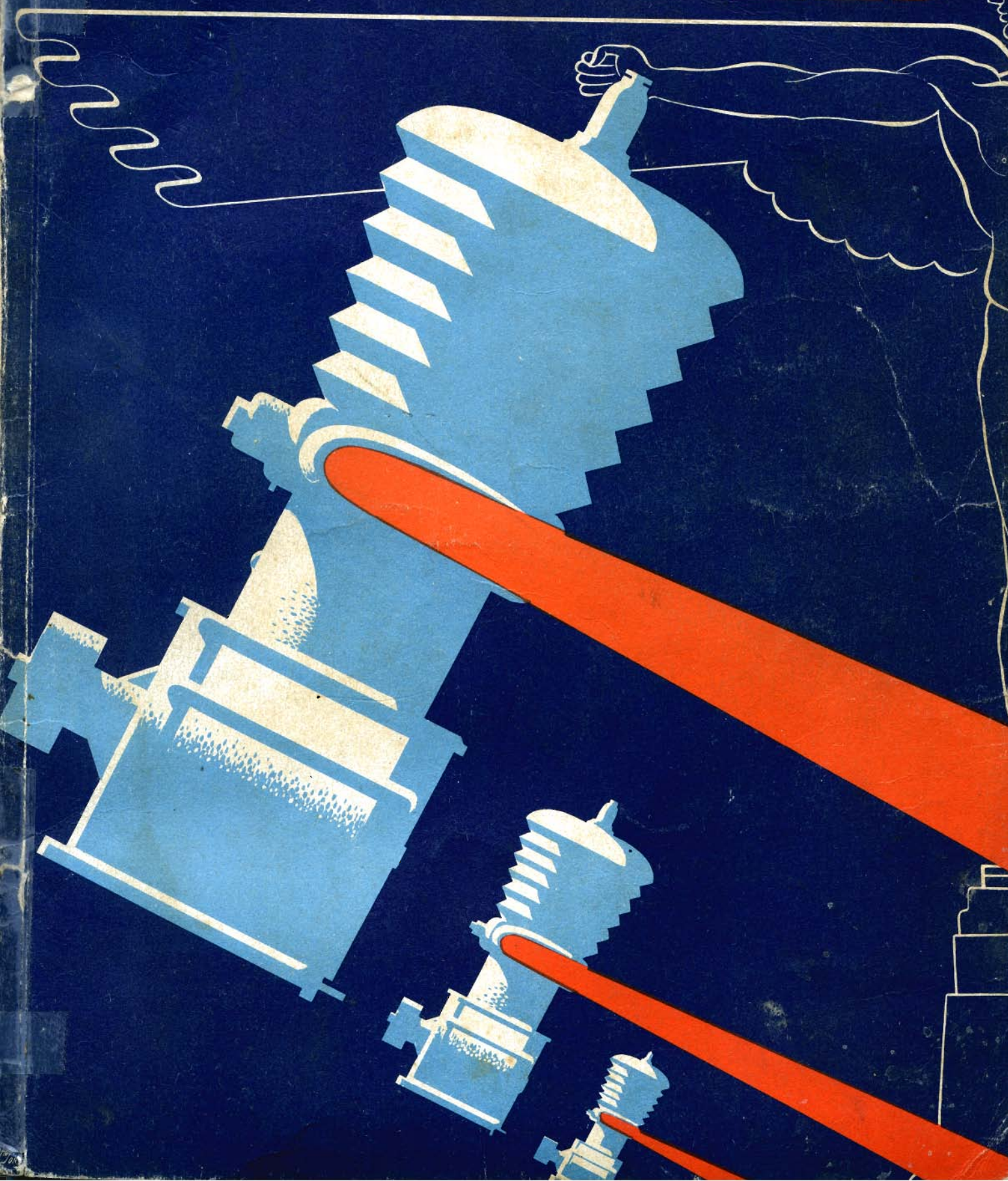


AIR AGE

GAS MODELS



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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.



