, Husky, Cyclone, Gwinn-Aero and Brown "B," "C," and "D," giving most gratifying results with all of them. The ship can be flown in both the large and small N.A.A. events at contests. On occasions it has flown over five minutes without covering more than 200 feet distance from the take-off spot. Its outstanding flight characteristic is the extreme stability. Due to a low center of gravity and a low center of lateral area, the climb is a tight, vertical spiral. The glide is very flat and slow due to the high lift, stable airfoil. A great deal of airfoils were tested on this ship till the present airfoil was chosen. The ship rides thermals with remarkable facility as has been proven at various times. An associate model builder who constructed the same job, and used a Husky for power, attained flights of over eight minutes. The ship weighed 1½ pounds at the time. If a small motor is used, it is recommended that the builder use lighter wood which will cut down on the wing loading.

Construction Fuselage

The fuselage is built of 3/16" square balsa strips. From the nose back to section X-X the fuselage has an oblong cross-section, and that part of the body is built in the orthodox manner. While building it allow the side longerons to extend the full length of the fuselage. Note that the outside motor mounts are integral with the side longerons. Make all the joints running into the motor mount especially accurate and strong, as this part of the body must absorb a great deal of strain. The two sides are completely joined from X-X forward before the rear of the body is built up. Then the two side longerons are joined at the back.

The front of a new top and bottom longeron is now glued in place, and then joined to the respective rear positions as indicated on the plans. The rest of the braces are now set in place; so that when finished, the sections from Y-Y to Z-Z will be diamond shaped, and from Z-Z to the back they will be triangular. The nose block of soft balsa is glued to the body and then carved to conform to the outline of the nose. It should be rounded as much as possible. The cowl formers are shown in full size on the bottom right of plate one. Landing gear and skid details are shown clearly on plate one with everything labeled. Note that the skid is one complete piece.

The landing gear is one piece. The axle is a straight piece of wire, bound with iron wire and soldered to the wire struts. Battery box details are shown on plate two. The coil box is built around the coil. Note the hooks near the side longerons to hold the wing rubber bands. The circuit diagram is shown on plate two. The upper timer is the self-timer, while the lower one is the one on the motor.

Tail

All tail construction is covered completely on the plans. The rib sections are shown on plate two and should be used as a guide in con-
CHORD LINE

ROOT RIB SECTION — MODIFIED GRANT M2-10
DOTTED LINES SHOW HOW TO DERIVE THE OTHER RIB SECTIONS

4 TH ELEV SECTION FROM CENTER

2 ND RUDDER SECTION FROM TIP

SOLDER USE INTERMEDIATE CELLS

WIRE CONNECTIONS.

BATTERY BOX OF 1/8 HARD SHEET

3 13/16
THIN BRASS PLATE

SPRING STEEL STRIP

Nose View

CIRCUIT DIAGRAM

BATTERIES
BOOSTER
TERMINALS

TIMER

COIL
COND.

GROUND

TIMER

USE REMOVABLE INNER MOUNTS FOR SMALL MOTORS. INSTALL THIRD SET IF NECESSARY TO FIT MOTOR. OUTSIDE MOUNTS FOR 1/5 HP MOTORS.

"THE SKYSCRAPER" SCALE FULL SIZE PLATE 2

DESIGNED BY LEON SHULMAN
DRAWN BY ROY HILBERT
Tricky "Props" For Flighty Ships

Two Expert Model Fliers Tell You How to Make Free Wheeling Folding Propellers and Give Other Suggestions on Model Design

First Author Dick Everett Says:

While not the latest, but probably the most efficient development that the new rules have brought to light are the folding propellers. This was first observed by the writer at the Junior Aviator Nationals of 1935, when Bob Cahill used one on his 300 inch job. His ship was not consistent for the simple reason that the prop would not always stop in the correct position. Then in 1937 the Cahills scored again, when Jimmy took his ship to the Nationals and walked away with a first prize and a place on the Wakefield team. His high time can be attributed to the fine streamlining and the resultant low resistance that his ship presented in the glide. He used a one-bladed folding prop and his ship had, by far, the flattest glide of any. Some of the Chicago boys also had folding props but the way that they folded was not observed. There were also some new type of free-wheelers and ideas for feathering props. Altogether the gang tried everything to decrease resistance in the glide. The one-bladed prop is not the most efficient to use because there is so much vibration, but it will work quite well. Jimmy Cahill used a piece of aluminum for a hinge, which stuck out in back of the hub. The only difficulty there is with this particular type is that you must be able to get aluminum which should be of Dural, and that a small drill of 1/32" in diameter is used to drill a hole for the axle. The idea shown consists of merely wire and (Continued on page 80)
How to Build
A Three-Foot
Gas Model

Here Is a Beautiful Flier That Is Simple
to Build and Easy to Transport

If you join the large group of gas modelers who are taking up the small gas job
as a great step forward in our hobby, you are faced with a peculiar paradox. In almost
every field of design that you can think of, full size aeronautics not excepted,
progress is achieved by an increase in the size of units. The bigger the ocean liner or
air transport, the more reliable it is; and the safer and more efficient does it become.
Exactly the opposite seems to be true of gas models.

Why this is so is not evident. All we can say is that while these small gas jobs are
not capable of turning out long endurance flights, they are much more dependable.
They seem to be able to take “in their stride” rough handling and hard landings
that would demolish models that are twice as large. In addition, they obviously have
the edge over the big fellows when it is a question of ease of construction, of transpor
tation and of setting up for flights.

A grave disadvantage of the big gas models is the fear of losing months of work, as well as a considerable sum of
money. That throttles whatever original work a builder may be contemplating. On
the other hand, a small engine fairly begs to be mounted in a model that is a little
out of the ordinary. You see, there is so m uch less to lose if your friends are right
and you are a crackpot after all.

In glancing over the design of the S-4, one thing should be almost instantly ap
parent. Here is a gas model that is almost as simple as it could be. The elimination of
unnecessary construction was kept foremost in mind while the designing was in pro
gress. The result is a model that will fly out of your workshop in about twenty hours to
begin a long career of thrilling flights. The

S-4 usually outclimbs every large gas job
on the field with ease; but like most of the
other small gas buggies with which we are
familiar, its soaring possibilities are rather
limited. However, this last disturbing fact
is so far outweighed by the previously stated advantages of
these gadgets that we are sure that as soon as the
movement to put them in a separate class by themselves
at contests becomes widespread, the eight to ten foot
“barn doors” will be definitely on the way out. We’re
afraid that we are finding it hard to wait for this to hap
pen.

Fuselage

In keeping with the general simplicity of the S-4 it
self, we have tried to make the plans as clear and as
helpful as possible, by including a large number of full sized patterns. Transferring
these patterns directly to your materials by means of templates, or carbon and tracing
papers, will save quite a bit of building time and give you a better model. Pay particular
attention to the odd angles at which the fuselage compression members are cut. Get
ting these angles made correctly is very impor
tant for the strength of the completed fuselage. We suggest that they be cut out of
3/16” square hard balsa directly on the magazine plans, and numbered immediately
to avoid confusion. It is also wise to place a spot of ink on either the top or the bot
tom of each piece to avoid reversing them.

This work can be done while the flat basic fuselage framework is drying. The latter is
built of 3/16” square hard balsa on a full size top view lay-out of the fuselage. To
draw up plans is the hardest part of building a gas model for many fellows. However,
just a little familiarity with a ruler and 30-60-90-triangle should make it easy to
enlarge plans. You will find that a roll of ordinary shelving paper is an excellent
medium for this work. The job of cementing the compression members and the bot
tom stringer in place goes on while the base framework is still pinned to the plans.
Since the compression members are not exac
tly perpendicular to the base framework, we would advise you to make use of little
cardboard or balsa templates, as suggested in Plate I. However, if you prefer to do
without these templates, the compression members may be set perpendicular to the
base framework and the necessary changes made. Note that the slot in compression
member number 9 is cut after bulkhead number C is glued into place along the for
mer. This is done to prevent breakage while the construction is going on. When
the framework is dry it can be taken from the plans nad the landing gear may be add
ed.

Bend the 1/16” round music wire to the
correct shapes and then bind these struts
securely in their positions in the fuselage.
Continue wrapping thread about the wire
and the fuselage members until you feel that
the attachment is rigid. Then coat the bind
ings several times with cement. Wrap the
Although it is very advisable to use the removable motor mount, some builders may think that they lack the necessary experience to tackle it. A rigid mount can be made by gluing the motor mount runners in place at all points of support and binding the wiring circuit in place in the fuselage framework.

The cowling is best made by first cementing the lower cowl block in place, and then adding members “g” and “h.” On the right member “g” only, you will have to make a rectangular slot to allow the carburetor adjustment to be changed while running the engine in the model. The arrangement for the carburetor adjustment is sketched in on the model drawings. Members “h” and “e” are cemented into place as blanks, and cut to shape when dry.

The tail cradle is made of medium hard 1/16” sheet balsa and is first cemented into the fuselage along the edges marked 1 and 2. When it is firmly set this way, pinch the rear of the cradle together, and cement in members “w” and “v.” Hold these together with pins while the glue is drying. Then add the rest of the fuselage details such as the 1/16” soft sheet balsa window formers, the bamboo windshield strips and the celluloid windshield and windows. Leave just enough clearance for access to the interior of the fuselage. As a final touch apply a light coat of varnish to the fuselage framework in front of station 8 to prevent the wood and the joints from weakening, as a result of the action of the gas and oil that inevitably finds its way into the fuselage.

Cover the fuselage with regular gas job bamboo paper, which is applied with model cement and a brush and tightened with a spray of water. Finish the fuselage with a thin coat of clear dope and two coats of thinned out colored dope. One or two extra coats of paint up front will help you to get a good finish. Then cover with ten nought sandpaper between dope coats. 3/16” inch wide black tissue striping around the windows and windshield is a slick looking detail.

The Wing

The wing has 241 square inches of area, but only 219 of these are effective. This makes the S-4 a small gas job even for a 1/8 inch bock engine, and you might expect a fair bit of speed to develop in flight. As a matter of fact, the model flies at an estimated 20 miles per hour, and could be made to fly even more slowly. We attribute this very desirable quality of slowness to the wing section used; the same airfoil section that Kovel used on the KG-2. In addition, this airfoil permits the use of a deep wing spar, which strengthens the wing considerably.

The wing construction is started by building up this spar from a piece of medium hard balsa measuring 1/8” by 7/8”. Cut the angles where the two halves meet as shown on the center piece and the two center section places marked “x”.

Be sure to make the joints clean and well fitting. While the spar is drying, the requisite number of full size wing ribs and the tip ribs are cut from medium hard 1/16” sheet balsa, and the tips are cut from 3/16” soft sheet balsa.

Cement the two halves of each of the wing tips together before fitting the tips to the wing. The leading and trailing edges can be shaped at this time. It is preferable to use a ready-cut trailing edge on the wing. Next, add the ribs to the center spar, making sure that they are in perfect alignment. notch the trailing edge, cement it in place and add the leading edge to the framework. Once the tips, the center section strips and the necessary sheet balsa have been added, the wing can be covered. Be sure that there are no warps at this point.

The wing can be covered with ordinary bamboo paper, just as was the fuselage; but if it is possible to secure a light grade of tissue paper, we would advise you to use that for both the wing and tail. While the wing is being water-sprayed, be sure that it is weighted to a flat surface. The wing and tail are finished like the fuselage; one thin coat of clear dope followed by two thin coats of colored dope. If sufficient care has been employed all the way through the wing will be free from warps.

To prevent the wing from sliding around on top of the fuselage as a result of motor vibration during flight, cement four 1/4” square pads of coarse sandpaper to the underside of the wing where it is in contact with the fuselage. Apply heavy cement skins to the other end of the corresponding portions of the fuselage.

Another useful gadget for the wing is a set of two 1/32” sheet aluminum cleats. These cleats slip over the trailing edge just where the rubber that holds the wing down passes, and prevent the latter from cutting the trailing edge.

The Tail Assembly

The tail is such a simple affair that it is strongly recommended that assemblies on many large rubber-powered models. Like the wing, it is built up around a spar; this time with a strip of 1/16” by 1/4” hard balsa. The tail section is an approximation of the streamline shape. With the exception of the center ribs, this approximation is reached by eye. Therefore, in the place of shaping the slip rectangulal STRIPS OF 1/16” SHEET BALS A (HAVING THE CORRECT LENGTH DIMENSION) ON TO THE SPAR, AND CEMENT THEM IN PLACE. THEN THE LEADING AND TRAILING EDGES ARE NOTCHED 1/16” INCH TO RECEIVE THE RIBS, AND ARE CEMENTED IN PLACE. THE TIPS FOLLOW, AND THEN, AFTER THE ENTIRE FRAMEWORK IS ASSEMBLED, THE RIBS ARE SHAPED WITH BLADE AND SANDPAPER. THE UPPER Rudder IS BUILT IN THE SAME MANNER, AND WHEN COMPLETED AND COVERED IT IS GLUED DIRECTLY TO THE TOP OF THE STABILIZER. Note that the rudder spar projects slightly into the sheet balsa stabilizer center section. The entire wing has been painted, the covered and painted unit is glued directly on to the tail cradle.

The lower fin has a few uses. In addition to its function as lateral area to supplement the upper rudder, it also supports the tail skid and carries the flaps that is used to control the model’s turn. The main part of this member is a piece of 1/16” soft sheet balsa whose grains are set at an angle of 45 degrees. While this laminate is drying the other parts are prepared. To carry the tail skid, there is a piece of very hard 1/8” by 1/4” balsa which is marked “J” on the plans. The skid is bent of .034 music wire, bound and cemented to this piece. We fair member “J”
The ratio of the span to the chord of an airfoil is called the Aspect Ratio and this is a very important factor in the design and performance of airplanes. It is, of course, always greater than unity, as the airplane wing works most efficiently when shaped to present its longest dimension perpendicular to the direction of motion.

The importance of aspect ratio from an aerodynamic standpoint is apparent from a consideration of what is happening at the tips of an airfoil moving through the air. Since the pressure of the air below the wing is greater than that of the atmosphere, the air flowing along the upper surface of the wing is accelerated and has a lower pressure. Lift is generated, as it is necessary to support the weight of the airplane. The lift generated by the wing is equal to the weight of the airplane when it is in equilibrium.

In considering the lift produced by a wing, it is necessary to consider the lift generated by the wing at a given angle of attack. The lift generated by a wing at a given angle of attack is proportional to the square of the velocity of the air passing over the wing. The lift generated by a wing is also proportional to the length of the wing, since the lift generated by a wing is directly proportional to the area of the wing.

Does Aspect Ratio Increase Duration?

By GEORGE H. TWENÉY

The net result is again in favor of the model. It is a well-known aerodynamic fact that for best all-round efficiency an airplane should fly at the best L/D value, which theoretically is the highest value. In considering the lift generated by a wing, it is necessary to consider the lift generated by the wing at a given angle of attack. The lift generated by a wing at a given angle of attack is proportional to the square of the velocity of the air passing over the wing. The lift generated by a wing is also proportional to the length of the wing, since the lift generated by a wing is directly proportional to the area of the wing.

Rough longitudinal trim is obtained by moving the battery box. Finer adjustments are made with the wing. To make these latter less haphazard, be sure to draw a series of ink lines across the top of each upper longeron (perpendicular to the line of flight) about where the trailing edge is going to be. Space them about 1/16 of an inch apart and number them.

When you think that the settings are O.K., try short power flights. In a little while the adjustments should be perfect, and then—well, then the chances are that your batteries are all bad; but, if by some odd coincidence you happen to have a good set—get ready for a chase!
The little plane glides in with all the realism of a full scale craft.

Here it is at last, fellows; a model airplane that flies and glides like a contest model and yet looks like a Real Plane. It is an airplane that one will be proud to take to any contest — it has "fly-ability plus.

You may have owned models that had a good climb but we believe nothing can compare with the "Meteor." The original ship was flown with a Bantam engine, would zoom around the sky at about sixty miles an hour and when the motor cut out it was just a speck in the sky. The glide couldn't be beat, it seemed like it would never come down. The Meteor is a model that really wanted to defy the laws of gravity.

If you haven't built your contest model for this summer's flying and are trying to find something suitable, stop looking and get started on one of the finest designs we've ever flown! The "Meteor," a model designed by one of this country's leading aeronautical experts, Charles H. Grant.

Building and Flying the "Meteor"

Fuselage

Before attempting to build the Meteor the plans must be scaled to full size. It is only necessary to scale up the crutch on the fuselage as all other parts are given full size.

After the crutch is constructed, cut bulkheads 3, 4, 5, 6, 7, 8, 9, out of 1/8" sheet balsa and bulkheads 1, 2 and 4A from 1/16" plywood. Place them in their respective positions on the crutch and cement thoroughly. Allow to dry a while, then add top rear longeron which extends from bulkheads 6 to 8; the top cabin longerons are then added. Both the top longerons and crutch are constructed from 3/16" sq. The keel is then cut from 1/8" sheet balsa; two are needed as the keel is laminated, a balsa gusset cut from 1/4" sheet is glued to the firewall and keel.

The rear landing gear and shock absorbers are bent to shape and glued in place with 5/16" sq. grooved basswood. (See landing gear detail on plate 1.) The fuselage is then covered with 1/16" sheet balsa: it is advisable to use three-inch widths for this purpose. The motor mount

B-2 right above the keel between the 1/4" sheet gusset and the 3/16" sq. reinforcement. A 1/8" dowel is firmly cemented into each hole and allowed to protrude about 1/8"; these serve to keep the removable nose unit from shifting; see nose detail on plate 1. The removable nose unit is slipped into place and a 1/16" hole is drilled through section A and B; a 1/16" dowel is then slipped in, serving to hold the removable nose unit in place. The front landing gear is bent to shape and cemented in place with 5/16" sq. grooved basswood.

When the Meteor is assembled and ready to be flown, rubber is passed around the front landing gear and the wire hook on the bottom. A piece of plywood 1/16" x 1-1/8" x 6-1/4" serves as the ignition track, this is cemented in place below the 1/4" sheet filler at the motor mount rear; see motor unit detail on plate 1. After this has dried the coil, condenser and batteries are wired as shown in the wiring diagram; you will note the ignition is mounted on bottom of the ignition track. If in doubt consult the plan side view. On the wiring detail you will notice the timer is fastened permanently into the fuselage: fasten it to a piece of 1/4" sheet, then glue the sheet balsa to the fuselage bottom.

Now glue the Fahrstock clips to the Though of scale proportions, it climbs at 45 degrees.
CUT B1, B2, & B4 A FROM 1/16 PLYWOOD

FULL SIZE BULKHEAD PATTERNS

CUT B3, B4, B5, B6, B7, B8 & B9 FROM 1/8 SHEET BALSAM

CUTOUT IN B3

NOTCH B4 TO RECEIVE TRACK
fuselage near the crutch, a wire is soldered from each timer point to the clips. When the ignition track is wired up the two wires that go to the timer are left free; when the motor unit is installed into the fuselage these wires are inserted into the Fahnestock clips.

The nose block is formed from a piece of balsa 2-3/4" x 5" x 6". The block is glued lightly to the fuselage and the outside shape is cut and sanded. The block is then removed from the fuselage and the cowling center is cut out as shown on the cowling detail or plate 2. The front of the cowling is recessed about 1/16"; 1/16" tubing is inserted in this space to give a radiator effect. The cowling is cut in half and the 1/16" pegs are inserted in place to properly hold the halves together. The windows are covered with celluoid and the fuselage is now ready for covering.