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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!

NOTE

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

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 midjet gasoline motor made its bow that this activity came into its own. Fellows who expect to take 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 need some good cross-country 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, powered by the now famous "Brown Jr." motor. The first flights 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 should not be allowed to compete against rubber-powered ships. Accordingly, 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 in this event, only two of the 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 testhops. 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 planning improvements 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 further on.) At this 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 their position by this time, 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 fellows who would like to build a gas model, 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) offers many more 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 to 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 can be counted on to give 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 $\frac{1}{2}$ lb. per sq. ft. of area.) This will give the ship a low flying speed, which will tend to minimize the damage due to crashes, 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 makes 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 market now are made so that 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, and 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 fly without stalling 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 its being 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 of span, that is, if 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!

"Detachable 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 overhauling of the power plant. It also permits replacing an engine unit, should the motor act balky, with one which functions properly. 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 of the battery-box, slip in a fresh set, 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 it was flying crashed into a hangar head-on. The only damage sustained was two wrecked fuselage 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 when, after you have 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 wooden prop). A wooden propeller is 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 itself. If a metal prop were used, 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 cowl that will not complicate the removal of the engine unit to any extent. You might have the two sides and bottom of the cowl 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 about it would be to have a completely 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 any 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 fins. Last but not least on the subject of construction design. Remember that strength receives 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 template looks like the curve you are going to use. Be sure that it is exactly the curve you want to use. If your template is out a bit 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!

If you're a beginner in 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 plan, the result will be to change the 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 fin, then cover 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.

If the ship is covered with sheet-wood, you'll probably want to color it. A good method would be to give it a coat of colored tissue. This not only serves to beautify the model, but also makes the covering tougher.

With regard to the motor-mount—it can be built either all-metal, or, preferably, of a hardwood framework covered with plywood. Should you build the wood 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 .096 music wire with a pair of pliers, you'll realize what a trying job it is. If 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.

Well, that just about covers 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 good place to test-hop the ship.) 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 crate to fly properly, use the above-mentioned runway as often as possible, as it is a distinct aid to 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 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, heave it hard enough so that it will gain flying speed immediately. Otherwise, it may hit the ground before it can get started. 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 safely on the ground until it has 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

possible) and note its action. If it refuses to gain altitude, you may either move the wing forward slightly (on the next flight, of course,) or raise the trailing edge of the stabilizer a bit. If the ship swoops up, stalls, then dives, then keeps repeating the maneuver, the best bet would be to lower the trailing edge of the stabilizer about a half degree ($1/16''$ for each 4" of stab. chord), especially if you're sure you have the wing set in its proper position. If the ship has a tendency to bank steeply, give it a bit of opposite rudder. You may have to move the wing back slightly after doing this, but try it first with the wing set as it was.

Now that you've got her flying right, the next step is to get a car so that you can chase the crate when it starts on one of its cross-country jaunts.

NO MATTER how well a gas model may fly, no matter how perfectly it glides, there is always a time when something goes wrong. "Into each life some rain must fall." The ship may either fly into something or hit some obstruction while coming in for a landing. Although this mishap is comparatively rare, it is entirely possible that the model might be hit by an auto while landing. (Yes, it happened to me once!) Then there's always the chance that the crate, reverting to nature, might land in a tree or on some telephone wires, thinking it is a bird (probably a cuckoo). If you get it down uninjured, you're one of the lucky few! The fact remains that sooner or later, there will be some repair work to do. Don't be satisfied with a make-shift job. Of course, there are times, at contests for example, when you haven't much time for an elaborate repair job. In that case, it's all right to do a temporary job, but just as soon as you have the time to do so, ascertain the total extent of the damage, remove the damaged parts, and replace them with new parts, so that the finished job makes it hard for the casual observer to note just where the repairs were made. In the case of a broken wing or stabilizer spar, or fuselage longeron, it would in most cases be impractical to replace the entire spar or longeron. In that case, the job would be to splice a new piece into place, and cement a gusset strip to each side of the joint.