**Wing**

The wing is first scaled to full size, it will be noted the wing has no taper and the tips are perfect half circles that are drawn with a compass. The ribs are spaced 2" apart. The center ribs are made of 3/32" sheet to take the strain of the rubber when the wing is fastened to the fuselage. It will be necessary to elevate the front wing spar about 1/16" from the board because of the airfoil undercamber. The ribs are then slipped onto the spar in their respective positions, then the leading and trailing edges are cemented in place. The tips, which are formed on the plans before the wing is built, are cemented in place. The top spar is cemented in place. After the wing is removed from the board the rear spar is glazed in place.

Repeat this procedure for the other wing half. The wings are then sanded and joined at the correct dihedral angles, which is 3-3/4" at each tip. The final step is the sheet covering and cap stripping. The top is covered with 1/20" x 2" and the bottom with 1/20" x 3"; the cap strips are 1/20" x 3/16".

**Stabilizer**

The stabilizer is shaped same as the wing, in that it has no taper, round tips and also drawn with a compass. The stabilizer outlines are first constructed on the board. The leading edge is pinned to the board and the other parts of the outline, tips and trailing edge are raised off the board 1/16". With a pencil mark the edges where each rib fits on the leading and trailing edges, then remove the outline from the board. The ribs are now glued in position at the pencil marks. The top and bottom spars, 1/8" x 1/4" are cemented in place. The stabilizer top and bottom is covered with 1/20" sheet balsa at the center.

**Rudder**

The rudder is built flat; the plan is self-explanatory. After the rudder is built it is glued to the stabilizer top and a fillet is formed with 1/16" sheet balsa.

**Covering**

The original Meteor was tissue covered; the body with blue tissue and then painted all blue, the wings and tails double covered with orange, tissue cross-grained and then trimmed with blue paint. Give the model at least five coats of clear dope before painting.

**Flying**

Before flying the ship be sure there are no warps in the wings or tails. We have thoroughly tested flown the Meteor and all adjustments are on the plans, but as no two models are built alike in respect to balancing, your plane should first be glued until a long flat glide is obtained. On the first flight it should be flown at half power with an engine run of about ten seconds. If the Meteor performs satisfactorily fly it again with a 20 second motor run, gradually increasing the power on each successive flight. Good Luck!

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**Tricky “Props” For Flighty Ships**

(Continued from page 69)

washers, which every modeler is sure to have on his workbench. This particular type has yet to fail—it has worked perfectly on all occasions.

To make these types of folding props is very easy so we will now get to work. The first thing that must be done is to carve a prop in the usual manner; but if the builder so wishes, he may take an old prop and use it. After the prop has been carved and the usual fine finish put on it we will start on the folding part. Using a coping saw, make the cut as shown on the plans. No dimensions are given for the reason that the device can be put on a prop of any size. After this cut has been made, take a piece of .046 wire and bend it as shown on the plans. Be careful when bending to make the parts as accurate as possible, for to have a smooth working prop the parts must work properly. After the wire is bent the washers and washers are cemented in place very lightly. When these parts are dry try out the mechanism to see if it is working smoothly. If not, make the necessary changes and cement securely with about three coats, putting a cement skin around the part indicated on the plans. This precaution will assure one that his prop will stay together under the most trying conditions.

The other type shown uses hinges of 1/32" sheet brass. Simply take the piece of brass and after cutting as shown, roll the ends around a piece of wire and solder securely, using as little solder as possible. Make the two pieces as shown and be sure that they work smoothly. The pin holes are then punched in the hinge and you are ready to cement on the prop. The pin holes in the brass allow an extra holding place. Use the above precautions in regards to cementing.

While this is drying put a rubber tension on your plane, to stop the prop in the correct position on every flight. The one shown is a departure from the usual practice but one which will work perfectly on every flight. The best place to stop the prop is in a horizontal position alongside the fuselage. Of course you may stop the prop in any position but the place specified has worked the best.

Just try a folding prop on your next ship, and instead of coming down, your ship will seem to be actually climbing.

**Vernon Boehle Says:**

*SOME of the later developments on model aircraft are the folding propeller, gear mechanism which permits the use of two, three or four motors, and the gradual turning by model designers toward more streamlined design. Perhaps some of you model builders have noticed the fine glide that a gas model possesses. This is largely due to the small size of the propeller which offers but little resistance even though it does not free-wheel. The largest gas model uses a smaller propeller than a three to four foot rubber powered model. The large props on a rubber powered model although tending to increase the efficiency, do not help the glide. Even though they may be free-wheeling props they have considerable drag.

Last summer I saw a model on which was used a propeller which folded back, and it increases the glide by about 25%. A model equipped with this type propeller should greatly increase its duration, especially in calm air, when there is little or no thermal air currents.

A propeller of this type is carved the usual way, then cut in three sections, one cut on each side of the prop shaft and approximately one inch from it. The two blades are then hinged, the hinges being put on the back which allows the two blades to fold back but not forward. When the rubber motor is unwinding, the action of the air on the blades and centrifugal force, keeps the blades straight. When the power is exhausted, the resistance of the blades forces them to fold back. Free-wheeling is also used on this type propeller and these two methods combine to practically eliminate propeller resistance.

The use of gears on model airplanes although having been experimented with for a number of years, still hasn’t proved itself to be superior to the usual type of direct drive motors. The reason for this is that a gear model can hardly be built that is not one-half to one ounce overweight. If it is within the usual weight limit, that of one to two ounces, the extra inches of wing area it will not be strong enough to withstand the usual bumps and crack-ups that models are liable to have.

Many model builders will argue that this should make little difference, because the amount of winds which can be put in two motors should be double the amount that can be put in one single motor. However, they forget that the heavier the model the more rubber is needed, and if the number of strands are increased the weight increases still more; to say nothing of the loss of power due to the friction of the gears and the difficulties experienced in winding the model.
THE GAS "CHAMP"

By RUSSELL SIMMONS

Editor's Note

IN the opinion of the editor, this is one of the finest gas models in the country and with a most consistent performance. It has shown itself equal or superior to all gas models in the East; having placed in every contest in which it has been entered. It climbs with tremendous speed to a high altitude, then leveling off, it exhibits astounding soaring qualities. Following are some of the contests in which it has been entered and the places it has won:

The All Eastern States Meet at Hadley Field: first place with a wing loading of 10-1/2 oz., using a Super Cyclone engine. Another machine of similar design also took third place, using a motor of 52 cu. in. displacement and a wing loading of 8-1/2 oz. In the Trenton, N.J., contest planes of this design took first and second place. It placed second with only two flights; average time being considered. At the American Legion Meet at Hadley Field it placed second. In the three other contests it has placed first, second and third.

The truly a remarkable ship and gives promise of being the outstanding gas model in the country.

Building the Plane

The first step in building the ship is to enlarge the plans to full size, from the dimensions given. This may be done by redrawing to larger scale or by having enlarged photostats made of the plans.

Fuselage

The first step in building the fuselage is to get all medium-hard wood for the entire construction. The sides are built of 1/4" square balsa. To assure accuracy, build two sides on top of one another.

Use plenty of cement on all joints. After the sides are dried, cement in the crosspieces which are 1/4" square. After the sides are assembled, put the plywood firewall as shown full size on the plans. To assemble the motor skids on the firewall, first cut two 1/2" x 3/4" holes in it, then put the notch in the skids in which the landing gear goes. Use plenty of cement and large balsa fillets on top and bottom of the skids to the firewall.

Incidentally, we used maple motor skids which will last much longer than pine or basswood.

After the skids are in place and dried, bend the landing gear from 1/8" music wire; do not heat. The top part of the landing gear should be as wide as the inside of the gussets. The landing gear extends 8" from the skids; allow 1-1/2" on each side on which to put the wheels.

Installation of the landing gear is easy and strong.

First there is a notch put in the motor skids 1-1/8" deep for the wire to go into. This helps keep the motor skids from pushing through the bulkhead in event of a collision and holds the landing gear in place. Then clamp the bottom of the landing gear to the bulkhead with steel plates and bolts. The whole bulkhead is then finished and should be put in place with plenty of good cement. Now put
crosspieces from the skids to the uprights of the fuselage to brace the skids.

The next step, putting on the stringers, is to start on the sides and cement a 1/8" x
No down or side thrust in motor.

Gusset

Nose blocks hollowed out.

All longerons, uprights and braces 1/4 square.

1/8 plywood cut out for longerons and motor mounts.

Stringers taper towards tail 1/2 size shown.

BULKHEAD - FULL SIZE

EASTERN STATES CHAMPION
DESIGNED BY RUSSEL SIMMONS
Scale 1/4" = 1"

Plate 1
EASTERN STATES CHAMPION

This hole to fit block under stabilizer.

RUDDER CONTROL

BATTERY BOX CROSS SECTION AT "A"

$\frac{1}{2}$ size

Long grain
Cross grain

$\frac{1}{2}$ block

Balsa block
Stringers

$\frac{1}{2}$ inch square

Leading edge 2 - $\frac{1}{4}$ sq.
glued together.

Ribs $\frac{1}{8}$ x $\frac{1}{2}$

$\frac{1}{4}$ sheet

$\frac{1}{4}$ x $\frac{1}{2}$

$\frac{1}{8}$ sq.

$\frac{1}{8}$ sheet

STABILIZER

$\frac{1}{2}$ size

Plate 2

Trailing edge
2 - $\frac{3}{16}$ sq. glued together
False ribs are cut here.

RIB - FULL SIZE

$\frac{1}{4''}$ Hard balsa

$\frac{1}{16''}$ plywood cemented to $\frac{1}{4''}$ spars at center.

Note splices

All bridging $\frac{1}{4''} \times \frac{1}{6''}$

Trailing edge $\frac{1}{4''} \times 1''$

Leading edge $\frac{5}{16''}$

False ribs

$\frac{1}{4''}$ Sheet

$\frac{1}{4''}$ Spars $\frac{1}{4''}$ Sq.

A

B

C

EASTERN STATES CHAMPION

$\frac{1}{4''} = 1$ inch

38" $\times$ 8"

Plate 3.
1/2" strip tapered to 1/8" x 1/4" down the center of the fuselage. Between this and each longeron cement a 1/8" x 1/4" stringer. On the bottom is only one 1/8" x 5/8" stringer. On top is a 1/8" x 3/4" stringer tapered to 1/8" x 3/8" at the bulkhead in front of the tail assembly. Then put on the other two 1/8" x 1/2" stringers, which are also tapered to conform with the general shape of the body. Cement the stringers to all crosspieces and braces and sand them down to help assure a smooth covering job.

For the wing mount, take a block of medium balsa and trace the shape from the full-size plans to it. A coping saw is used to cut the outline and the sides are rasped out and then sandpapered to a regular and streamlined form. Next comes the battery box, which is in the wing mount to keep the weight high and give easy access to the batteries. Hollow out the wing mount so that two medium batteries will fit. In one end put a piece of straight brass and form a spring of brass for the other end for the contacts. The wires from the battery box go down through two drilled holes in the mount. About 3/4" from each end of the battery box drill a 3/16" hole and cement dowels all the way through for strength. The longerons for the wing rub rail gigs are 3/16" diameter and are put in at an angle to keep them from slipping off. Small gussets are also used on top of the wing hooks for strength. On top of the wing mount is glued 1/8" hard balsa, cross-grained. On top of this is cemented soft 1/4" sheet, tapered to 1/16" at the center, in which the wing sets. The wing mount is set on top of the crosspieces in the fuselage. These pieces should be well cemented several times. The 3/4" center stringer runs to the end of the wing mount.

The bottom part of the rudder is put on the fuselage next. It is made of 1/4" sheet balsa and put on at the center, in which the longerons forms a good-looking fillet. The coil should go right behind the firewall and attached to the motor skids; while the condenser should be kept any place near the motor. The trimmer should be mounted behind the wing mount so you can easily get at it. A good wiring diagram rubber bands are put to be sure to use a good grade of stranded wire and have all the joints well soldered as there is no cabin in which to make repairs. The nose blocks are the next step. One large block forms the bottom and the sides are cemented on. When dried they are carved to shape and a piece of 1/8" aluminum tubing is put in the bottom as an oil drain. The top of the nose block is made of 1/4" square balsa cemented on top of each other to form the curves and made to fit the motor as closely as possible so that there will be no large holes around it to spoil the appearance and streamline effect of the ship. The whole fuselage is given a good sanding job and is covered with silk to make smooth fillets and give added strength. Give the fuselage about ten coats of dope so that oil and gas will not seep through.

The Wing

The spar is 1/4" square hard balsa, spliced for the dihedral. The center section of the spar is filled in with 1/8" plywood. Use plenty of cement on this.

While the cement is drying, cut the ribs from 1/16" hard sheet, which are drawn full size on the plan. Mark off 2-3/4" spacings from the center out for the ribs and cut a 1/16" notch 1/4" deep in the trailing edge where each rib meets it. This prevents the trailing edge from turning up or down. Plane and sand the trailing edge to shape before cementing the ribs to it.

The next step is to make full size plans of the wing tip and trace it on 1/4" medium balsa sheet. After the wing tip sections are cemented and dried, fit them to the leading and trailing edges and main spar. Then put the tips in. The 1/8" x 1/4" bridgework is put between each rib, on the spar, as shown in the plan. Cut out the false ribs and insert between each full rib. Now put the 1/8" x 1/4" strips between the main spar and trailing edge, starting from the center and working toward the tip.

After both halves of the wing are completed, cover the center section with 1/16" sheet. Before the final sanding give all the joints an additional coat of cement. Sand the leading edge and tips with rough, and finish with fine, sandpaper.

When covering the top half of the wing with silk, first cement the silk to the center section and draw it to the tip, but not tight. It can then be drawn down to the tip dihedral joint. An application of cement should have previously been put on the edge of the rib at this joint. Give the wing several coats of dope, thinned with acetone or thinner, which prevents heavy drops of dope from going through the silk and drying on the other side; thus spoiling the appearance of the clear portions of your color scheme. After the pores of the silk are filled it is all right to use straight dope.

When the dope has dried the wing should be blocked down to remove any warps. However 1/4" wash must be put in the left wing to overcome the torque when the motor is running; and the warp causes a drag when gliding which causes the plane to circle to the left.

The Tail

Note: When scaling the plans up the leading edge is two 1/4" square strips cemented together and the trailing edge is made the same way but with 3/16" sq. strips.

To form the leading edge place pins on the plan along the Leading edge and bend one strip around them. Then apply cement to one edge of the other strip, bend this strip around the first, and leave to dry. Do the same to the trailing edge.

Now cut the 1/4" x 1/2" spar the right length, taper, and put in place. Then take the 1/8" x 1/2" strips and put them in the places as marked. After they are dried in place carve and sand them to shape. Cut the notches in the ribs where the 1/8" top strips go. After they are in place the elevator should be sanded to the cross section shown on the plan.

Scale the rudder plan to full size, trace the trailing edge on 1/4" sheet balsa and cut out. Pin the leading edge, two spars, and trailing edge, to the plan and cement in the 1/8" x 1/4" ribs. The hinge is a straight pin pushed through the two 1/4" square spars. Sand the rudder as shown on the plan and cement to the elevator. Before covering make a former similar to the last one on top of the fuselage and cement it to the front part of the elevator. Then put a balsa fillet, with the same contour as the fuselage, along the bottom of the rudder. After the tail is covered give it about five coats of thinned dope. Cement a 1/4" x 1/2" rib near the front of the elevator to go between the longerons of the fuselage. Cement two other pieces near the back of the elevator which fit on the outside of the longerons. The rudder adjustment shown works well and flight Adjustments are easy.

On one of these ships, powered with a Super Cyclone, it was necessary to add weight to bring it up to the minimum weight required. Therefore by adding wheel pants, we brought the weight up, improved the appearance of the plane and probably made it more streamlined. We did not find it necessary to use pants to increase the weight when using the Ohlsson "60," as this motor has less displacement than the Super Cyclone.

Flying

Take your plane to a field and test-glide it many times if necessary, until you get a long, straight glide. A circle which shows up in a hand-glide may turn out to be a tight spiral if continued for a length of time. But don't worry too much about your model gliding straight after the motor cuts; some unseen warp or adjustment will probably cause it to circle and after the first flight you can make adjustments to suit yourself. Since the accessories can't be moved the stalling or diving, if any, can be removed by changing the incidences on the wing.

We have built five ships of this type and all flew fine on the first flight, after getting them to glide perfectly by hand. Be sure you have the 1/4" wash in the left wing; and you may need more with the more powerful motors. On the first power flight slow the motor to half-speed and about a ten-second run. After the first flight make one adjustment at a time. Our ships have had many happy landings and we hope yours will have the same. Good luck!
Here’s a Little Gas Model that Has Every Desirable Quality—Small Span—Small Engine—Unusual Stability and a Big Performance

THE PRESENT trend towards the smaller type gas engines was anticipated some time ago when the design of “Miss San Diego” was started. It is one of the first gas models designed around a small power plant to be built in the United States and the engine has a bore of less than 5/8”. Its small size makes it extremely easy to build and to fly and it is particularly adapted to handling, transporting to and from the field and storing away at home. The parasol wing makes the little plane very stable and insures dependable performance.

The ship performs beautifully with an inverted engine installation. Almost any of the popular small type engines can be easily adapted to this gas job, by merely altering the design of the metal mounting plates, which are located on the wooden beams. Whatever the engine make might be it should be inverted for maximum flight performance.

On several occasions it has flown over fifteen minutes on a forty-second motor run, and has a slow, lazy circling glide after the motor cut. Its flight abilities are most agreeable for contest flying.

Specifications

Wing Span .................................................. 4 ft.
Wing Area .................................................. 252 sq. in.
Wing Loading .............................................. 64 lb./sq. ft.
Max. Wing Chord ......................................... 6-3/4 in.
Overall Length ............................................ 31-1/4 in.
Stabilizer Span ............................................ 19-1/2 in.
Overall Height ............................................ 10-3/4 in.
Tread ......................................................... 8-1/2 in.
Weight, Ready to Fly (With Engine) ................. 1 lb. 2 oz.
Enlarging the drawings to full working size as the first step, making use of the dimensions as given on the assembly drawing. All the balsa used is to be of firm medium-hard variety, unless noted otherwise.

Fuselage

Begin the construction with this unit. Build two side frames of 1/8” square balsa, using wood which is very firm, especially for the longerons. Fillers of 1/16” sheet are put in each frame at the front. Build the frames together in the usual way, pinning each up-side-down on the work table. When all 1/8” square cross bracing is cemented in place, cut a piece of balsa size 3/8” x 9/16” x 1-7/16”, which is the tailpost and which is installed next. All fuselage formers are of 1/16” sheet balsa except No. 1 and No. 9, which are 1/8” thick. Locate the positions for fuselage formers No. 8 to No. 12 inclusive, and cement each in place.

The top, forward, removable section of the fuselage is assembled next. Lay the two 1/8” square longerons down, followed by formers No. 1 to No. 7 inclusive. Place the top center 1/16” square stringer first, followed by the remaining four. Cut and cement in place the 1/8” sheet balsa pieces upon which the No. 00 dress snaps are mounted on the removable section. The balsa strips for the fuselage frame, to receive the other half of the dress snaps, may be installed at the same time. Using metallic cement, secure the light halves of the four snaps in place on both the fuselage and removable section, making sure that all are in perfect alignment.

It has a sturdy structure and can "take it"

It gains altitude quickly with a steep climb

Now cut two strips 5-7/8” long and 1/8” wide from 1/32” sheet aluminum and cement them on the top fuselage longerons, where stepped down and where wing support slides. The main switch, of the small button type, and the booster plugs should be installed on the right side of the fuselage at this point. Next cut the rear motor beam anchorage bulkhead from 1/8” sheet balsa, as shown. Place it on with ample cement. The 1/32” balsa sheet can now be applied from formers No. 8 to No. 12.

The outline of the cockpit is penciled on a sheet size 3-1/8” x 3-5/8” x 3-3/8” long, which is applied between formers No. 8 and No. 9. The cockpit is cut out after the sheet is cemented and dry. Proceed to finish by cutting a piece 1-1/4” x 3-1/8” x 7-1/8” long from the 1/32” stock size, applying it in the same manner between formers No. 9 and No. 12. Cut lengthwise through one wall of a length of 1/8” O.D. diameter rubber tubing and lay it, using cement, around the cockpit edge to form the combing. The head-rest is carved from soft balsa and should be followed out. The block is 3/4” square at the cockpit, 1/8” x 1/4” at the rear end, and is 7-1/2” in overall length. Cement it in position.

Using the template provided in the plans, cut the windshield from the celluloid specified, but do not install it until after the model is covered and painted.

The landing gear is formed from 1/16” piano wire. First make the front side frame, followed by the rear side frame and the center shock strut. Cement two cross braces on the fuselage bottom, each size 1/8” x 1/2” hard balsa, to receive the landing gear. Use ample cement to bind each landing gear frame to these and also be sure that both balsa mounting strips are well braced with gussets and cement at the lower fuselage longerons. Heavy thread and metallic cement render a satisfactory and permanent job of securing the landing gear to the fuselage. To finish it, bind all three frames together at the axle with fine copper wire and solder well. The tail skid is formed from a length of the same wire used for the landing gear. It is installed where shown.

By ELBERT J. WEATHERS
Make the firewall from 1/8" plywood of good quality. It is 2-1/4" x 2-5/16" in size. Cut the motor beam and wiring holes and then install it against the end of the fuselage frame, using a common butt joint and plenty of cement. Follow with the motor beams, which are 1/8" x 3/4" x 4-1/4" in size. They should be cut from black walnut, maple, or some similar hardwood having the necessary shock-absorbing qualities. Make the two engine-mounting plates from 27-gauge galvanized sheet metal and install each on the wooden beams as shown, using 6-32 steel or brass machine screws and nuts. The wooden beams can now be shoved through the firewall and rear anchorage bulkhead and securely cemented in position, making sure that each are parallel to the top longerons of the fuselage.

Install the coil, condenser and battery holder where shown. The battery holder is of simple sheet brass construction. See drawings for this detail. Complete the fuselage by wiring everything with fine, stranded-and-tinned-insulated wire, using the diagram provided.

The wing strut unit, or cradle, which supports the wing, should be constructed next. It is formed from the same wire as used for the landing gear. Begin by forming two end frames, as shown. It will be noticed that each are to be bent with a narrower spread at the tip ends than that of the fittings on the wing center section, as the cradle thereby needs to be only sprung apart to drop the wing between it, to secure it for flying. The two diagonal side braces are formed and soldered to the end frames, the joints first being bound with fine copper wire. Be certain that the frame is in perfect alignment. Go soldering. To complete it, apply 1/16" x 1/4" balsa strips to each side of the struts, routing out channels for the wire and soldered joints and cementing the two halves together over the wire. Sand the balsa struts (now 1/8" thick) to streamlined cross section and cover them with tissue later on, when the model is covered, to insure for a good finish.

**Wing**

The ribs are all of 1/16" sheet balsa, except ribs W-2, which are of 1/8" sheet balsa. Both the leading and trailing edges are cut from 1/16" sheet balsa, and are of 3/8" width. Each consists of three parts, as the center section of the wing is constructed first, although the wing is a one-piece unit when completed. The wing spar is built up from three pieces, as shown in the plans, and is cemented together as one piece before being laid down in building the center section. Each wing tip is 1/16" sheet balsa. The balsa veneer leading edge covering is prepared after basic construction is completed.

To build the wing, first construct the center portion by pinning into position the leading and trailing edges, and the spar. Raise the leading edge 5/16" from the work table. Wing ribs W-1 and W-2 are now cemented in position. (If an engine having a suction feed and therefore close-coupled tank is to be used, the brass gas tank, and its installation in the wing center section can be disregarded.) The fuel tank and wing strut fittings are installed later.

When dry, remove the wing center section construction from the work table and lay down the spar on either side to proceed with the right or left wing panel. Pin the leading and trailing edges in position and after raising the leading edge 5/16" at the inner end and 3/32"
at the tip, proceed to install and cement wing ribs W-4 to W-11 in place. The trailing edge gussets are 1/4" x 3/8" in size and are made from 1/16" sheet balsa. After installing them, follow with the wing tip which is cemented in position, with 1/16" sheet balsa bracing on the top and bottom. When the wing structure is completed, proceed to cover the front portion with 1/64" sheet balsa, as indicated. A piece 2-3/4" x 6" is required for the center section while two pieces, each size 2" x 2-3/4" x 18-3/4" will be needed for the left and right wing panels, between ribs W-3 and W-10. The portion remaining from rib W-10 to the tip is covered with two small pieces. In laying the balsa veener on, start by making a line of pencil marks across the tops of the ribs which will show the position of the rear edge of the veneer, on the top side. Apply cement to these rib positions and lay on the sheet, using pins to hold until dry. When set, moisten the sheet balsa with water where it is to be pulled over the leading edge proper, or the sharpest bend to be made with it. Proceed to bend it over and pin it underneath along the whole panel, as you did on the top. Cement is next applied between the veneer and the ribs such at every rib. Be certain that the veneer follows the rib contours, by stretching it tightly. From 1/32" thick sheet aluminum, cut and install the four wing strut plates on wing ribs W-2 as shown. A hole a trifle larger than the wing strut wire is drilled in each. Use plenty of metallic cement in securing them in place. The wing unit is now completed, ready for covering.

Tail Surfaces

The empennage is of simple construction. Begin by forming all of the parts, ready to assemble. The fin, stabilizer, leading and trailing edges are 1/16" x 1/4" balsa and all ribs are of 1/16" sheet balsa except fin rib F-4, which is 1/8" sheet. The stabilizer and fin tips are also of 1/16" sheet balsa, and the main spars for each surface are cut from 1/8" sheet balsa. Both the stabilizer and fin are of the same type construction. To build the stabilizer, lay the spar down first, followed by the leading and trailing edges. At stabilizer rib S-5, block the spar up 1/8" and raise the leading and trailing edges 7/32" from the work table. Install the ribs and cement in position. Cut two pieces of 1/16" sheet balsa and cement well between ribs S-1 as shown. The dress snaps which hold the tail surfaces in place are mounted on one of these two sheet balsa fillers. Use an ample quantity of metallic cement to install the other three halves of the No. 0 size dress snaps.

When the basic construction of the fin is completed, connect the tab with the fin by means of small copper or iron wire hinges. The tail surfaces are completed by covering both the stabilizer and fin leading edges with 1/64" sheet balsa, done in the same way as that on the wing.

Covering

The original model was covered with Mino Tissue, which is the cream-colored "natural" paper sold for rubber powered model aircraft. It has watermarked parallel lines running through the sheet about an inch apart, and with that description anyone building this ship can easily procure it if it isn't sold under the name of "Mino." It is ideal for the covering material for this small light gas job. Cover the wing, tail surfaces and fuselage in the conventional manner and water-shrink the covering. When dry, cement the fin to the stabilizer very securely, making sure both are at right angles. Remove the paper over the center of the stabilizer, in cementing the fin, to insure for a strong joint. Dope the entire model with two coats of clear dope and follow with two coats of pigmented dope (sprayed if possible) in a color or colors of your own choice. The original was first painted a vivid orange and later a bright yellow with black trim, both equally effective.

Assembly and Flying

First install the motor on the motor mounting plates. Then remove the top section of the fuselage and lay the wing cradle across the main longerons. Secure it with 1/8" flat rubber making it just tight enough so that it may be adjusted on the ground but can't shift in flight. Install the battery in its holder just ahead of the cockpit. Connect the rubber gas line to the carburetor (if using gravity feed) and lead it through the top section of the fuselage, followed by the snapping of this removable unit into place. Connect the other end of the gas line to the wing tank, after springing the wing into position in the support for it. The tail surfaces are snapped on and it is ready to balance. Supporting the ship by the fingertips about 40% back from the wing center section chord, adjust the wing back or forth until the plane balances with the nose slightly down. Before test-hopping under power, it can be safely hand glided to insure for maximum gliding performance on the first powered flight, if desired.

Although the original ship was flown on limited motor runs of about 30-40 seconds by clipping the gas line shut behind the carburetor, some builders may desire to install a mechanical timer such as the Autokinns, etc., the installation of which is left to their own ingenuity. (Timers, as used today, were hardly known or thought of at the time this model was designed.)

In test flying, throttle the engine down to about half speed and allow it to take off under its own power, flying in no wind if possible. Set the timer or gas shut-off for about 10-20 seconds. After initial hops, if all is satisfactory the engine may be revved up to its maximum r.p.m. (with the prop being used) and the plane is liable to be "gone with the wind" if any.
A High Powered Contest Model That Climbs Straight Up—Equipped With Pontoons It Won the First Official Seaplane Contest

By SAL TAIBI

This business of "packing" power in ships has long been carried to extremes. Engines of a quarter—or even a third—horsepower have been built into tiny ships, giving them a startling climb, but seldom if ever does the glide match that stupendous rise under power.

We have always figured that, given enough power to obtain a good climb, a big ship had considerable advantage in the glide.

We recall seeing a pilot and a mechanic (from an adjacent airport) standing near the starting line when we started the motor of the Powerhouse in a recent meet. The pilot turned to the mechanic and said, in a "know-it-all" manner:

"There's a big job . . . sloppy climb. No power."

He almost ate his words when the ship was launched. In twenty seconds the Powerhouse had gained tremendous altitude. When the motor cut out, a strong wind carried the ship off the field and despite an excellent flight we had no joy in our hearts for the plane was lost. We hired a Cub to look for the job from the air, but to no avail. Our only consolation was that, at last, we had developed a fast climbing large gas job, and as such we now present—The Powerhouse.

Just a brief history of the ship.

In the first appearance of the Powerhouse, at Creedmore, L.I., on February 12th at a contest sponsored by the Metropolitan Model Airplane Council, the ship did 6:04 out-of-sight, and took first prize in the Class C group. Later it took first place in the Flareen High School Model Airplane Contest, doing 2:35 for the best flight of the day, despite a 30 m.p.h. wind. Equipped with floats the ship took first honors in the first annual Eastern States Gas Model Seaplane Contest on August 20 at Lake Hopatcong, N.J., averaging 1:07, establishing a new world's record for gas model seaplanes. In addition the ship has taken a number of other prizes in eastern contests. Four foot, five-foot and six-foot versions of the ship, powered with Class B and smaller Class C motors (Browns, Denettes, etc.), have also made fine showings and won several prizes.

In the first place a big ship is more stable, responds to adjustments more easily, and is less inclined to be critical and cranky. A big ship has but one disadvantage—it's a trifle hard to transport. Otherwise, give us a big ship that can really take advantage of a thermal and make the most of any altitude it may get.

The Powerhouse represents a development in design, and as is the case with most models, it took almost a year before the design was finally perfected. In contest work we had always noted the failure of planes with large wing spans to obtain a sufficient altitude. Of course, once they did get "up there" they performed beautifully, but the difficulty lay in the climb. The first ships we built did not come up to our expectations so we traced the trouble to several small elements. One of the large jobs was too heavy, although it performed beautifully AFTER it got sufficient altitude. But 20 seconds was far too little time in which to get the job up, so we abandoned that design.

The second ship had a diamond fuselage and the cabin resembled that of a blimp. The performance was as bad as that of the first job, so we firmly crushed the ship under-foot. The third ship had the familiar box-type fuselage and was an excellent performer except for one small item—the motor could not be opened wide because the ship had looping tendencies. We later found that the tail moment arm was too small. We took several high prizes with the ship in that condition, but we knew we could improve the design and built our next ship accordingly.

The principal changes were to lengthen the fuselage and increase the wing chord by an inch. That was the answer. In her first contest the ship performed sensationaly.

Through several seasons of contest work we have developed such units as the nose construction, motor mountings, battery housing, construction, etc. and these are included in the design.

(Continued on page 98)
PLATE ~ 2

Cowl ~ Make two from 1/8 sheet

Front former

Tailskid is carved from pine 1\" thick

Rear former ~ both formers are 8\" thick

Windshield Pattern
PLATE 4

Scale 1/8" = 1'

Rails are cut from 1/4 sheet balsa

8 Dihedral

2" squares

Ribs are cut to shape after they are glued in place.

See instructions for explanation.

Cover centre section with 1/8 sheet.
Cut all ribs from 1/8 sheet balsa.

Main rib - Make 25

Tip rib - Make 2

5 1/4" + 3 1/2" = 8 3/4" 

Propeller Pattern

PLATE ~ 5
Construction

In building the Powerhouse the fuselage is the first step. Select a hard grade of 5/16" square balsa. Behind the cabin a softer grade of balsa may be used. For strength will not be needed to such an extent at that particular part. The motor mount bearings are 5/16" by 7/8" hard gum or bass wood, preferably the former. Get the red gum-wood if possible; it's better.

Sides of the fuselage at the nose are cut from 5/16" sheet as indicated on the drawings. This is important as it adds to the rigidity of the nose. After the sides are built they are joined as indicated on the top view of the plan. Check the fuselage for alignment at this point. Next the firewall of 1/4" sheet balsa is added as indicated. Following the installation of the firewall, the nose block is added and securely cemented in place. After thoroughly dry, the nose block may be carved to shape.

Inasmuch as the nose construction of the ship is the recipient of most of the shocks of flying, it is important that cementing at that part of the fuselage be very thorough. At least three or four coats of cement should be given at each joint, allowing at least fifteen minutes of drying between each coat.

Following the installation of the nose block, the formers are added to the fuselage. While they are drying, two pieces of 1/16" by 3" by 7" balsa are cemented together to form the nose cowl over the formers. After the cement has dried thoroughly sand the fuselage and the nose block smooth. Give the nose block several coats of cement to assure a smooth finish. This is important as balsa alone is a notorious absorber of gas and oil. Should you skip this step, your nose block and construction will soon become saturated with gas and oil and cement will eventually loosen, necessitating a complete job of rebuilding.

The next step before covering is the wiring of the Powerhouse. Mount the coil where shown on the plan and construct the battery box as indicated. It is most advisable to use a good quality wire (preferably spaghetti covered) which will not be affected by gas and oil or be subject to breakage under vibration. Always use stranded wire for all connections and be sure that all solder joints are secure and electrically perfect.

It might be advisable to stress, at this point, that one of the most important phases in the construction of the Powerhouse (or any other ship) is the wiring. If the wiring is imperfect you are certain to have trouble no matter how well-built the ship may be in other respects.

The detailed plans will give you all the measurements for the construction of the landing gear which is formed of spring steel wire of 1/8" diameter. The spreader bar is added after the landing gear is installed on the fuselage.

The construction of the rudder, shown in the article, is entirely self-explanatory and should be comparatively easy.

Covering the windows with celluloid is the final step in the construction of the fuselage prior to covering.

The covering is done in the conventional manner. After the paper is applied, spray the ship with water and let dry. Between each coat of clear dope, sand all surfaces with 10/0 sandpaper. Use at least three coats of dope before applying color dope to the finished fuselage.

Let us emphasize that the wing of the Powerhouse is designed not so much for sheer beauty as for ruggedness and high performance. The aspect ratio of six has been found admirably suited to all flying conditions and the entire wing is rugged to an extreme.

We can't define the wing section. It has not had the benefit of wind tunnel tests by experts; however we've found in actual practice it gives us the results we want... a fast climb and a slow, steady glide.

The rib sections are indicated on the drawings. Cut them from soft 1/8" sheet balsa, and after cutting them be sure and sand them. This is best done by pinning all the ribs together and sanding them even with a sand-block.

The wing spars, leading and trailing edges, should be of a hard grade balsa. In order to avoid warping of the wings, be sure the balsa used is straight in grain. Pin the quarter-square balsa spar to your work-table and cement each rib in position according to the plan. Next cement the top spar in position. The leading and trailing edges are then placed according to the plans. Allow all joints to dry at least an hour before removing from the board.

The spars are cracked slightly, as indicated, to form the tip and the wing tip outline is then added to the structure. Form the other half of the wing in the same manner. After sanding and cementing all joints thoroughly, the wing is ready to be joined at the center section.

If you will study the construction details on the plans, you will observe that the center section is simple; yet very strong. Pieces of 1/8" hard sheet balsa are cemented in each side of the front and rear spars. Pins are used to hold the construction while the cement is drying.

Note that there are eight inches of dihedral in each wing tip. Check your construction very carefully to insure that the two sides of the wing do not vary, as this is detrimental to good flying.

The bottom of the center section should be cut flat. The ribs are then added to this section which is then sheet covered with 1/16" sheet balsa, top and bottom.

The Stabilizer

The stabilizer is elliptical in outline and may be easily constructed by referring to the plans. The method of tracing the outline is as follows:

Obtain a piece of cardboard, approximately 15 by 17 inches. Measure out the space needed to form half of the stabilizer. Box this space into two inch squares, then trace the stabilizer outline. Cut the outlined form from the cardboard and you will have a pattern for half of the stabilizer. On a piece of paper 15 by 33 inches, trace both halves and you will have the entire outline. Draw in the spar and ribs and follow the method of construction as shown on the plans. Wings and stabilizer are covered in the conventional manner. Silk or two layers of strong tissue may be used. Several coats of dope over the tissue make it very strong.

Adjusting and Flying

Incidences in this ship are "built in." Very little, if any, incidence will be needed in either the wing or the stab. The ship should be hand-glided to assure a steady, smooth glide before any power flying is done.

On the first flight the motor should be just "ticking over." In other words, run the motor as slowly as possible. Hand-launch the ship, letting the motor run about 20 seconds.

If the ship shows no spiral tendencies, due to warps, etc., more power may be used until finally you are using the maximum power available. It is advisable to decrease the motor run as you add power for the ship has decided "out-of-sight" tendencies.

Slight thrust adjustments, right or left, and rudder adjustments are all that are needed to give the ship proper turn under power and glide.

Notes

Propeller—With a Forster motor best results have been obtained with an 18" propeller of approximately 12-14 pitch. If you make your own prop and follow the diagram you will have such a propeller and will find that the performances is much better than that which may be obtained from a majority of custom-made props on the market.

If you wish to check your finished ship with the original model, here are the weights. Original job, Forster motor, medium batteries, 4-1/2 pounds. Same job, plus floats, 5-1/4 pounds.
AN ERCOUPE FROM LILLIPUT

A stable low-wing scale sportplane with unusual flying ability that is easy to build

by SYDNEY STRUHL

The Ercoupe is its ease of handling and performing. The Ercoupe is certified by the Civil Aeronautics Authority as "characteristically incapable of spinning." And the ship does have amazing stability—it will not get out of control. Even with the wheel full back, straight flight can be maintained or turns performed at will. It is absolutely impossible to spin the ship. The quick takeoff run, fast climb and high sustained cruising speed of the Ercoupe provides point-to-point transportation which will surprise and please the private pilot. On the ground as in the air, the plane handles with great ease; no nose-overs are possible even with full application of the hydraulic brakes.