Unless you have a real efficient landing gear, that is the part that usually comes up most for repairs. If you have a wire gear, the damage is usually limited to a couple of bent struts, which can be straightened without much difficulty. It is the woodstrut type that seems to take the most beatings. A good temporary repair job may be had by cementing a strip of wood or sheet metal to each side of the break, then winding silk over the joint, giving it a good coat of cement to finish the job.

If you expect to enter contests with your ship, do not wait until the day of the meet to test-hop your ship. Test it as soon as you can, so that you'll have plenty of time to make any necessary repairs and to take out any of the "bugs" the ship may have. If you have time, carve about four or five spare props. They're sure to come in handy some time. Arrange

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 at 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 is brought to a sudden stop 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 strands 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 fellows 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 not later than the day before the meet, so you'll be sure the motor will run 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 might not run on his fuel. Do you remember that old saying, "What's fuel for one engine is just a lot of hooey to another?"

Well, that pretty nearly covers the preparation for a meet. Now for the problem of putting the ship into storage between contests, or for the winter. If there are any damaged parts, repair 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 there are any rusty parts 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, clogging the gas line. Pack 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 damp place will cause the surfaces to 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, remember's 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-model.

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)! It would take many articles 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 to do is to get "in the swim." The water's fine!

* *

Progress in gas model design in the past few 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 the inherent 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, normally 50 to 100 feet away. The operator pulls or relaxes the various wires thereby 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. Main object, for competitive purposes, is high speed 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.

A new sonic remote control has been experimented with in which a noise of a specified pitch actuates the control surfaces. Automatic stabilizing devices are now in development, the equivalent of the well known automatic pilot used on large airplanes.

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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 I

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 17-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.