The Ercoupe's structure is all metal, as is the covering of all but the outer wing panels. The use of corrosion-resistant aluminum alloys in structure and covering brings to the lightplane pilot the dependability and freedom from maintenance of the large transport planes.

Powered with the Continental A-65 engine, the plane has remarkable performance with surprising economy. Maximum speed is 117 mph and cruising speed is 105 mph. Cruising range is 350 miles and the landing run is only 200 feet. Fuel consumption is but 4 gal. per hour.

As a scale gas model we claim that the Ercoupe performs just as well as any other model even though it is a low-wing design. You know that a low-wing model can be designed to fly just as well as any parasol model if certain aerodynamic principles are observed; such as the proper distribution of your forces (C.G., C.L.A., C.P.) and the correct setting of attack of the plane and thrust line.

Since all forces are designed into the (Continued on page 104)
STEPS OF PROCEDURE IN THE CONSTRUCTION
OF THE FUSELAGE.

CONSTRUCTION STEPS 1 AND 2 ARE
PERFORMED ON A FLAT WORKING
SURFACE OVER FULL SIZE PLANS
OF THE FUSELAGE CRUTCH.

1/8"X 3/8" HARDWOOD
MOTOR MOUNTS.

CUT ALL TOP
BULKHEADS FROM 1/8" SHEET AND
CEMENT IN PLACE ALONG
WITH 1/8" SQ.
STRINGERS.

SPACED MOTOR MOUNTS
TO FIT INDIVIDUAL
MOTOR.

NOW BUILD THE
LOWER FRAME
WORK AND
ADD REMAINDER OF
BULKHEADS AND
STRINGERS.

MAKE A LIGHT
FRAMEWORK
OF CABIN AND
COVER WITH
CELLULOID

THE FUSELAGE
IS NOW COVERED
WITH HEAVY
SILKSPAN.

NOTE:
TOP VIEW OF FUSELAGE IS
SHOWN ABOVE # 4.
FUSELAGE CRUTCH IS SHOWN
BELOW # 4.

COWLING DETAIL
CARVE TO SHAPE
FROM A SOFT BALSA
BLOCK.
HOLLOW TO
THICKNESS SHOWN IN
DOTTED LINE
IN SIDE VIEW

THIN
CELLULOID

SHAPE COCKPIT FROM
1/16" SHEET

STRIPS OF BLACK PAPER

BASSWOOD
LANDING GEAR
RETAINER
BLOCKS.

SHAPE LOWER
COWLING FROM
BALSA BLOCKS
TO FIT MOTOR.

FRONT LANDING
STRUT DETAIL
CEMENT TO
BULKHEAD "A" WITH
BASS L.G. BLOCKS.

1/8" X 1/4" CRUTCH

1/8" X 1/4" BOTTOM
LONGERON.

1/4" SHEET
FILL IN

1/2" SCALE SHOWN

3-1/2" DIHEDRAL UNDER
EACH WING TIP.

WING OUTLINE

CENTER SECTION RIB

ALL STRINGERS ARE 1/8" SQUARE.

BASS L.G. BLOCK

HARDWOOD
FAIRING

WING RIB

BASS AND CEMENT
TO FRONT WING SPAR.

2" DIA. SINGLE WHEEL

2-7/16"

WING SPANS

2-1/2" WING SPAN.

1/8" WING SPANS.

1/8" WING SPANS.

FRONT LANDING
GEAR STRUT

3-13/16" 3-13/16"

4-15/16"

BELOW C.

1/8" SHEET
FILL IN
IMPORTANT
SET WING AT 0° INCIDENCE.
STABILIZER SET AT MINUS 1 1/2°
SET THRUST LINE AT 0°-0°.

WING CENTER SECTION DETAIL
BEFORE COVERING

NOTE HOW SECTION IS BUILT TO FAIR INTO THE BOTTOM OF THE FUSELAGE BETWEEN BULKHEADS "B" AND "C".

"ERCOUPE SPORTPLANE"
BY SYDNEY R. STRUHL

WING SPAN 44 1/2"
FUSELAGE LENGTH 30"
MOTOR POWER CLASS A OR B
SCALE PLATES 1 & 2 1/25-1"
PLATES 3 & 4 FULL SIZE

PLATES 1 AND 2.
SYDNEY R. STRUHL

BULKHEAD 'A'
3/32" PLYWOOD

TAIL BLOCK

ALL 'R' AND 'W' MEMBERS ARE 1/4" SHEET 2 OF EACH R/O'D.

W3

R3

R4

W2

W1

R2

TIP RIB
2 OF 1/16"

MAIN RIB
2 OF 1/8"
1/3 OF 1/16"

PLATE 3.
plane you can't alter then at all, however you must be sure to keep the wing set at 0° and stabilizer set at 1-1/2 0° minus. The thrust line is kept at 0°-0°; that is, no down or side thrust.

With this general setup you can make almost any low-wing model fly in a very stable manner.

The construction has been kept rather simple. The use of a "crutch" in the fuselage is a great aid.

All-in-all the Ercoupe is a dandy flier, a swell looking ship, easy to build—so—what do you say if you take a crack at a low-wing scale gas model?

FUSELAGE—Make a full size drawing of the fuselage crutch. No other fuselage drawing is needed. The bulkheads are given full size. Use of balsa is naturally advised but if supplies are limited, substitutions of pine or bass may be made in most cases without too great an increase in weight. Use your own judgment as to sizes of the heavier woods.

Pin 1/8" x 1/4" strips in place on the drawing of the crutch and cement cross members in their proper locations. Basswood motor mounts 3/8" x 1/2" and now cemented in place. Space the motor mounts to fit your individual motor. Add the 1/4" sheet fill-in around the motor mounts and crutch with several coats of cement.

Cut the bulkheads top portions from 1/8" sheet balsa and cement them in proper locations. Add necessary 1/8" square stringers to the turtle back. Cement 1/16" sheet balsa to form the cockpit shape.

Build the lower portion of the fuselage by constructing the "V" shape from 1/8" x 1/4" balsa strips between bulkheads D and G. The lower portions of bulkheads D, E, F, and G are now cemented against the 1/8" x 1/4" uprights. Bulkheads A, B, and C are now added with H connecting A and B. The remaining fuselage stringers are now cemented in place. Cement a 1/8" sheet flooring between bulkheads B and D at the bottom of C as shown in the fuselage side view. This forms a box for the wing to slip into.

Bend the front landing gear strut from 1/16" music wire with a single 2" diameter balloon wheel to the required shape. This is now secured to the plywood bulk-

head A with basswood blocks, as shown, and several coats of cement. Make sure all joints are very firm.

The cowling is shaped from balsa blocks cemented in place then carved and sanded to shape and hollowed to fit your motor. Motor is inverted so lower cowling is permanent while upper hatch is removable to allow engine adjustment.

The tail block is carved to shape from a soft balsa block to the shape shown on plate 3. Cut two light formers to the cockpit outline from 1/16" sheet and then proceed to cover the cockpit with heavy celluloid. Cement 1/8" hardwood dowels where shown to wrap the rubber strands around that hold the wing and stabilizer in place.

TAIL SURFACES—The rudders and stabilizer are very simple to make and are constructed directly over full size drawings.

The stabilizer is built in one piece. Pin the 1/4" sq. leading edge and the 1/4" sq. spar on the plans along with the 3/16" x 1/2" trailing edge. Cut the ribs from 1/8" x 1/4" balsa strips and cement in place. Note the end ribs are 1/4" sq. balsa. This is to give a firm base on which to cement the rudders. Sand the ribs to a slope to flow evenly into the trailing edge, which is also tapered.

Rudders are constructed in quite the same manner as the stabilizer. Full size rudder patterns are given on Plate 3; since there are two rudders, two of each pattern is needed. Cut these outlines from soft 1/4" sheet balsa and pin them in place on the plans. Insert the 1/8" x 1/4" spar and ribs and cement each joint firmly. Trim and sandpaper rudders to a streamlined crosssection. Note the rudder rib that joins with the stabilizer is 1/4" square balsa.

WING—The wing is constructed in one piece, built over a full size drawing. Wing construction is very simple but care must be used to avoid any warps.

Cut the wing tips from 1/4" sheet balsa; full size patterns are given in Plate 3. Cut the required wing ribs.

Trim the 1/4" x 1" trailing edge to shape and pin in place. Pin the two 3/16" x 1/2" wing spars in place. Now insert wing ribs in proper locations and cement firmly. The 1/4" sq. leading edge is now cemented in place. Note that the leading edge is set on edge. Trim and cement the wing tips in place.

Install 3-1/2" dihedral under each wing tip; make sure the dihedral joint is strong. Use 1/8" sheet gussets on the spars and leading and trailing edges for extra strength.

Bend the rear landing gear struts from 1/16" steel wire and mount as shown in the diagram. Note the ends of the landing gear struts are wrapped to the wing spars with heavy thread. It is also backed up by grooved basswood block cemented between the two spars over the wire. Use lots of cement at this point. The wheels are held in place by a drop of solder at the end of the axles. A very hard piece of balsa is used as a fairing on the upper part of the landing gear strut. Cement this to the rib too.

The centersection is now covered with soft 1/16" sheet balsa to provide extra strength around the dihedral joint and landing gear stations. Trim the top and bottom of each rib 1/16" so that the wing contour is the same all along the wing.

Build up a small box-like structure at the wing joint to fair into the fuselage as shown in the sketches. Use 1/8" sheet for this work. This box fairing should fit
FLYING—After completion of the Ercoupe Sportplane check the model's surfaces for warps. The Ercoupe's tail and wing are constructed solidly enough to resist warping, but if warps do occur take them out.

The coil and battery box is located in the fuselage where it gives the best balance for flight.

Initial flights of the original Ercoupe proved its airworthiness, and by carefully making flight adjustments championship performance will result. Remember the wing must be kept at zero degrees incidence and the stabilizer is kept at 1-1/2 degrees negative incidence. Never change these settings. Shift weights to trim the ship. The thrust line has no down or side angle.

Glide the ship several times, shifting weights to obtain adjustment. Remember that careful slow adjustments save much time and effort.

Set the timer for 15 seconds for the first flight and use very low power. Under power the model should climb slowly in 200 foot circles to the right. When the motor cuts it should go into larger circles in a very slow glide. If the ship reacts well on the first flight, fly it again with the same power run. Then each next flight should have a wider open throttle until you are flying under full power.

We have presented you with a low-wing scale gas model that we claim will fly as well as any other model on the field. If you build this model we are sure it will meet with your approval, and we know that it will bring you many hours of satisfaction flying and enjoyment.

**Bill of Material**

- 2—1/4" x 1" x 36"
- 4—3/16" x 1/2" x 36"
- 3—1/4" x 1/4" x 36"
- 4—1/8" x 1/4" x 36"
- 10—1/8" x 1/8" x 36"
- 4—1/16" x 1/2" x 36"
- 3—1/8" x 2" x 18"
- 1—1/4" x 2" x 18"
- 1—3/8" x 1/2" x 15" basswood
- 3—Sheets silkspan
- Sheet celluloid
- 1—1/16" steel wire x 24"
- Balsa cowling blocks
- 1—2" Dia. wheel
- 2—2-1/2" Dia. wheels
- 1—Piece 3/32" plywood
- Cement
- Clear dope

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**Stepping up Your Power**

A Simple and Inexpensive Way to Increase the Power of that Sluggish Motor

By SIDNEY STRUHL and CHESTER GREENBERG

The supercharger scoop may be clearly seen located in the propeller slip stream

NOW that the gas model regulations adopted by the Contest Board of the Academy of Model Aeronautics state a gas model must weigh not less than 80 ounces for every cubic inch of engine displacement and it shall not weigh less than 8 ounces for each square foot of wing area are in effect, a contestant finds contest competition growing keener every day. Present-day design of gas models is becoming more and more standardized as characterized by all the high-wing pylons, polyhedral and large stabilizers that are found at all gas model contests. This standardization of design was created by years of experiences by the “game’s” top-notch model builders; motor manufacturers also standardized their productions so that each motor that comes off their assembly lines develops just as much power as the one that precedes and the one that follows.

With all of this “cursed” standardization going on you begin to wonder just how you can get enough edge on the other fellows so that you can win that forthcoming contest. You’ve just finished your “Super-Dipper” gas model and have mounted your new “Pul-Er” gas engine in its nose. This is all very fine but you know for a fact that at least three members of your club have exactly the same combination, so you know the competition is going to be mighty tough.

Well, sir, we believe we can give you a little tip on a gadget that will practically guarantee your ship to “fly rings around” all others on the field—and that includes model combinations that are just like yours. The answer? A supercharger for your motor!

As you probably know, all the latest top-flight military fighters have power driven superchargers attached to their powerplants. Of course we model builders could not use such a complicated system as the “big boys,” so we had to devise something...
A reliable easily-built class A gas model designed to give highest performance

by
FRANK EHLING

Have you ever watched a contestant walk up to the processing table, have his ship checked, be assigned to his timer, and go out to turn in a prize winning flight? Well it is not entirely the contestant that deserves the credit; true, he must build and ship and get it in flying form... but here we have a ship that need only be built, because she will fly by herself with no tricks necessary to obtain good flights. For this reason it is a favorite with all that have seen her perform.

At the first contest, after a number of test hops, the ship was entered for an official flight. There was little time before the meet to install a dethermalizer for bringing the ship down in the required four minutes, so we got the bright idea of camouflaging the ship to make it invisible after about four minutes had elapsed. But we are still being ribbed, for when it made its second flight the recorded time was only thirty-five seconds (the timer's stop-watch stopped); the actual flight time was three minutes, forty seconds.

The second meet in which this ship was entered was a marathon contest. In such contests the builder is under as much strain as the ship, for the fellow that turns in the most flights over a minute is declared the winner. This meet was between the Linden Model Club and the Jersey Air Wheels. The Linden boys won high; with Minnay first with eight, yours truly second with seven and Mush third with five. This shows the ship to be a consistent flyer as well as one capable of high time.

It was designed especially for the new rules. The fuselage shape used gives the least drag for the amount of space required to house the coil, condenser, battery box and timer; also it blends well into the pylon which was used to get the wing high and well forward. This is the best way to spell "stability." The wing was designed with a thin wing section in order to decrease drag in the climb. The long tail moment arm was used in order to make it hard for the ship to soar in a thermal. The ship was designed with a short landing gear to serve as landing purposes only.

These features put the ship in the high performance class despite the little power. On the wing plan you will notice that there is a section that may be added if a motor with a larger displacement than .097 cu. in. is used; however, motors over .199 should not be used.

Enough talk, a "slip of the lip" won't build this ship; so clear the work table and to work. The plans are one-quarter size, so enlarge the plan of the crutch, wing, stabilizer and rudder four times the size shown on the plan. Start by cementing the motor bearings to the crutch and then assemble. The formers are now cut and cemented in place.

The pylon is now made up and cemented in place. Install the ignition and sheet the sides and bottom as shown on the plan. The landing gear is now bent to shape and bolted in place. The tail

(Continued on page 109)
rest is cemented in place; this is used in order to keep the tail from wobbling in flight. Cover and water dope; set aside to dry.

The wing is very simple to construct. Cut the ribs out along with the spars and wing tips and assemble. As the wing section is flat there will be no trouble in construction; after which the wing gussets are added. These are used to maintain the dihedral of the wing. Add the covering and go over the whole wing with sandpaper so the wing will be smooth in order to get the covering on smoothly. It is best to cover the wing with Silkspan and apply it wet to the wing. This is done in order to get the covering on easily.

The stabilizer is then made in the same way except that there is no dihedral. Cover the stabilizer in the same manner and put it aside to dry with weights to prevent any warps that might occur.

The whole model is now given a coat of clear dope. After this dries the second coat should be applied, but it is best to brush the dope opposite to the first coat, in this way there is less chance to miss any spots. The colored dope can now be applied; this is best done if the dope is thin. After two coats are applied the model can be rubbed down. A good trick is to get a damp cloth and a little Bon Ami and start to go over the whole plane as if it was dirty. In this way the covering will not be cut through in any spot like sandpaper will sometimes do if extreme care is not exercised.

Test flying this ship will need no explanation to talk about; simply glide the ship till a good glide is obtained, add a little negative to the tail if the ship seems nose heavy. Start the motor and set the timer for about five seconds, observe the flight and glide to see that the ship is circling opposite the glide.

This ship, despite its cost, should give you plenty of fun flights as the original is still going strong and the only trouble that was encountered was to recover one section of the wing.

TAMING BALKY MOTORS
by HERSHEL TUMIM

The main seat of trouble in many new motors is the result of internal friction. This is particularly true of those new motors with aluminum pistons and steel or cast iron cylinders in which piston rings are relied upon for a compression seal. Motors utilizing steel or cast iron pistons individually lapped to fit the cylinder or pistons and cylinders of the same material will result subject to troubles traceable to internal friction. This statement is not to be construed as an argument against the former arrangement. Excellent performance is easily secured from the ringed, aluminum piston type of motor provided reasonable care is exercised during the break-in period.

Internal friction troubles are most easily recognized by the following symptoms:

1. The motor starts easily and runs for a short time when cold. Subsequent to this run, only very short bursts are obtainable.

2. At the end of each burst a thermometer placed against the base of the spark plug shows the same reading. This temperature will be called "final temperature."

3. The final temperature is far below boiling.

In such a motor, experimentation with oil to gas ratios will show that longer bursts and higher final temperatures are obtained with gas to oil ratios as low as 1.75 to 1 up to 2 to 1. Although the use of such a heavy mixture insures a perfectly broken-in motor, it considerably shortens spark plug life. Oil accumulates about the spark plug and increases the break-down potential to such an extent that the arc may find a path through the porcelain and puncture it. After this, no satisfactory runs with this plug can be obtained. It is well to have several new plugs available during the break-in period, one of which is kept in good condition as a check plug against the performance of which the others can be measured.

This does not mean that a fouled plug has reached the end of its useful life. After the motor is sufficiently broken in to run well on a standard 3 to 1 gas to oil mixture, a thorough cleaning may bring it back as a good serviceable plug. However, when the motor is new, it is unwise to multiply existing troubles with a poor plug.

The fact that the motor will not run steadily when new is due to the unequal rates of temperature expansion of the piston and cylinder. Aluminum pistons are characterized by a high rate of expansion. They therefore enlarge more quickly than the cylinder, resulting in an increase in initial friction to the point where all the power developed by the motor goes into overcoming this friction. The motor will die at the temperature which corresponds to this tightness of fit. This is the final temperature and is therefore a good measure of progress.

Any method of increasing the running time of each burst will considerably shorten the troublesome break-in period. Since the length of these bursts is determined by the motor temperature, it will be advisable to maintain the cylinder at a low temperature for as long as possible. This can be easily accomplished by cooling the motor during the running periods by holding ice cubes against the cylinder head and cooling fins. After the motor stops and the final temperature is measured, the ice should again be applied until the cylinder head becomes cold to the touch. The motor may then be started again and the process repeated.

The break-in period will continue, even though the motor runs steadily, until it begins to develop maximum power. From here on the progress can be gauged by the depth of the corrugations or lathe marks on the piston rings. These will disappear completely when the motor is well run in. This may take an accumulated running time of two to three hours. During this entire period, the gas to oil mixture should be fairly heavy; somewhere between two and three to one is satisfactory. This condition will result in higher peak power and longer life after the motor is thoroughly broken in.

Since so much oil is used during the break-in period, the motor will cover everything in its vicinity with a heavy oil film. It is therefore advisable not to break in the motor while it is mounted in a shiny new model plane. In addition to the dangerous carbon monoxide hazard, this furnishes another reason why the motor should be run out of doors.

A hint on ignition systems that may not be amiss concerns the wire used. The current through the ignition coil primary winding must exceed four amperes in order to satisfactorily operate a high compression motor. With this current the voltage at the terminals of two new medium sized flashlight batteries will not exceed 1.25 volts. With number 18 solid copper wire 10% of this voltage is easily lost in the wiring alone. The loss of this 10% in the wiring may easily mean the difference between a smooth, steady running motor and a ragged irregular run. The use of No. 16 solid copper wire is more easily justified in all ignition wiring. A voltmeter placed across the low voltage terminals of the ignition coil with the switch on, and breaker points closed will give a true indication of the effectiveness of the batteries and wiring. The value below which this voltmeter must not fall can be determined by putting a variable resistor in series with the booster batteries with no batteries in the plane. The motor should then be run and the resistor set to that value below which satisfactory operation is no longer obtained. If the voltage across the coil primary is too high, then the smallest satisfactory voltage will be obtained. This value will be in the neighborhood of one volt for low compression motors and slightly higher for the higher compression types. A six ohm variable resistor capable of carrying five amperes will be satisfactory for this determination.
Of course, we're in favor of big ships with plenty of area and a maximum of stability and performance. Those were our prime considerations and the HORNET finally emerged as the plane we wanted. It combines all the features we desired, PLUS streamlining, in a design that is simple to build, easy to adjust and pleasing to the eye. Under power it climbs in a left corkscrew. At the top of the climb it 'rolls out' into a flat, level glide to the right.

The first test flights were uniformly successful. The first flight, which was made with a 20-second very low-power motor-run, demonstrated to us that the ship had the inherent stability we had sought and that the glide was perfect. After making minor adjustments, gradual increases in power were made until finally the ship was ready for a real flight ... and what a performer it proved to be.

By SAL TAIBI

From a standing start, with absolutely no hand-guidance, the ship amazed all witnesses by consistently doing 1:40 on a TEN SECOND MOTOR RUN.

What about a 20-second motor run? Sorry fellows, the ship goes too far and performs too well for it to be risked on test flights, but if you really want to see what it does on a 20-second motor run, we are sure it will live up to this bright promise of long flights.

Building and Flying

The first step in building the Hornet is to "scale up" the plans to full size. Ordinary bond paper may be used for this process, which may be obtained at any stationery store for about a dime a roll. In scaling up a plan the builder will learn more about the construction of the model than he can in any other way; points of construction which looked complicated in the smaller plates will become perfectly clear when seen in actual size. Scales are given under each particular section ...
RIBS ARE CUT FROM 8 M.D. STOCK

\( \frac{1}{4} \) INCH SQUARES - RIBS ARE HALF SCALE

TO OBTAIN THE CORRECT WING SPAN, PLOT ONE INCH SQUARE TO THE SHAPES ON THE DRAWING

POLYHEDERAL JOINT
ALL SPAR JOINTS ARE OF SIMILAR CONSTRUCTION

WING IS \( \frac{1}{8} \) SCALE

COVER CENTER SECTION WITH \( \frac{3}{16} \) SHEET BALSAL

BLOCK 'A'
BLOCK 'B'
2" 3/16 LEADING EDGE
1/4 " 7/6 SPARS

6' 3/4 STRINGERS

1 1/2 X 1/2 MEDIUM STOCK ALUMINUM TRAILING EDGE PROTECTOR

- 3 1/2
- 24"
- 44"
- 20"
some parts have been drawn quarter-size, some full-size, others one-eighth size. Careful study will result in a clear, easily understood plans and subsequently in a well-built ship.

The Fuselage

The first step in building your Hornet is to lay the longerons on the plan. (Build two sides at a time—that is, lay one longeron atop the other.) The bottom longerons, which take a greater part of the shock, are of very hard stock. Top longerons may be of medium stock and it will be noted that these top longerons are doubled at the cabin. After these longerons have been placed on the plan, the A and D braces are inserted and the thrust-line longeron (which is 5/16" x 5/8" stock) is cemented in place. The remainder of the fuselage is of conventional construction and may be easily followed in the plans.

After the two sides are built allow them to dry for several hours. While these sections are drying, cut out the main bulkhead (A) from 1/4" birch plywood. The sides of the fuselage are then removed from the board. Assembly starts at this point by placing the bulkhead between the fronts of the fuselage sides and cementing it in place. This bulkhead automatically squares up the fuselage assembly and the rear of the fuselage is tapered and cemented and the rest of the braces are cemented in place according to plan.

The motor mounts and landing gear are cemented in place. A careful study of the plans will make this process relatively simple. The fuselage skids, of 1/8" wire, are bound to the lower longeron with linen thread and the “tie” is cemented. The bulkheads and stringers are then cemented in place. The sub-rudder is formed and cemented, and as the final fuselage assembly step, the tail skid and tail hook and dowels to hold swing and tail are inserted in proper places and cemented. All joints should be cemented thoroughly at least two or three times.

Ignition

A carefully wired ignition system will repay the builder many times in efficient operation. The plan should be followed very carefully in this step. All connections should be soldered, as the connections are made on the ignition platform, which is finally cemented into place.

Nose Block

The nose block is a work of art, but is really simple to build. The center portion is of 2" x 3-1/8" soft balsa, as shown by dotted lines on the plans. After this has dried it is cut to the solid line outline on the plan. Sides are formed of 5/16" sheet which are cemented in place to complete the cowl. The motor should be mounted before the cowl is finished for your mounting may vary in slight respects.

The final interior finishing of the cowl is determined by slipping the block over the nose and letting the motor make an impression on the soft wood of the block. Cuts may then be made to allow better fit, until finally the block rests flush against the fire-wall and the motor is completely enclosed. The hole for the exhaust and adjustment holes for choking and adjusting needle valve may be made. The final forming of the cowl is done with the aid of a sand block, plenty of elbow grease and an eye to the outline on the plan. Final step is a covering of silk, followed by two coats of cement, sanding with 10/0 sandpaper between coats. The cowl is finally given a few coats of clear dope, sanding between each coat and is then ready for the final color dope.

Tail Assembly

The elevator surfaces are built in the conventional manner. The main spar, the leading and trailing edges are placed on the plan and the ribs (which you will note are NOT cut to an airfoil at this stage) are inserted. After the section has been formed (see isometric view) the entire assembly is cut and sanded to shape. The rudder is built “flat.” All edges are cut from 5/16" sheet. The spar and the ribs are of 5/16" stock. When completed the entire assembly is sanded.

The Wing

The first step in building the wing is the cutting of the trailing edges and tips of 1/4" hard quarter-grain balsa. The wing is built in two halves and tip dihedral is put in after each half is built. The lower leading edge spar is pinned to the board. A half-inch block is placed at the tip and this spar is “cracked” at rib E, this joint being thoroughly cemented. The ribs are then slipped in position. However the rib at the tip-diheeral break is left out in this assembly step to make dihedral forming easier.

The two top spars are placed in position and the leading edge is cemented in place on the ribs. The trailing edges and tips are inserted in place, thus completing one half of the wing. Similar steps are used in forming the other half.

To obtain the proper tip dihedral, a block 6-3/4" is placed under each wing tip. The quarter-sheet dihedral braces are inserted in the proper position and the assembly should be allowed to dry for at least an hour.

After the tip dihedral has been put in the wing halves are joined: the dihedral being formed in the same manner as was done in the tips. Block A is cemented in place and allowed to dry about half an hour, then Block B is inserted. The 1/4" x 3/16" stringers are set in the ribs and the center section is then covered with 1/16" sheet.

The original job was covered with yellow paper and trimmed with India red dope; but such color schemes are optional, of course. Don't forget, put plenty of clear dope on the Hornet. This prevents oil-soaking and lengthens the life of the model, besides making for a much neater job.

![NACA Airfoil Sections](image-url)
BIRD WING GAS MODEL

A stable consistent flier that soars like a bird

by GEO. EVALENKO

Here we have an easily built, excellent performing contest model which has won or placed in every contest entered since the installation of a Super Cyclone. However, in powering this model, almost any Class C motor will do the trick.

Bystanders have been astounded by the amazing thermal tendencies the model exhibits; more often than not, a ground riser is all that is necessary to cause the owner quite a bit of consternation. The author attributes the extraordinary "floating qualities" to the Grant G-8 bird wing aircraf employed.

As one may note by glancing at the plans, an extremely stable aerodynamic force arrangement was used. The use of a lot of lateral area near the tail makes the "V" tail very efficient. This type of tail causes a properly designed model to whip into a corkscrew climb immediately, and utilizes more effectively the motor power.

In spite of the fact that the plane is a highly efficient contest model, it is not tricky under power, and has never spun in, looped, performed aerobatics, or shown any tendencies to do so. At the 1941 Nationals, because of maladjustments, the model circled in a 90 degree bank for ten seconds, neither gaining nor losing altitude. On the next flight, at half-throttle with a 15 sec. motor run and a Brown doing the work, it flew out of sight. The time was approximately one-half hour, and, of course, was unofficial. The last time the author flew the ship, it went out of sight in the only thermal of the day, and that in the evening.

In these trying days, rare enjoyment can be obtained from this consistent flying job. Time's wasting, so clear off the drawing board, and let's get started.

CONSTRUCTION: The plans must be enlarged six times to full size. A pair of dividers and a little patience (which every model builder is credited with having) are the two essentials needed. It is best to work from a centerline. Use the dividers to scale up all dimensions not given in the plans.

FUSELAGE: Put the top view of the fuselage in position on the workboard and place wax paper over it to protect your masterpiece. Select two pieces of 3/16" x 1" medium hard balsa of equal density; splice the hardwood motor bearers to them. After pinning the crutch pieces in place, add the cross pieces, and allow to dry thoroughly. Refer to perspective of assembled crutch if necessary. While waiting, cut out bulkheads, wing rest, tail former, etc. Now assemble bulkheads and firewall to crutch. Next add wing mount, top and bottom stringers, and cement cowling and nose blocks in place. Reglue all joints and check alignment per crutch. A glance at the assembled fuselage perspective might be helpful at this point.

Fasten coil securely to bulkhead No. 1, and, using standard wiring diagram, install ignition system. It must be realized that a good ignition system is essential for peak performance. Therefore, solder all connections well and check the entire unit. The timer and booster plug may be attached after fuselage is planked. Mount condenser on or near motor.

The battery box is mounted on a piece of 1/8" plywood, with a slot cut the length of it, but 1/8" off a bolt. The motor is movable, and will aid greatly in balancing the model. Wires are connected to the box by clips so that the box is easily removable when it is necessary to change the medium size batteries. An unexpected advantage of this method is its shock-proo protection. If in the event of a one-point landing (Heaven forbid!) the battery box will slide almost the length of the plywood and thus absorb the shock. The author has seen many crash landings in which flying batteries caused the sole damage.

Drill holes in plywood bulkhead No. 1, to attach landing gear. Form landing gear as per plate 2 from 1/8" music wire, and bind firmly with wire. A drop of solder will anchor wire to landing gear solidly. Now cover cabin sides with soft 1/8" sheet. Plane the portion of the fuselage bulkhead with soft 1/8" x 1/4" from the firewall to bulkhead No. 4. Work from each side equally until the bottom stringer is reached.

Now add stringers spaced as your judgment dictates. Shape the cowling and nose blocks roughly. Reglue the entire fuselage; when dry, sand thoroughly first with fairly rough sandpaper, and then with a finer variety. Attach windscreen braces and cut out windows from medium thick celluloid. Make a template of front windscreen, from stiff writing paper, and, using it as a pattern, cut out celluloid windscreen. Glue booster plug and timer securely in place after soldering connections. Be sure to mount plug and timer on the right-hand side of the model in order to clear exhaust fumes. The two being close together make for easy changing from boosters to inside batteries. Cement in place dowels for wing and tail. Bind and glue front wing hooks to cabin. Install keel and adjustment blocks for tail (see plate 1).

Fuselage is now ready for covering. Use any good covering material made in U.S.A. Cover over planking for additional strength. Dope covering about eight (Continued on page 121)

Above This unique model with its bird wing section soars on the slightest upcurrent of air. Note the combination fin-stabilizer tail plane. Left The author with his G-8 bird wing plane before the flight on which it disappeared.
NOTE: SPACED MOTOR BEARERS TO FIT YOUR PARTICULAR MOTOR
Bird Wing Gas Model

(Continued from page 177)

times, using thin dope to begin with, and apply ten coats at the nose, where oil accumulates. Color scheme is left to the individual builder; however the fuselage side view shows the color outline used on the original. Now cut out mounts, drill the necessary holes to accommodate your particular motor, bolt to bearers, and mount motor. Solder wheels to axle, install tail hook, and fuselage is completed. Now you might give in to that inevitable craving and run your motor to reassure yourself that ignition is O.K. and motor still revs.

WING: Choose a good quality quarter-grain 3/32" wood for ribs (use medium 1/8" if a good quality 3/32" isn’t available). Cut out and sand to a smooth finish. Cut out wing tips. Select and cut to length spars, leading and trailing edges. Block up lower spars to compensate for undercamber in airfoil. Lay out and glue ribs perpendicular to spars. Next add leading and trailing edges and top spars, as shown. Tip ribs may be cut and sanded to rough outline. When thoroughly dry cut tips, leading and trailing edges to a streamline shape with less undercamber than regular wing ribs. Then sand completely, making sure the tip ribs are of correct shape, and glue well.

Dihedral may be put in now. Fill in space between spars with a solid block of medium wood. Glue 1/16" or 3/32" plywood to spars, and if additional reinforcement is desired, attach another hardwood brace to the other side of the spar.

Repeat entire procedure for second half.

Join the two panels by blocking up one or the other 6" at the tip dihedral joint. When dry reinforce joints in manner described above. Now reglue entire wing, giving strategic points of the wing extra coats of glue. Now finish sanding wing with fine sandpaper and wing is ready for covering.

The tail is built in the same manner as the wing. Now cover wing and tail. Be sure to glue covering to ribs on bottom of wing. Use thinned out dope for the first two coats; apply six to eight coats.

Wing and tail need not be colored if extreme lightness is desired. Glue block of wood to tail at its center dihedral joint and sand to a smooth streamline shape. Model is ready to fly. Now to enjoy the fruits of your hard labor!

FLYING: Adjusting your model is simple, and even a beginner will have no trouble. Original flew with predetermined adjustments and required only minor changes. However, in spite of simplicity of initial adjustments, employ great care and time in perfecting them. A noted model authority has said: "A good flight is comprised of 50 per cent design and 50 per cent adjustments." Your success in the flying of this model is directly proportional to the care and time put into the building and adjusting. The model flies left under power and left in the glide. It is not sensitive to rudder, so the tail may be moved 1/8" at a time, until the proper circle under power and in glide is obtained.

With a little care and prudent judgment, the plane will give its owner more than one season of profitable and enjoyable contest flying. Its sturdy construction will also permit a good deal of sport flying.

Stepping Up Your Power

(Continued from page 105)

to these requirements.

To put it briefly, the air is scooped up in the celluloid funnel and transmitted to the motor air intake. The funnel is placed in the nose of the model, where air pressure is caused by the propeller wash and where the least amount of dust is present. A rubber tube is attached at the end of the funnel, run up through the nose of the model and then slipped over the air intake tube (see diagram). Simple isn’t it?

And now for the actual practice: To choke your motor all you need do is squeeze the rubber tube between two fingers. This of course shuts off the air supply the same as if you were to place your finger over the air intake. Of course your needle valve will have to be changed or adjusted to meet the additional air force being driven into the motor.

WARNING: You can use this supercharger for only short motor-run periods. It is not advisable to use it for runs of over a minute or a minute-and-a-half, because the motor speed is increased to such an extent that longer periods may cause damage by overheating. These periods are adequate enough for the 20-second runs of today, and more.

May we suggest that all test hops be conducted with the motor running under normal conditions, merely by pulling the end of the tube off the air intake. When you are ready for your official flights just slip the rubber tube over the intake and your supercharger is ready for action.

And when we say "action" we mean that if your ship is adjusted properly it will, by far, outclimb any other model on the field with the same class of motor as yours.

Try it and see for yourself!!

GAS MODEL PERFORMANCE CHART

FOR N R ENGINES

A
B (W) FOR ESTIMATED MAX PERFORMANCE (COEF.)

MINIMUM PRACTICAL WING LOADING

VALUES OF (A) & (B) FOR MAX PERFORMANCE (COEF. x 14):

- 121
THE NATIONALS
WINNING PACER

A consistent class C winning
gas model that is easy to build

by SAL TAIBI

The Pacer placed first in the open class
"C" event at the 1941 Nationals. On its
first flight, with a 7 second motor run, it
flew for 1 minute and 22 seconds. The
duration of the second flight was 13 minutes
and 55 seconds, and the third and final flight
was 10 minutes and 5 seconds.

There are many factors that make up a
championship flight, and although luck is an
element, the model itself must get up there
quickly and then glide well enough to take
advantage of lurking thermals. The ship
must be consistent, stable, and a dependable
flier that performs well under all conditions.
The Pacer has these necessary "virtues."

Class "C" ships usually outdo the
smaller class "A" and class "B" models,
but their drawback is comparatively poor
climb. The class "C" Pacer compromises
between the fast climb and poor glide of
smaller ships, and the exceptionable glide
and poor climb of larger ships. The result
is a fast climbing class "C" model that gets
up to the thermals, and then has the ability
to take advantage of them. The Pacer is
powered by a motor having a displacement
of .35 cubic inches. Because it has a wing
area of 502 square inches, the model has to
weigh 31.4 ounces; it is simple, rugged in
construction and flies easily.

Fuselage
The first step in building the fuselage is
to draw the top view full size. An elaborate
drawing is unnecessary; a center line with
the width markings suffices. The formers
and bulkheads are drawn full size on the
plan and can be traced directly to balsa
with carbon paper, or can, like the formers,
be built on the plan.

1/4" x 1/2" gunwood is spliced to the
two longerons before starting to build the
"crutch." Former 1 is built of 3/16" x
1/2" balsa; 2, 3, 4 & 5, of 1/8" x 1/2" balsa;
6 & 7 of 1/8" x 3/8" balsa; 8 & 9 of 1/8" x
1/4" balsa; and 10 & 11 are cut from
1/8" sheet balsa. The bottom bulkheads are
cut from 3/32" sheet balsa. While the
crutch is drying, cut out the firewall and
bulkheads, and build the formers. After
these have been cemented to the crutch, the
1/4" square top longeron is added. The 1/8"
x 1/4" bottom stringers are then inserted in
the bulkhead notches. Mark the formers
where the 1/8" square stringers cross them,
and cement the stringers in place. The
fuselage wing rest (WR) is now traced off
the plan, cut out, and cemented in place.
1/8" sheet is filled in beneath the top
longeron and between the formers, to pre-
vent the top longeron from sagging.
The landing gear is bent to shape and glued
to the firewall with pieces of 5/16" x 1/2"
grooved basswood as shown on the plan.