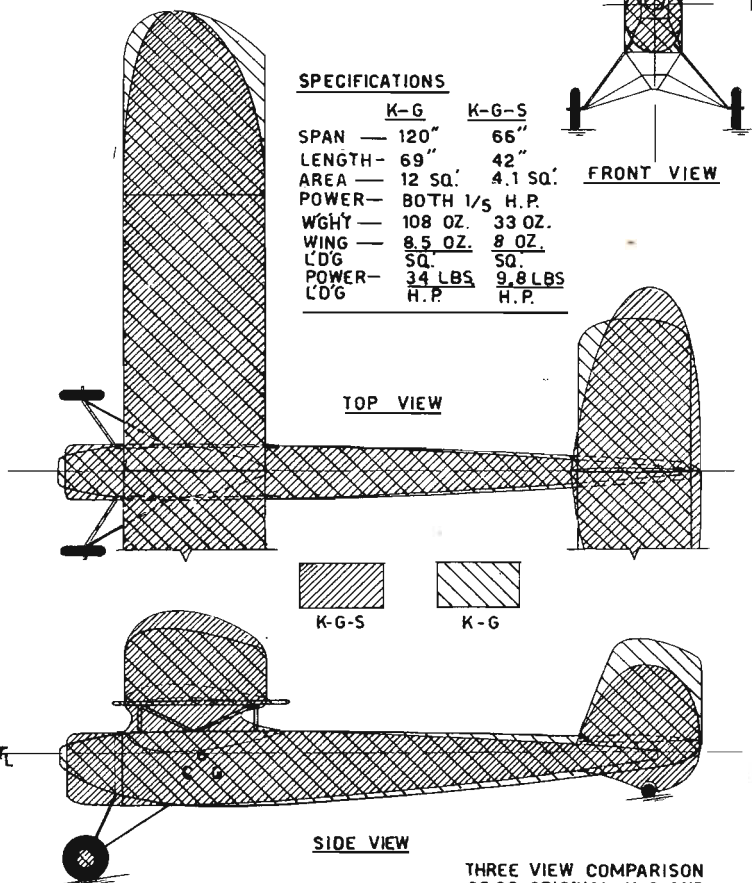
Construction Notes and Material List

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



PLATE I

ASSEMBLY VIEWS



THREE VIEW COMPARISON OF ORIGINAL K G AND MODERN COUNTERPART

PLATE III

PATTERNS FULL SIZE

CAP STRIP

W-1

W-2

W-3

W-4

W-5

S-6

S-5

S-7

S-3

S-2

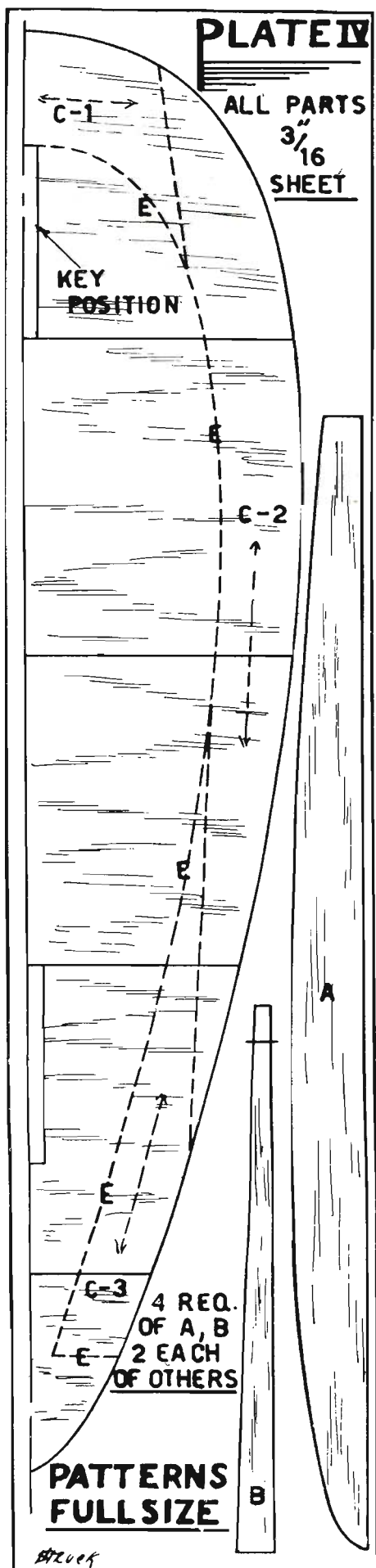
S-1

18 OF W-1 REQUIRED
2 EACH OF ALL OTHERS

ALL RIBS
1/16 SHEET

CAP STRIP

DRUGH



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

- (4) 1/16x 2x36—Soft balsa
Stabilizer leading edge cover, ribs.
- (2) 1/16x 3x36—Med. balsa
Wing leading edge cover.
- (8) 1/8x 2x36—Soft balsa
Bulkheads, planking.
- (2) 3/16x 2x36—Med. balsa
Trailing edges of tips, fillets and pylon formers.
- (5) 1/8 sq. x 36—Med. balsa
Inner frame of fuselage.
- (3) 3/16 sq. x 36—Med. balsa
Leading edges.
- (4) 1/16x1/4x36—Soft balsa
Cap strips.
- (3) 1/8x1/4x36—Hard balsa
Leading edge spars.
- (3) 1/8x1/2x36—Hard balsa
Mainspars.
- (2) 3/16x3/4x20—Med. balsa
Trailing edge.
- (1) 6x4, 1/16" plywood
Front bulkhead.
- (1) 3x3, 1/8" plywood
Motor bulkhead.
- 24"—1/8 wire
Landing gear.
- 12 sheets tissue
Covering.
- 1/4-yard silk
Fillet covering.
- 3x5,—.040 alum.
Motor bearers.
- (5) 3/32"x3/4 bolts
Motor mount assembly.
- 12"—.028 & .040 wire
Wing and tail hooks.
- (2) bicycle spokes
Motor retainers.
- 24"—1/4 alum. tubing
Rudder outline.
- 1 pt. cement and 1 pt. clear dope.

Wing and Tail Construction

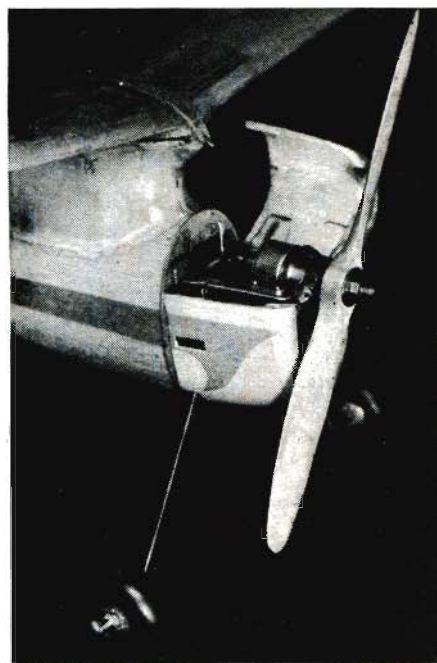
As the construction of the wing and stabilizer is identical, they will be described together. From the 1/8" to 1" drawings given on Plate II make full size layouts on which to build. The distances from the leading and trailing edges to the center line are given for each rib station. Connect these points 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 cross 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



The engine cowl cover folds back allowing access to the engine unit

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 width strips over the center ribs. Trim excess balsa from the leading edges and smooth the framework with successively finer grades of sandpaper. (See typical airfoil construction, Plate II.)

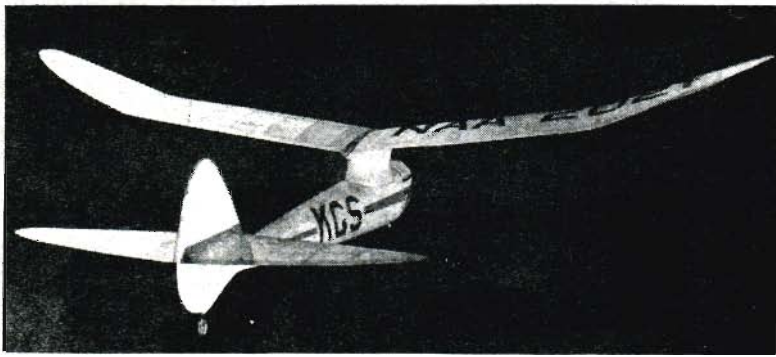
On Plate IV the wing and tail base patterns are given in full size. Parts E and the extra pairs of A and B form the wing and tail rests incorporated in the fuselage. Next step is to set a pair of auxiliary spars of 1/8" sheet in the center section. Cement the wing base outline composed of C-1, 2 and 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-



It embodies the same stable arrangement as its big brother K.G.

wise. Cover the bottom of the wing first, being careful to dope the tissue to the bottom of every rib to preserve the air-foil 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 till 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 ad-

justment 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.

Engine	Displacement	Minimum Possible or Required Weight	Wing Loading in Oz. per Sq. Ft.
*Ohlsson 23.....	23	33 oz.	8
*Hi-Speed Torpedo.....	30	33 oz.	8

The next 5 engines give the best results in Class C

Baby Cyclone.....	0.357	33 oz.	8
Mighty Midget.....	0.45	36 oz.	8.6
Gwin-Aero	0.45	36 oz.	8.6
Hurleman Aristocrat.....	0.488	38 oz.	9.1
Sky Chief.....	0.526	42 oz.	10
Dennymite	0.57	46 oz.	11
Brown	0.6	48 oz.	11.3
O. K.	0.6	48 oz.	11.3

*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.