3/32" O.D. aluminum tubing is securely
cemented behind former 10. The tubing
passes through the top longeron and
through a 1/4" square brace that is ce-
mented between the crutch longerons. This
tubing is the pivot about which the rudder
turns. A piece of 0.16 aluminum 7/16" x
1-5/8" is cemented to the fuselage at the extreme rear (see rudder detail). Another piece of aluminum, 1/2" x 1-7/8" is formed as shown on the plan and cemented in place. Drill a 1/16" hole through both pieces of aluminum and trim one end of a piece of 1/8" dowel to 1/16" round. This peg is inserted into the holes in the aluminum and into the clutch. To remove the rudder, the peg is taken out and the rudder slips out of the tubing and off. The turn adjustment is controlled by bending the aluminum either way.

The cowling is drawn to scale making it necessary to enlarge the drawing before proceeding with the construction. Mark off on a piece of paper, one half inch squares equal one inch squares of the cowling drawing. Now reproduce the drawing in the large squares as it is in the small squares. Select a medium piece of balsa 5" x 5" x 3" for the cowling. Fit the block into the fuselage and cement lightly. After several hours of drying the cowling is ready to carve. After the cowling is completed, the outside shape is flattened down to fit the fuselage. The bottom block is made similarly except that it is cemented permanently in place. Motor mounts are made of brasswood and are bolted to the gunwale longeron. Mount the motor on the brasswood mounts as shown. The coil is enclosed in a 1/8" sheet box and cemented in the bottom of the cowling. Let the high tension wire clip protrude from the box in order to attach the high tension wire. The condenser is mounted on a clip bolted to the firewall. The outside battery box facilitates battery change. It is made of 1/8" sheet with .034 wire springs attached to the top where the wiring is attached. After the motor has been mounted the exhaust hole can be cut out and a hole to fill the gas tank while the cowling is on. Don't forget the reinforcement pieces at the top of the cowling. 1/8" dowel is cemented to the bottom front of the wing rest. It should protrude about 1/2" because the rubber that holds the wing is looped over it. After the timer has been mounted the wiring can be completed. Use multi-stranded wire as it is less liable to break from the vibrations. If in doubt follow the wiring diagram on the plan. The batteries and cowling are held in place by stretching a rubber band between hooks; one on the cowl to the fuselage on one side, and a hook on the cowling and one on the fuselage rear of the batteries on the other.

Stabilizer and Rudder

A full size drawing of the rudder is necessary before it can be built. The rudder has an ordinary flat cross section and is simple to build. Force a piece of 1/16" wire into the rudder and cement it firmly as it is the front pivot.

After drawing the stabilizer plan by the previously described method start building. Be careful when drawing full size parts to use correct size squares. Lay down in order, spar, leading edge, and trailing edge. Cement 1/8" x 1/2" ribs in place and allow the entire unit to dry thoroughly. After removal from the workboard shape the ribs with a knife or any other suitable instrument. Temporarily attach the stabilizer to the fuselage with pins. Cement B9A to the stabilizer and insert the stringers. The underslung rudder, cut from 1/4" sheet, is cemented on after the stabilizer is covered.

Wing

Again make a drawing of the wing before starting construction. If the wing is drawn on thin paper or tracing paper, only one half the wing need be drawn. The paper can be reversed and the other half of the wing can be built. Elevate the bottom spar 1/8" from the plan because of the undercamber. Ribs are then fitted into position, and the leading and trailing edges attached. Then the top spar is added and the wing is dried for several hours. After the other half of the wing has been built, the halves are cemented together at the proper angles. Joints are reinforced with 1/8" sheet gussets and the ribs with 1/8" sheet triangles. Attach the sheet wing mount and cover the leading edge of the wing up to the top spar with 1/16" sheet balsa. Cap strips are now added on top of the ribs and over the trailing edge. Sand away the strip at the trailing edge as shown on the full size drawing of the wing rib. A small piece of light aluminum is attached to the wing center as reinforcement against chaffing by the rubber wing tie.

Covering

Cover the fuselage with silk if possible, although Silkspan or bamboo paper is almost as good. Double tissue, bamboo paper, and Silkspan each have merits as a wing covering. However if double tissue is used, be sure to cross the grain of the two layers. Give the surfaces about four coats of dope and the fuselage about six. Use a half dope—half cement mixture for applying the covering.

Flying

A few days after completion check the model surfaces for warps. The Pacer wings and tail are constructed solidly enough to resist warping, but if warps do occur take them out. Enough Pacers have been built to prove airworthiness, and by carefully making flight adjustments championship performance will result. The wing is set at zero degrees, and stabilizer with reverse camber, at 1/2" positive incidence. Set the rudder 1/4" to the left. Two degrees left thrust and two degrees down thrust are the requirements for motor setting. Glide the ship several times putting more or less incidence into the stabilizer. Remember! Careful slow adjustments save much time and effort.

Set the timer between 10 and 20 seconds for the first flight and use very low power. Launch the Pacer and watch the flight very carefully. Under power the Pacer should climb in approximately fifty foot circles to the right. When the motor cuts, it should gradually turn to the right and glide in about two hundred foot circles. Each model may have individual flight characteristics but all Pacers, without exception, climb to the right under power, and glide to the left. If the ship reacts favorably on first flight, fly it again with the same power and motor run. The ship should be flown about ten times, gradually increasing the power to maximum.

If you have followed instructions, and were guided by common sense, you now have a perfectly flying ship that will afford you many hours of satisfaction, and what's more, an excellent chance to win.
SIDE VIEW - HALF SIZE

GLUE WING MOUNT SECURELY OVER FORMERS 3, 4, AGAINST 2, 5.

SOLDER IGNITION WIRING TO EXTERNAL END OF BUSHING.

DRILL 1/8" X 3/4" TO BREAKER POINTS.

1/8" X 1/16" X 1/2" ENDS FOR TERMINALS.

1/8" X 1/4" X 3/4" FOR SPRING BRASS CONTACT PLATE.

BATTERY BOX TO PLUS HIGH TENSION LEAD.

BOLTS PLUS BOOSTER BOLT CONNECTION.

GROUNDED TO ENGINE BOLT.

TO IGNITION DIAGRAM.

DATE: 8-29-47

PLATE ONE

FRONT VIEW

THE SAMBA

DESIGNED BY F.P. CONANT

WING SPAN 42"

CHORD 5-1/2"

ARM 1/4"

ENGINE ATOM

BOLT POSITIONS FOR ATOM ENGINE.

MAKE COIL BED FROM SCRAP BALSAM CARVED TO FIT COIL USED.

SCRAP BALSAM CARVED TO FIT COIL USED.

SOLDER WASHERS TO WIRE.

NOTE: ALL GUSSETS SHOWN ON THIS PLATE ARE TO BE MADE FROM 1/16" PLYWOOD.

CELLULOID WINDSCREEN.

WINDSCREEN FORMER MADE FROM 1/8" SHEET BALSAM.

ALL STRINGERS MADE FROM 1/8" X 1/8" STRIP BALSAM.

AUSTIN TIMER

DRILL 3/4" HOLE IN NOSE BLOCK, USE AMPLE GLUE.

1" 1/2" BALSAM OR PNEUMATIC WHEELS FOR BOTH FRONT & REAR GEAR.

1/8" MUSIC WIRE.

FORMER 5

FRONT LANDING GEAR.

FORMER 3, 4, 5, 6

WING MOUNTING 1/8" DOWEL.

1/8" WOODEN WOODS.

ISOGRAM OF GRUTCH & LANDING GEAR.

GRUTCH LONGERONS.

1/16" D. MUSIC WIRE.

BRACE.

MAIN STRUT.

STRINGERS.

Nose block.

HOLE FOR BENDING LANDING GEAR TO FORMER 5 USE STRONG THREAD & PLENTY OF GLUE.

BOLT POSITIONS FOR ATOM ENGINE.

DETAILS OMMITTED FOR CLARITY.

PLATE ONE

TOP VIEW
DESIGNED for those modelers who are tired of building planes that look and fly like a darning needle with a "hot foot" the Samba makes its debut.

Contrary to what a great many model builders think, a "tailless-pusher" or "flying-wing" compares in endurance, stability and all around performance, with the more conservative type that employs a tail assembly. Admittedly, the Samba is not a contest plane, but she is just right for sport flying, giving the builder constant and steady flights. It is practically impossible to damage her; the original dope in from about 70 feet when the rubber bands holding the wing to the fuselage broke, and only the windshield was smashed. In over 50 flights including tests, not a propeller has been broken.

First step in building the Samba is enlarge plates 1 and 2. Some paper, a pencil, ruler and pair of dividers is all that is needed. Start with the fuselage by drawing a line representing the top of the hardwood crutch. Now lay off positions of the formers and draw lines perpendicular to the former stations. Measure the distance from top of the crutch to bottom of the fuselage, double it, and with the dividers mark it on the perpendicular line that represents the particular former you are enlarging. Now measure from the fuselage top to the crutch, and after doubling it, lay it off on the perpendicular line. Repeat this process for all the formers and any other stations that warrant it. Use the above method also for enlarging the top view and wing plan.

After plans have been enlarged actual construction is started.

FUSELAGE: First build the crutch. Assemble on the top view and be sure to use plenty of cement between crosspieces and longerons. Allow the whole assembly to dry for about four hours. While the crutch is drying follow instructions on plate 3 for making the formers. Sheet balsa is usually sold in 2" widths, and this is just the right size for making the Samba's formers, as they are made in halves, glued together over the crutch. When cementing the formers to the crutch be sure they are at right angles to it. This can be done by using a small 90 degree triangle which can be bought at any stationer's.

Make the battery box and solder the ignition wires to it; be sure to use enough wire to reach the timer and other parts of the ignition system. Now mount the coils as shown on the side and top views. Use plenty of glue, as the coil will do untold damage if it ever breaks loose from its mounting.

Carve the nose block from a piece of soft balsa and sand it down to remove the fuzz and smooth it off. Drill a hole through it so that the timer will slip through. Install the timer and be generous with the glue. Drill a 1/16" hole, as shown on the side view, for the passage of the ignition wires to the timer. Small holes for wires will also have to be drilled through the formers, but this will not weaken them.

Build the wing mount and wing saddle at the same time. Cement the wing mount to the top of formers 3 and 4 and against 2 and 5. This is shown on the side view. Cut out the gussets and glue them in where shown. Drill holes through the gussets un-
NOTE: CENTER LINE A-B IN FORMERS 2, 3 & 4 DIVIDES THEM IN HALF. BUILD THESE FORMERS IN HALVES AND THEN GLUE TOGETHER WHEN READY TO MOUNT, SLIP OVER CRUTCH TO PROPER POSITION AND CEMENT THOROUGHLY.

ALL FORMERS ARE FULL SIZE EXCEPT AS NOTED.

FORMER 5
1/8" PLYWOOD

GUSSETS (REF)
WING MOUNT (REF)

FORMER 6
1/8" SHEET BALSA

GUSSETS (REF)
WING MOUNT (REF)

FORMER 3 & 4
1/8" SHEET BALSA

GUSSETS (REF)
SLOT FOR CRUTCH

FORMER 1
1/8" PLYWOOD

GUSSETS (REF)
SLOT FOR CRUTCH

BATTERY BOX (REF)

FORMER 2
1/8" SHEET BALSA

GUSSETS (REF)
SLOT FOR CRUTCH

WING MOUNT (REF)

WING MOUNT
1/8" SHEET

MAKE TWO BALSA

HALF-SIZE

FIN: MAKE ONE FOR EACH WING TIP FROM 1/8" SHEET

ALUMINUM HINGES

R U D D E R
MAKE ONE FOR EACH WING FIN FROM 1/8" BALT.

NOTE: FIN PLAN IS HALF SIZE. MAKE IN 4 PIECES AS SHOWN AND GLUE THEM STRONGLY TOGETHER.

HALF SIZE

GLUE THIS END AGAINST FORMER 2 - SEE PLATE 1

PLATE THREE

DAVID ANDERTON
nderneath the wing mount for the 1/8" dowels; these dowels retain the rubber bands that hold the wing on, so allow them to project about 5/8" beyond the wing mount.

LANDING GEAR: The tricycle landing gear should be made very carefully. If made properly, it will be very strong and you will have no trouble with it. The rear landing gear is made in two pieces, the main strut and the brace, from 1/16" music wire. Bend the main strut from the wire first, using the side, top and front views as a guide. Wrap the wire around the rear of the brace. Cut 4 gussets from 1/16" plywood and drill 1/16" holes in them. Force these gussets onto the main strut and brace. Now glue the main strut gussets against former 2 and the crutch; glue the brace gussets against former 1 and the crutch. Cement thoroughly. When dry, slip washers on between the rear landing gear and solder them to the wires to keep them flat against the side of the gussets. These washers will prevent lateral slipping of the landing gear. Bind the brace to the main strut with fine, clean copper wire and solder, using a very hot iron.

The front landing gear is also shaped from 1/16" music wire and then bound to former 5 before the nose block is attached. See front and side views on plate 1. Do not solder the wheels to either the front or rear landing gear as they will only get in the way when the fuselage is being covered, but rivet them in place until the fuselage has been completely finished before attaching the wheels permanently.

Do not glue the 1/16" x 1/8" strings in place before the ignition system and landing gears are completely finished and installed. Strungers are glued to the top of the formers—they are not notched. This prevents the stringers from binding to the formers when dope is applied.

The ignition tract is self-explanatory and the only thing to worry about is the soldering. As the coil is completely inaccessible when the fuselage is covered, a good soldering job is imperative. A good trick is to soak the end of the soldering wire to the end of the coil, to be sure that it doesn't vibrate loose. The author built a celluloid window in the fuselage so the coil could be inspected for broken connections. As this is optional, it has not been included in the plans.

Make the coil bed from soft balsa and glue the coil to it. Then glue the bed between the crutch longerons. With the ignition system and landing gears installed, the stringers are now glued over the formers in their correct positions.

WING: The wing is built in two sections. The right half is shown on plate 2. After enlarging it in the same manner as the left half, you may make the left wing by turning the plan over and working on the reverse side.

To build the wing first protect plans with wax paper and then pin down the trailing edge and spar. As the ribs, when carved, will vary slightly in length, do not notch the trailing edge until you see how far the rib will project into it. In other words, "custom fit" the ribs and the result will be ten times stronger than a sloppily built job. After the trailing edge has been notched glue the ribs to it and the spar. Let dry overnight to be sure there are no weak spots to invite warping. Remove the work from the plans and attach the leading edge. Now shape the trailing and leading edges; be sure to sand thoroughly, as rough and uneven edges "do more to spoil the looks of the covered wing than anything else." When the wing is put in place, you'll find that the aluminum hinges will have a strong, rectangular piece of wood to "bite into," rather than a weak, triangular one. Cover the last two ribs with 1/32" sheet balsa, top and bottom.

Construction of the rudders is self-evident, but be sure to apply plenty of glue between the sections of which it is made. Examine all the ribs from each piece of balsa, if possible. If it can't be done draw a diagonal through the elevator plan and shape the pieces of balsa to the triangles described by the diagonal, and then glue them together. Carve the elevators as you did the trailing edge and hinge it to the unshaped part of the trailing edge.

After the two panels have been completed the wing is ready to be joined. First loosen the two center ribs of the two panels and tilt them apart until they produce an angle that will, when the panels are brought together, raise the wing tips to the required 6° dihedral. Leading and trailing edges will now project beyond the center ribs so shaves with the dihedral brace to bring panels to the ribs and spar. Glue into place the two trailing edge gussets. Be very careful that there is no sagging of wing tips when supporting blocks are removed. Now plate the wing section with 1/16" sheet balsa. Be sure to do this to the top and bottom of the centersection.

Draw a line through the center of the wing saddle and place this line directly underneath the two center ribs. Before cementing be sure the wing is on an even keel with the wing saddle by placing blocks underneath the wing tips until they are 6° off the table. While cement between wing saddle and sheet covering is drying, carve six "braces" and sand them so they fit snugly between the saddle and lower camber of the ribs. Glue these in place, and set aside to dry.

COVERING: With time and patience the fuselage can be covered so there is not even a wrinkle in it. The trick is to use wet "Silkspan," covering relatively small areas at a time. This is particularly true around the rear landing gear. For a paper adhesives use rather thick dope and apply it carefully so that it doesn't pull the paper down to the formers. When the dope has been applied to the boundaries of the area to be covered, lay the wet Silkspan on it and gently pull out any wrinkles. When the paper is dry, trim off the Silkspan edges and start on another section. The paper grain should run lengthwise to the fuselage. When the whole body is covered give it two or three coats of celar dope.

The wing is covered in the usual manner, with grain running spanwise. Wet Silkspan is again advised. Be sure to smooth out the wrinkles that always occur along leading and trailing edges, tip and centersection. To cover the undercrease part of the wing the wet Silkspan should be doped to each rib to retain the airfoil section. The general procedure for covering the lower wing half is to tack the Silkspan, with dope, to the wing tip and rib that is just outboard of the wing saddle. Then the dope is applied to leading and trailing edges and undercamber of the ribs. The wet Silkspan is then pulled smooth. Trim off ragged edges of Silkspan and let dry. Be sure that the paper does not pull away from the ribs' undercamber. This is the critical period in which "inherent warps" are formed, so be careful.

When the Silkspan is dry brush on three or four coats of clear dope. This is another "critical period" and too much caution cannot be advised about guarding against warps.

The author's model was covered with white Silkspan, doped and then color-doped. Wings were white with blue rudders, elevators and leading and trailing edges, separated by a thin red line. Fuselage has a black body and a wide blue band at each side, with all three bands separated by a red stripe.

If your model is color-doped the interior beneath the windscreen should be a dark color: the author used blue. The windscreen formed should also be painted before the windscreen is mounted. Actual fitting of the windscreen is a hand-tailoring job, so measurements are not given.

After it is glued on the nose block is very heavily doped to fill in the pores of the wood. Then dope Silkspan to it to provide a smooth base for the color dope.

MOTOR INSTALLATION: The Samba is designed for the Atom engine in conjunction with a "push prop," either 8" or 9" in diameter. The propeller ought to be heavily doped, and even color-doped, as the gasoline and oil from the engine are blown back on it. However, when finished with the oil-proofing be sure it is in balance.

Before drilling the bolt holes as marked on the plans, double check them with the mounting holes of your own Atom.

A metal condenser is used, grounded to one of the mounting bolts. The lead-off wire of the condenser is soldered, along with the connection from the coil, to a lug. This lug is held to the insulated part of the timer arm by the same nut which holds the stationary contact point.

TESTING AND FLYING: When the model is completed and checked carefully for warps, the important testing time is at hand. First the model must be glided. If there is tall grass nearby, use is as a testing ground; if not, the model must be launched from the last few times from a kneeling position. Pick a windless day for your testing, preferably early morning or sunset. For the first few glides launch the plane into whatever wind there is and keep the nose pointed down. Do not throw the model away from you; rather hold it in one hand and contrive to bring the hand forward until the flying speed is reached—then let go. Experiment with the rudders and elevators until the model has attained a nice,
slow, steady glide.

For power flights set the Austin timer for about 10 seconds. Get the Atom running smoothly and slowly, with the timer are just above the starting position. Cut in the flying batteries with the Austin, disconnect the boosters, walk a few steps into the wind, holding the model at shoulder level, and release it. The plane should continue to gain altitude until the engine cuts, then she will turn to the left and start to glide in. There should be no need of incidence under the wing, but if needed, add in small doses till the correct amount is obtained.