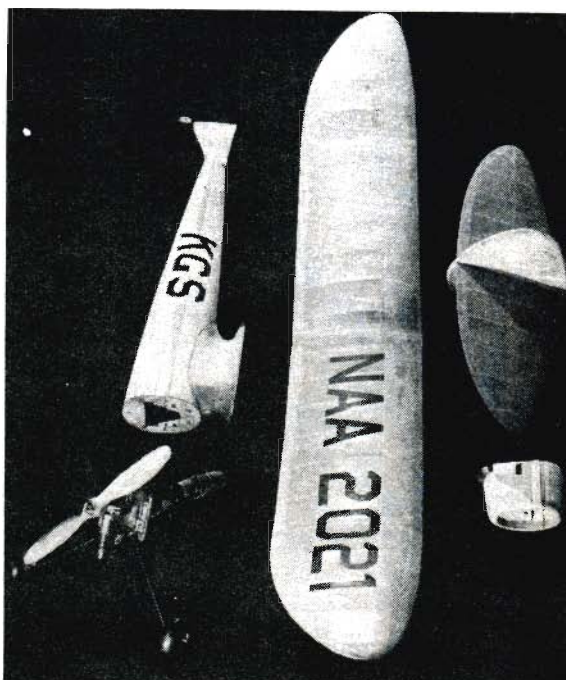
PART 2

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



It is composed of structural units that may be assembled or taken apart quickly

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, shown full 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 "U" 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)

PLATE V

MOTOR MOUNT RETAINER DETAIL

MARK PLANK AND CUT ALONG DIAGONAL

BICYCLE SPOKE

F-2

F-3

4"

1/8" SQ.