Modifications of the thrust line produce great differences in performance, some un-

A True Pitch “Gas Prop”

By H. A. THOMAS

A PRETTY propeller is not necessarily a good propeller. It is true that neatness goes hand in hand with accuracy and efficiency; but in the case of propellers careful and accurate design is of a great deal more importance than appearance.

This article simply explains the author's understanding of the subject and is intended to acquaint those who may be interested with some of the basic facts of propeller design. Every effort has been made to keep this article as simple and as graphic as possible. If the inexperienced gas model fan can grasp these points, he will be able to design his own true pitch propellers.

“True pitch” is a phrase that is freely used regarding propellers, many of which are not what the words imply. To be correctly called “true pitch,” a propeller must be so designed that all points along the blade can deliver their proportionate amount of traction or thrust. It would be practically impossible for a person to take a block of wood, sketch arbitrary blade shapes, taper the block by guesswork and complete a propeller that would be true in pitch. No doubt this procedure is used in a large percentage of all gas model propellers made, and while many of these may produce satisfactory results, it is logical to assume that performance would improve with more efficient design.

In attempting the design of an efficient propeller for a gas model, we will begin with our own specifications. In this case we will assume that the motor we plan to use is capable of turning a fourteen-inch propeller of eight-inch theoretical pitch. Due to a certain amount of slippage, our propeller will not operate at 100 per cent efficiency; so we refer to the eight inches of pitch as theoretical. We begin by making a tentative blade pattern and side view of the blade. At equal intervals from the center, along the centerline, we strike off four equally spaced points. For greater accuracy more points can be used, but we will use only four. Fig. 1. These points will be known as 1, 2, 3 and 4. When the
propeller is rotating, these points follow spiral paths, or more specifically, "helical" paths. In other words, in one revolution, each point inscribes a separate "helix." Fig. 2. To find the true length of a helix, we must know the pitch, the diameter and the number of turns. The pitch will be eight inches, the diameter will be twice the distance of each point from the center and the number of turns will be one. By applying these to the formula shown on the drawing, we can find the true lengths of the paths these points follow in one revolution. We will call lengths h₁, h₂, h₃ and h₄. To show more clearly the distances covered, Fig. 3 shows these helices straightened out. This plainly indicates one relationship between points along the blade. It further shows why the portion of the blade nearer the tip need not have a large angle of pitch to produce the proper amount of traction.

In constructing Fig. 3 we will draw a long base line and at one end erect a perpendicular. On this perpendicular we will measure accurately the desired eight inches of pitch and label that point X. With a long arm compass or a string, we will measure h₁, and with that as a radius and X as a center, we will strike an arc through the base line and label the intersection M. Using h₂, h₃ and h₄ in a similar manner, we can arrive at points N, O, and P, all being on the base line. By connecting M, N, O and P with X, we have a diagram of the paths of points 1, 2, 3 and 4 in one revolution—each at eight inches of pitch. We will label the smaller angles formed at the base line as ∠1, ∠2, ∠3 and ∠4.

Back to Fig. 1 note line Z. This is the tentative entering edge line. Since the blade sections have an aerofoil, line Z is located in its position due to the upper curvature of the blade. In Fig. 4 we have reconstructed the four angles over which we superimpose the block cross-sections at their respective points. Our task now is to adjust the blade widths and thicknesses so that we can make the upper legs of the angles pass through point Z at each station. For this reason we have previously referred to these patterns as tentative.

To be structurally sound, the blades should taper toward the tip in the same manner that a cantilever wing is tapered. With this in mind, we draw in the blade sections. Fig. 5.

It might be pointed out that there can be numerous types of propellers laid out, all of which can be true in pitch. The reader need not feel that incorporating these points of design will necessarily restrict him from using his favorite type of propeller. Fig. 6 shows alternate blade patterns with the same pitch and blade widths used in Fig. 1.

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**Plotting Sections The Easy Way**

by CHRISTIAN DEAN BERGER

Plotting individual ribs for a tapered or elliptical wing used to be a long tedious process. We say "used to be," because now, when you want to plot these ten or fifteen different ribs, you won't have to draw an individual graph, divide up odd size lines, read coordinates and estimate the position of points, again and again. Our new method of plotting looks somewhat odd, but is actually based upon the older method and is absolutely correct, mathematically. Although our new method takes only one-fifth the time, the results are just as, if not more, accurate.

The procedure is to first draw a chart (like that shown in the drawing) which is kept for permanent use; then by using this chart we can draw any size airfoil in about three minutes. A separate chart must be made for every different airfoil but it takes only about one hour to draw one, which isn't long, considering you can use it for years. That one hour investment will pay tremendous dividends in time saved later on.

The chart shown is for R.A.F. 32 airfoils of any size up to 10'; gasoleers who use larger size airfoils should make larger charts. The chart should be made on a good piece of paper. (Bristol board is excellent for the purpose.) In the upper left draw a ten inch airfoil of whatever particular airfoil you want. The 10" is chosen because it is easy to plot even by the regular method, using an engineer's scale. Readers not familiar with the regular method of plotting will find an explanation on the drawing. Now from point B (the 100% point of the airfoil) draw a line about 12" long at 60 degrees to the horizontal. From point A (the end of this line) draw lines to the intersection of the 10" chord line and the vertical station lines used in laying out the 10" airfoil. Call these base lines. Then draw lines from A to the points of the airfoil itself. Call these contour lines. Also draw a horizontal line through A. That's all there is to the chart and it is ready to use.

Suppose you want to draw a 6 7/8" airfoil. To do this, tack a piece of tracing paper over the chart and measure off 6 7/8" from point A along the horizontal line. From this point draw a line parallel to AB (i.e., 60 degrees to the horizontal). Where this line hits the 0% base line draw a horizontal line. This line is the chord line for the 6 7/8" airfoil. The next step, shown in Fig. 2, is to draw vertical lines through the intersection points of the 6 7/8" chord line and the base lines. Then as in Fig. 3, mark the intersection points of these vertical lines with the contour lines. Connect these points with a French curve and you have a 6 7/8" airfoil. Simple, isn't it?

Here are a few further hints in using the chart: To draw a complete set of ribs for an elliptical, tapered or other shaped wing, just repeat the above procedure for each size rib needed. They can all be drawn on one sheet of tracing paper, the paper being shifted after each plotting so the ribs don't overlap.

To make templates, paste the tracing paper to some heavy paper or thin plywood and trim to shape.
DESIGN FOR PERFORMANCE

A simple method of calculating performance of model planes by a combination of theory and experiment

by ROY MARQUARDT

What sort of a model builder are you? We know of at least two general types. One, Bill, builds models for pure relaxation and is very happy if only they will fly or maybe just look realistic; while the other, Johnny, is always striving to build better and better models. We have no quarrel with Bill for we built lots of models that way ourselves; yet we’re sort of glad that there are getting to be more and more Johnny’s for airplanes are going to be mighty important after this war is over and we’re convinced that building models is the easiest way to learn the fundamentals of aerodynamics.

Bill isn’t going to be much interested in our present series of articles, but if you’re like Johnny you should get a big kick out of them for we’re going to apply everything that modern aerodynamics has to offer in a big attempt to improve model design. Fortunately, it’s possible to use easy-to-read charts instead of formulae; but just in case some of you might feel slighted we’re including fairly complete mathematical discussions at the end of several of the chapters.

Well, let’s examine a few general methods that Johnny might use to improve his models. In the first place, he might just build model after model systematically varying one thing at a time so he could be sure of the effect of every variation. This is basically sound and, in fact, it’s the general method most of us have used although gosh knows the variations haven’t been very systematic.

Unfortunately there’s one trouble with the whole business; that is, we must measure the effect of the changes by actually flying the models. This is bound to lead to crude data due to air currents, variations in adjustment and what have you. We’ll find as a result that our models are far from perfect aerodynamically.

In an attempt to eliminate this flight test bugaboo, model builders gradually have begun to follow the lead of full-scale designers and use the results of wind tunnel tests. The development of wind tunnels has been covered in so many other places that we’ll skip directly to their advantages; the most important being that undesired air currents can be eliminated, the angle of attack exactly fixed and forces measured. As an additional advantage, various items such as wing, tail and fuselage can be tested separately thus immediately locating the source of erroneous designs.

Well, obviously the first question to arise is: Can we use the tremendous stack of wind tunnel data accumulated by full scale designers or do we have to measure our own? Most of us first felt that we must follow the latter course. Classic tests in this direction were made by McBride on the airfoils used by the high ten indoor models in the 1930 Nationals. Soon thereafter extensive tests on fuselage and indoor model airfoils were started at Boston and at the same time the writer supervised tests on wings of various sizes, aspect ratio and airfoils at Burlington, Ia. Unfortunately wind tunnel testing is quite an art and none of the results in the above references can be accepted without a grain of salt. Don’t take us wrong, it isn’t impossible for model builders to obtain accurate wind tunnel data but the odds are pretty high against it. You can’t just put a wing behind an electric fan and expect to get results much superior to those obtained from flight tests.

Luckily, we were completely wrong and it isn’t necessary to make all of our own tests. In fact, it is possible to use much of data already obtained by wind tunnels all over the world. However it is quite a problem to know the best way to use it. For instance, a direct attempt to systematically study this data was started recently by the writer, only to find that the logical procedure was to set up a basic theory and then use wind tunnel data as a check. As a part of the study the writer typed reams of paper with an investigation (unpublished) of our fundamental problem—that is, the variation of the characteristics with model size (so as to know how far full scale data would be applied), when suddenly the application of a little theory allowed an exact calculation and made nine-tenths of the experimental data unnecessary. (Don’t forget though that the other one-tenth of the data is still needed.)

This theoretical-experimental method is exactly the same as is used by most full scale aerodynamicists; in fact, it’s not completely new to the model field, a notable attempt having been made by Weiss to introduce the Oswald method of flight prediction. Unhappily, the Oswald and latter methods developed by Rockwell and White and Martin (also introduced at Cal Tech) are extremely unsuited to our needs. In the first place they are all based on the same approximation which gives very inaccurate estimates of minimum sinking speed which is just what most of us are interested in. Secondly, all three methods neglect special effects of our small models and low speeds. For example, take the problem of the best aspect ratio for endurance. Here from airflow considerations alone the Oswald method tells us to use an infinitely high aspect ratio whereas the analysis which we are about to develop shows definitely that this so-called aero dynamic optimum aspect ratio lies between 5 and 30 depending on the particular model. And there’s a long, long jump from 5 to infinity.

But enough of this lengthy introduction. Our problem then is to work out a general method of calculating the performance of a model airplane: its rate of climb, high speed, sinking speed, endurance, etc., and show how they are affected by airfoil selection, aspect ratio, wing loading and fuselage drag. As most modelers are only interested in endurance or possibly high speed we shall stick mostly to these two calculations. As a final chapter we shall investigate the stability problem; incidentally, this is a honey as it’s easily shown that the “dirtier” an airplane is the more stable it will be—unless we—but whoa, we’re getting ahead of the story. Let’s see about this
performance problem.

BASIC FLIGHT PREDICTION: On the other hand it looks as though it would be a plenty tough job to predict how an airplane is going to fly. Well, you're right, it is; but by sneaking up on things one at a time you'll be surprised how easy we can make it. For example let's take a simple glider model. We all know that if we make a particular adjustment and launch the model it will glide with a definite forward speed and vertical sinking speed. But what we may not realize is that for every steady forward speed (which we may obtain by various adjustments) there will be one and only one steady sinking speed. This means that for a given airplane we should be able to obtain a single curve of sinking speed (Vs) vs. forward speed (U) such as that shown in Fig. 1.1. Notice that such a curve immediately gives us five important items:

First, point A on the curve corresponds to the lowest forward speed or stalling speed.

Second, point B corresponds to the lowest sinking speed or minimum sinking speed. This is the proper adjustment for maximum gliding endurance.

Third, point D also gives us the forward speed for maximum endurance. We will see that it is necessary to know this speed in order to properly adjust our model for endurance.

Fourth, by drawing the tangent line OC from point C which corresponds to the forward speed for maximum gliding distance. That is, corresponding to the maximum lift to drag ratio and.

Fifth, point E also tells us the maximum lift to drag ratio itself which may be obtained by dividing the forward speed at point E by the sinking speed at point C. That is, if the forward speed for maximum gliding distance is 30 ft. per sec., and the corresponding sinking speed is 2 ft. per sec., the maximum gliding ratio will be 15 to 1.

In fact, we may calculate even the maximum time to descend from any given altitude with any known rising air current by the simple equation:

\[ 1.1) \quad \text{maximum gliding endurance} = \frac{\text{altitude}}{\text{Vs}} \]

\[ \text{min. Vs} \quad \text{speed of rising air} \]

Thus, if we have a minimum sinking speed of 3 ft. per sec. and launch the model from an altitude of 200 ft. in a current of air rising at a rate of 1 ft. per sec. the endurance will be:

\[ \text{maximum endurance} = \frac{200}{3 - 1} = 400 \text{ seconds} \]

Whereas, if the riser hits 3 ft. per sec., the endurance becomes infinitely large and the model will never come down—until it flies out of the particular rising current of air.

Well all this looks simple enough, eh? There's only one drawback—we don't yet know how to obtain the forward vs. sinking speed curve. Of course, if the model is already built we might obtain it by actually gliding the model. Incidentally, this is where the "steady" speed business that we've been talking about comes in; for to obtain accurate data the model must be carefully launched so that the forward and vertical speeds are constant or "steady" during the entire glide. Actually, however, we are much more interested in predicting our curve before the model is built. As this is going to require a little study let's examine first one other element of the performance problem; that is, the effect of engine power.

THE EFFECT OF ENGINE POWER ON A MODEL: Fortunately aeronautical engineers have invented a very clever dodge. Let's say, for example, that a particular engine puts out a certain amount of horsepower. By multiplying by a conversion factor (550) we convert this horsepower to foot pounds of work per second. Now, if it were possible to use all of this work to raise the airplane the rate of climb could be obtained simply by dividing the foot pounds per second output by the airplane's weight. With an actual airplane this is always somewhat optimistic as not all of the power can be used to raise the plane. In the first place, we must make allowance for power lost at the propeller, by introducing a thrust horsepower equal to the product of engine horsepower and propeller efficiency. If we now convert to foot pounds per second and divide by the weight we have an important quantity which we shall call the rising speed, i.e.:

\[ \text{rising speed} = \frac{\text{engine HP} \times \text{Prop eff.}}{550} \]

Fig. 1.1 shows a curve of rising speed vs. forward speed. Note that the rising speed gradually increases with increasing forward speed. This is due to the fact that for models the propeller efficiency always improves as the forward speed increases—but don't jump to the conclusion that the actual climbing speed will improve for, so far, we have neglected the loss of climb due to drag of the airplane itself. But wait a minute, the loss of climbing ability due to airplane drag must be exactly the sinking speed which we have already obtained. That is the rate of climb at any forward speed must be given by the formula:

\[ \text{Rate of climb} = \text{climbing speed} (V_c) - \text{sinking speed} (V_s) \]

sinking speed (Vs) i.e., the distance between the two curves on Fig. 1.1 is exactly equal to the rate of climb. Thus the maximum rate of climb must be given at the point D where the two curves are farthest apart. Note the corresponding forward speed is somewhat higher than the speed for minimum sink due to improved propeller efficiency. Point E is also interesting for here the two curves cross and Vs is equal to Vs. Eureka! This must be the maximum speed for level flight, for in order to obtain a higher speed the airplane will have to be dived. Note there is another level speed at point F. However it is usually not very important as it is normally above the stalling speed.
How to Put "Revs" Into Your Gas Motor

By FRANK TLUSH

Do you model builders give your engine the care it deserves? Probably some do, but on the whole the others take theirs for granted. They expect their engines to perform faultlessly at all times, not thinking of course about all the attention that has to be given them. Work it like a Mack and expect it to perform like a watch, forgetting that the little put-put is really a delicate piece of precision work. You never really can be too fussy. One of the most important reasons given for the care that these engines require is the high speed at which they operate, and the thin walls of both the piston and cylinder. You know of course the damages that are liable to result if some sand gets into the cylinder, but many fellows never give it a second thought at the contest field. They just pour the gasoline into the tank and then hope for the best. Then when their motor refuses to function properly because of a clogged gas line, they spend all day trying to remedy the fault. All that precious time wasted trying to fix something which should have never happened. Do you remember the time when your engine refused to function at the most critical time of the day when the thermals were just right and you wasted a complete day working on your engine? When you finally succeeded, the contest was probably over or the ideal time for breaking the world's record was gone. You swear and doubly swear to be prepared for the next contest, but it's usually the same old story over and over again.

Wiring, mounting, batteries, spark plugs, etc. How many contests have been literally thrown into the waste basket! You fellows can answer that question yourselves.

Now that that's off our chest, let's get down to business and do something about those engines. Let's make competition stiffer for each other so that there will be more scientific research going on than just guesswork. There are approximately six points that we must know and always keep in mind if we want to become experts at the game.

The first thing that we want to know about of course is how the two-cycle engine operates.

A cycle in engineering is any operation or sequence of operations that leaves the conditions the same at the end as they were in the beginning.

The two-cycle engine requires only two strokes, or one revolution to complete the cycle. This engine is sometimes called a valveless engine because of the absence of valves. As the piston receives an impulse, every other stroke a flywheel or propeller is employed to drive the piston through the non-impulse stroke. Starting with the piston at the top of its stroke, the combustible charge of gasoline is compressed and ready for ignition. On the down stroke, the charge in the combustible chamber is ignited by the spark plug, and the resulting force forces the piston downward.

At the beginning of the stroke the crankcase is full of a combustible mixture that has been drawn in through the ports and which is compressed by the piston on its down stroke. When near the bottom of the stroke, the top edge of the piston uncovers a series of ports in the cylinder wall through which the burned gases escape; the pressure in the cylinder dropping to about atmosphere. Shortly after the exhaust ports have been opened or uncovered, the piston, still moving downward, uncovers the transfer ports in the cylinder wall. These are situated diametrically opposite the exhaust ports. The transfer of the mixture from the crankcase to the cylinder is made through the ports in the piston. These register with the ports in the cylinder wall and admit the mixture into the bypass from whence it passes into the cylinder through the ports.

The top and bottom ports close simultaneously. To prevent the incoming charge from passing directly across the cylinder and out the exhaust ports, transfer and exhaust ports being open at the same time, the top of the piston is provided with a baffle or deflector plate which deflects the gas up to the top of the cylinder, thus aiding in cleaning out the exhaust gases. The ignition which is one of the most important factors...
When you purchase batteries, make sure they have plenty of amperage. Take along an ammeter to check the amperage. Sometimes the batteries may have the voltage, but this alone will not run your engine. The batteries should have about twenty amps.

Successful Operation of Your Motor Depends on Good Neat Wiring

The use of gasoline as a fuel brings up many points, which should be remembered. For instance, the care which we should take buying the fuel, mixing it, pouring it into the gasoline tank, and above all, the cleanliness and care in using it on the contest field.

All some fellows worry about is that the stuff smells like gas and looks like oil, never giving the quality and type a second thought. These factors all contribute to the long life of your motor and if not taken care of, your motor will not give the service it is supposed to give. Gasoline of the highest grade should be used only. Of course do not use fuels that are treated with chemicals, because they are liable to ruin the cylinder walls.

The type of gasoline best suited for these small engines is a fairly slow burning gas. I recommend that a gasoline with an octane rating of above 70 will give the best results. If a higher octane gasoline is used in the motor, results will not be so good as you might expect. The faster burning gasoline will have a tendency to pre-ignite and your engine will have a rebellious ping sound, with a consequent loss of power.

The lubrication of these motors should be looked into. The deciding factor for good lubrication is the high speed at which these engines operate. You know that no engine will last long if it is not lubricated properly. So figure it out, a motor operating at 4500 revolutions per minute, and the amount of oil that is mixed with the gasoline which is supposed to lubricate the walls of the cylinder and piston plus all the other moving parts is very little indeed. It certainly is not enough to prevent serious damage to a poor grade of oil can do to the engine.

The operating temperature of the engine is fairly high, running from about 250 to 350 degrees Fahrenheit. A poor grade of oil at this temperature will burn and form excessive carbon deposits and no lubrication which will adversely affect the engine.

Never use sandpaper or other abrasive materials. They scratch the porcelain, thus making the spark plug fouling.

The coil which is not the most important piece of apparatus needed in the operation of the engine should be treated like your best friend. When the coil is not being used, store it in a dry place. When it is being used in the ship, mount it in a place where oil will not reach it. If the coil becomes soaked with oil, there is a possible chance of it becoming grounded.

Without batteries your engine will never run no matter how perfect everything else is, so it is with dead batteries which are just as useless as no batteries at all.

Maintenance of the engine has already been covered in part, but now we shall deal with the care of the engine itself. As was previously stated, the engine is a fine piece of delicate precision work which requires special attention in order that it be kept in good running order. The only requirement that the users needs are that you make sure that all the moving parts be lubricated, kept clean, and above all use good gasoline and oil.

When you are not going to use your engine for any length of time, i.e., you are going to store it away during the winter months, you should do the following: Wipe the entire engine of any accumulated oil, then remove the spark plug to make sure that it reaches all the moving parts. Wipe the entire engine with an oiled rag. The engine should then be wrapped up in a piece of oiled cloth and stored in an absolutely dry place. This procedure will prevent rust from forming on the engine and will save the inside walls of the cylinder from rust also.

When you are transporting your engine to and from the contest field, keep the engine covered with a piece of cloth, so that no dirt or sand may get into the cylinder or gas tank.

Should your plane happen to have a rough landing during which the engine thoroughly for any signs of sand that may have fallen into the cylinder. If this should be the case, get a piece of clean cloth and wipe the engine and front of the plane clean. Make sure that you do not turn the propeller. Then get some clean gasoline and spread it over the engine and wipe it up. After this operation is finished, remove the plug and spill some clean gasoline into the cylinder to wash out whatever foreign matter may be in the cylinder. Make sure that everything is wiped dry before attempting to use the motor. Before sitting, don’t forget to put the motor in the case because if you put the telephone in the cylinder it also washes out the oil that was on the walls of the cylinder. Another important operation is to clean the breaker points. A simple way to do this is by inserting a piece of cloth between the points and then letting the points close. Pull the cloth out from between the points and they are automatically wiped clean and dry. Wash your spark plug dry in clean gasoline before putting it back in the motor.

The main reason why some fellows run into trouble is because of the way they care for their engines. Most carelessness is with the ignition system and this usually gives all the headaches. All some fellows worry about is to get the unit in the plane and depend on rubber bands to hold it down. When they run into trouble, they don’t know where to look. Some fellows bring their batteries to the landing gear, and common sense will tell you that when that particular model comes in for a landing something is bound to come loose, so why not do the job right in the first place. And all your headaches? When you and ready to transport your engine and ignition system in your ship, figure out the easiest or best way.
for rigging up the ignition system. Hook it up so that you will have easy access to every wire, so that when you get on the contest field and something goes wrong you will be able to look at the wires with a glance without having to tear half your ship apart to get at the wires. A splendid example of neat wiring and mounting job is the system used on the KG model. The complete unit including the motor and ignition is mounted in one compact unit, which is removable at all times for inspection. Another good example of neat wiring system is the one used by the CSS team from Lyndhurst. Now their ship is a high motor job with the motor mounted high on the wing. Naturally they could not follow the KG system so here is what they devised: The coil and batteries were set in the fuselage. They have wire of different colors running to a miniature switchboard which is near the location of the wing setting. This board is somewhat like a telephone operator's switchboard, and the wires which lead from the motor just plugged into their respective jackets.

Have you often wondered how some fellows can cure an engine of bugs in a remarkably short time when you spent a whole day trying everything from ether in the gas tank to new batteries every five minutes? You can be just as proficient as they are. All you have to know how to do is to be able to recognize various symptoms of motor troubles.

**Trouble Shooting**

To be able to shoot trouble successfully and systematically, it is necessary to know:

1. The general design of the motor, distributor, and the carburetor.
2. Degree of vibration at various speeds.
3. The correct spacings of the spark plug electrodes.
4. The correct spacings of the distributor contacts.

There are two main sources of trouble:

1. Carburetion.
2. Ignition.

It is wise then to be able to recognize various symptoms of troubles. The following chart of motor troubles should help you in analyzing and rectifying the troubles before successful operation may be had.

**Motor Refuses to Start**

Sources of Trouble.

A. **Carburetion**.
   1. Motor not primed.
   2. No gasoline in cylinder.
   3. Needle closed.
   4. No gasoline in gas tank.
   5. Gas line clogged. (Clean line. If necessary remove tank and clean.)

B. **Motor Flooded**.
   1. Needle opened too much. (Close needle, remove plug, turn upside down and pump out the gasoline.)
   2. Too much gas being drawn in without any spark occurring. (Clean spark plug, check batteries and connections.)

C. **Ignition—Weak or no spark**.

Open needle for more gasoline.
Check for loose connections and low batteries.

B. **Slow Running**.
   Too rich a mixture. Close needle.
   Test for good spark.
   Motor has too much gas in crankcase. Flooded.

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**A Gas Model Range Finder**

By ELBERT J. WEATHERS

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**IMPROVED WEATHERS’ RANGE FINDER**

**Procedure**

1. **Note Distance to Model**.
2. **Note Angle of Elevation**.
3. **Height of Plane** = Distance Away X TAN [Angle of Elevation,
   4. **Horizontal Distance** to Plane = Distance away X COS [Angle of Elevation].

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**Stiff Cardboard**

**IMPROVED WEATHERS’ RANGE FINDER**

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**Balance Block is Optional—Thumbtacks May Be Used.**

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Bring Them Down Safely!

Practical developments of dethermalizing models so they do not fly out of sight

by Carl Goldberg

By the end of the 1941 outdoor flying season so many gas and rubber powered models had been lost that there arose among model builders everywhere a clamor for some means which would prevent ships from flying out of sight. This was no new problem, nor was there lacking a device to bring models down. Every once in a while for several years past a bright idea would pop into the head of some ambitious model builder, who then proceeded to install a packed parachute in his model, the chute being ejected by means of some timing device at the moment previously set.

Mr. Goldberg holds Dave Kloepfer’s gas model equipped with stabilizer dethermalizer.

Because of the very high drag thus created, the model would settle to the ground.

But in general, most modelers were pretty well occupied with the problems of getting their models and motors to perform with reasonable dependability. Butters, they turned away from taking on a new and rather mysterious job; to put it is a nutshell, there were enough worries in getting the crate high enough to make a decent flight, on the skinny little motor run, without trying to bring it down afterwards. By 1940, this set of troubles was pretty well licked, and there were plenty of ships lost. In 1941 the art of adjusting fast-climbing, well-gliding ships “clicked” for so many modelers that as soon as a model was built and tested a few times there was great danger of losing it.

And then the clamor came. All sorts of rules were proposed: A rule to judge performance by the ratio of glide to motor run; a rule to judge a ship by its appearance, workmanship, engineering and ability to make a pretty flight; a rule for using complicated formulas. It seemed as though everybody and his brother had a pet idea on rules for 1942. Perhaps the most general idea was that weight of models should be increased and length of motor run cut from 20 down to 15 seconds. Both of these things ran against the grain, because the majority likes to hear the motor in the air for more than just a few seconds, and dislikes building ships which glide and sink so fast that they hit the ground with a resounding “clunk!”. But none of the other suggested methods held any great appeal either, so there didn’t seem to be much choice. The great number of letters and ideas submitted on the subject to magazines proved one important fact—that model builders everywhere were actively interested in helping to form the new rules.

About this time it became known that top-notchers Dick Korda of Cleveland, along with his fellow experts of that area, was using a simple and amazingly effective device to avoid losing rubber powered models. Using an Austin Timer for release, at the given moment a rudder tab was pulled over at an angle which caused the ship to spiral dive swiftly to earth. A magazine article by the writer helped give news of this development to the nation’s modelers, and asked consideration of the advantages of dethermalizing (bringing ships out of the thermals—rising air currents—which carry them away) as opposed to heavier ships, etc., etc. Granting that the speed of spiral dives would damage gas jobs, the idea was submitted that some safe means of dethermalizing these models be found.

And now the controversy rose towards its full height. At first, many thought, “Of all the scatter-brained ideas—this takes the
cake." But others saw the true value of dethermalizers and began
to fight for them. They could see that here lay our only worth-
while hope—a means of positively making the ship come down,
long after it was beyond reach, even though it was so high in the
sky it could hardly be seen.

Then suddenly we were fully into the war. Discussion of rules
ceased in magazines; the rules were supposed to have been officially
announced early in January 1942, to allow plenty of time for all
builders to work out any necessary changes of design. Instead,
in the middle of January a memorandum was sent out by the
Chairman of the Contest Board to certain leader members of the
Academy of Model Aeronautics asking their reaction to an entirely
new proposal. This proposal would have limited flights to a max-
imum of three minutes; anything under the limit was all right,
but even one second over would cause the flight to be recorded
as zero. In spite of the fact that there has never been any way
(aside from radio control) to accurately control the model's
descent, it was claimed that this provision would place a premium
on skill. Rather than calling for skill, however, it would be more
like a lottery, or bingo, or any other game of chance; and so it
was recognized by most people. So much opposition arose that
this rule was greatly modified before finally being announced as
official. The final form provided that 4 minutes was tops, and
anything over (such as 30 seconds over, or 1 minute 15 seconds
over, and so on) must be deducted from the maximum of 4 minutes.
Flights over 6 minutes are credited with zero time.

In some ways it is still a bad rule since it leaves so much un-
necessarily to luck. Flights of between 4 and 6 minutes surely
are deserving of at least a 4-minute credit, and some means of
settling possible ties can well be worked out. However all in all
the rule does no great harm, and it does accomplish the worth-
while purpose of encouraging us to keep the ship close to the
field, so that it won't cause confusion among aircraft spotters and
thereby bring down a government ban which, for the good of the
nation, would prohibit model flying. And it is good to keep in mind
the fact that there are always some people in power who like to
use any excuse to force a large group to bend to their will. (Gas
model flying was absolutely forbidden in several eastern states only
a few years ago, and the Academy and the National Aeronautic

Association by much hard work was barely able to prevent harsh
restrictions from being imposed on a national scale.)

It is easily seen that this four-minute rule lays heavy emphasis
on the use of some kind of dethermalizing device; yet, during
1942 only a very few dethermalizer types were developed and
publicized. This was partly due to the fact that when the rules
finally did come out it was already so late in the year that most
builders were unable to spend time on new designs, and many
contest directors could not arrange for meets. Indeed, a number of
contest directors refused to use this rule. Also, because of
conditions connected with the war, the Nationals was called off,
as were nearly all large intersectional meets. So, in spite of

Duane Webber and his tail-dethermalizer model
accomplishments to date.

To begin with, Korda's dethermalizer was good because it took proper account of four main points: (1) increased the sinking speed of the ship so greatly that no ordinary thermal would hold the ship up; (2) the device was simple and easily set; (3) was light, but not delicate; (4) and finally, didn't interfere with the plane's design. One disadvantage was that it couldn't be used very safely on gas jobs; it even damaged rubber ships occasionally, although only slightly. Of course, even a badly damaged gas job would be preferable to having the ship lost, but modelers in general have had so much grief with the results of not being able to use it that they just naturally stayed away from doing it on purpose.

To prevent this damage, Bill Schwab, also of Cleveland, worked out one of his usual clever devices. Schwab tied or glued the end of a spool thread to one wing tip of his model and put the spool inside a compartment which opened underneath the body. At the desired moment a timer opened the trap door through which the spool fell, unwinding the thread. With the spool hanging freely, 150 lbs. of thread tied to the wing tip, the weight and drag threw the ship into a steep spiral dive, the same as Korda's device. When the ship came down low, however, the spool hit the ground, thus taking the weight off the wing tip and giving the model a chance to straighten out and glide safely down.

Bob Burley of Chicago, and Don Foote of Oakland, Cal., separately worked out parachute devices which brought the ship down to a horizontal attitude. Burley built a compartmentalized stream-lined box containing the packed chute, a spring to eject it, and the timer, the box fitting on top of the center of his wing. The chute would stream back from the wing and create so much drag that the ship sank through the air at a very steep angle. Not much information on Foote's device has reached this writer, but it seemed also to be a stream-lined box similar in idea to Burley's, except that it attached under the body directly beneath the point of gravity. One advantage of this sort of dethermalizer is that, in case the builder has several models, the entire setup can be transferred from one to the other, thus cutting down cost and building time.

Dave Kloepfer, of Chicago, built a somewhat similar arrangement right into the body of his ship, and thus did not increase the drag. At the proper time a chute would pop out of the top of the body right behind the wing mounted. His beautiful flat spins soon disappeared, however, because the chute did not give enough drag to increase the sinking speed beyond common thermal rising velocity of 5 to 8 feet per second.

Another development of the chute device consisted of mounting the gadget about halfway out to the wing tip. When the chute was ejected it produced a kind of flat spin which brought the ship down fast, but without too much forward speed. Several other variations of the chute principle were built around the model of Chester Lango, of Cleveland. On a large outdoor rubber powered fuselage model he hinged a large portion of the top of the body so that it swung up and back to a vertical position. The drag was to cause loss of forward speed and consequently increased sinking. Some builders swung panels placed on the sides of the body out at right angles to the line of flight. Experiments and observations by the writer, however, soon convinced him that drag panels around the body are not an effective means because they generally cannot be made large enough to sufficiently increase the sinking speed.

One Chicago modeler, however, while experimenting with drag flaps located under the wing near each tip, discovered that although the ship would not sink fast when both flaps were down, it went into a satisfactory altitude-losing flat spin when just one flap was lowered. Sometime it seems as though accidental discoveries are the most advantageous! It was in just such a manner that in 1931 the writer discovered the principle underlying a very effective dethermalizing device.

At that time, while experimenting with a hand-launched glider, a peculiar effect was observed. The body of the glider had become broken just forward of the tail, but at the top of the break enough flares remained to form a sort of hinge between the tail and the body. The model could be thrown up, with the tail somehow remaining in line, but instead of the usual glide from altitude, the tail would then take on a large negative angle and a very steep descent resulted. The flight attitude remained steadily horizontal. There was none of the pitching up and down that model experience has always taught results from setting the stabilizer at a negative angle. The whole performance was rather mystifying.
but repeated trials worked exactly the same, until finally the tail broke off completely. On February 22, 1942, the experiment was once again repeated, this time using an Interceptor gas model belonging to Mr. Charles E. B. Wood of Chicago, who courageously volunteered his ship for the test. With the model gliding at an altitude of over 300 feet, the tail popped up to a pre-set angle of about 30°. The rear of the ship jerked violently down and the nose up, so that for a second the model looked like a rearing horse. Then immediately the nose came down slightly below horizontal and the ship went into a flat spin that brought it to the ground in 20 seconds.

This system has since been tried on all sorts of models, large and small, gas powered and rubber. Some further curious facts have been brought to light. At negative stabilizer settings of between 20° and 30° some models have shown a tendency to tailspin. With the nose steeply down the ship spins rapidly around and descends swiftly. One valuable feature of this peculiarity, says Milton Burley, 1942 city champion of Chicago, is that flight of the model. Although the tail is just a speck, can be more easily "picked up," when this rapid spinning begins. From 30° to 75°, the sinking speed increases with the steepness of the negative setting. At 75°, in fact, the ship sinks practically straight down and at its fastest. The attitude of the model is that of level flight; some flat spin to the right, some to the left, and some don't spin at all. If the stabilizer is allowed to reach 90° a fast series of small diameter loops (in other words, auto-rotation about the lateral axis) begins immediately and keeps up until the ship hits the ground. This happened to the writer a number of times and (miraculously, it seemed) always without damage. At seven months in 1942, taking at least one first in practically all of them, Burley saw this dethermalizer bring his ship down out of thermals. In fact, on one occasion, the ship was high out of sight for quite a while before it reappeared, spinning down.

Another peculiarity was discovered when, on the second trial with Hershey Goldenberg's model, the dethermalizer timer accidentally went off before the motor quit. The slipstream blasted the up-angled tail off the ship in a flash, breaking the weak hinge, and just then the motor stopped. The nose of the ship dropped to about 20° below horizontal and the ship proceeded to flat-spin down just as safely as, and even more quickly than the previous test. The tail, meanwhile, rolling over constantly, drifted about a block further before landing.

On other occasions the dethermalizer timer had been set for a short time and not carefully watched, with the result that it went off while the motor had some 5 or 10 seconds more to run. When the stabilizer went up some ships would hang in the sky, nose-up, with the motor roaring for all it was worth and going nowhere. Others would go into a flat spin. It all seems to depend on the rigidity of the tail hinging arrangement, and the warps (or lack of them) in the wing.

Special advantages of this system of dethermalizing are, briefly: (1) rate of descent (which can be governed by the setting of the tail) is fast enough for escape when captured by thermals, yet so safe that damage to the ship is practically unheard of; (2) additional weight which must be carried, aside from the dethermalizer timer, is less than 1/4 oz., making it practical for even the smallest gas and outdoor rubber powered models.

One method that has been widely tried is the "spoiler" system used on man-carrying sailplanes. When these small flaps are opened on a model, however, the ship goes into a steep dive and picks up so much speed that damage is almost sure to result.

Frank Elbing, the well-known old-timer from New Jersey, recently published details of his unique (as usual) dethermalizer which at the proper moment raises extra rudders which have been lying flat in the top of the stabilizer. The extremely large rudder area then forces the ship to head into the wind (except on calm days, of course) so that it doesn't get far from the field and soon drops out of the thermal which naturally is traveling with the wind. If the wind isn't too strong, it is even possible with this method for the model to return to the field!

It is worthwhile to mention the important work done by the Hillcrest Mfg. Co., of Los Angeles. Hillcrest discovered that the usual airdraulic timer exceeds the time for which it is set on the ground if the ship reaches any considerable altitude. Studying the reason for this (it's due to the decrease in atmospheric pressure with increasing altitude), they decided to take advantage of it by reversing the action of the spring inside the timer. Thus as the ship goes higher, the time necessary for the timer to work gradually becomes shorter! They also have worked out an adjusting screw which is ideally located for easy accessibility and setting. These contributions are notable indeed, and will no doubt soon be fully recognized and appreciated.

In closing, let's recall past days and compare them with the present. When your ship hit the ground you'd pray for it to be strong enough to hold the model as long as the timer at the field could possibly see it. Then you'd start wanting the ship to come down. Paying no attention, it would go soaring along, sometimes so high you could barely detect it by straining your eyes to the utmost, sometimes down to a few hundred feet so that you thought you'd soon have it back, only to have another thermal grab it and whisk it out of sight for good. It was always a gamble.

But today! Boy! What a feeling to chase your ship, knowing that even though it's already so high it's only a speck, it will begin twisting its way down, down, down to safety and many more thrilling flights!