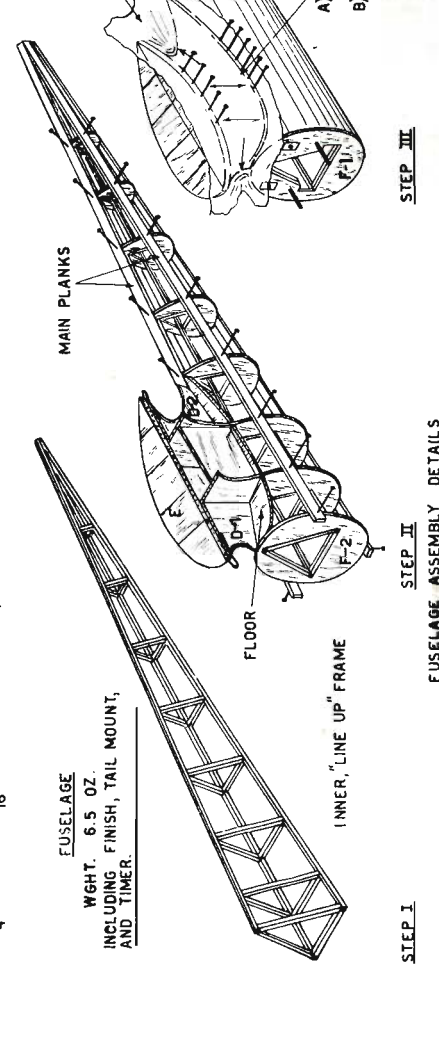
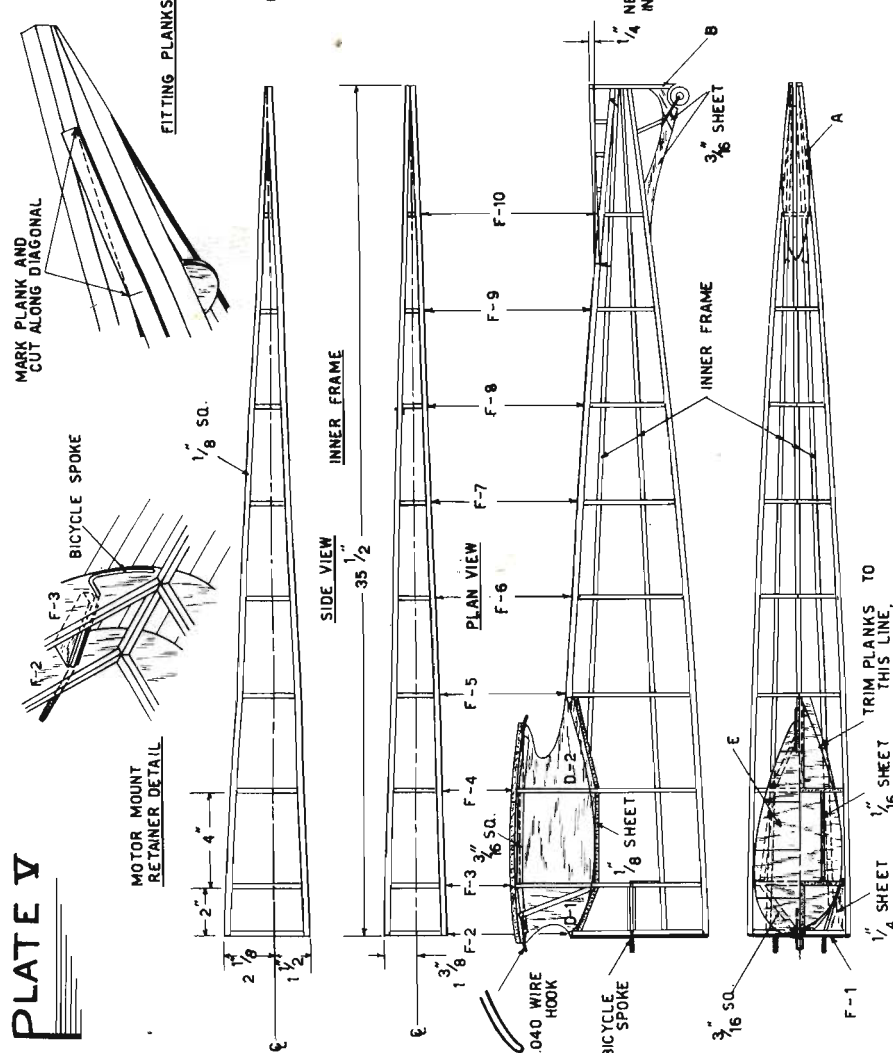
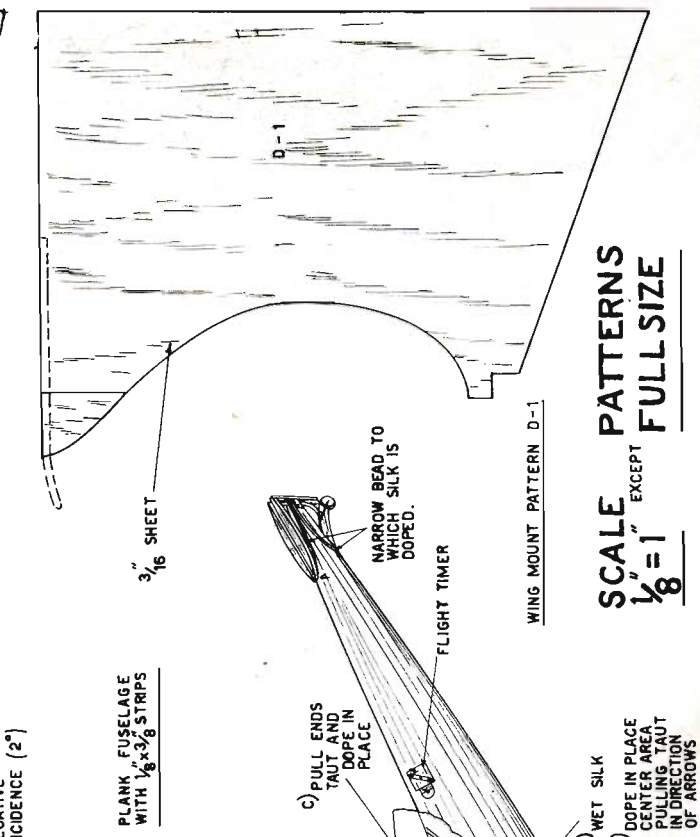
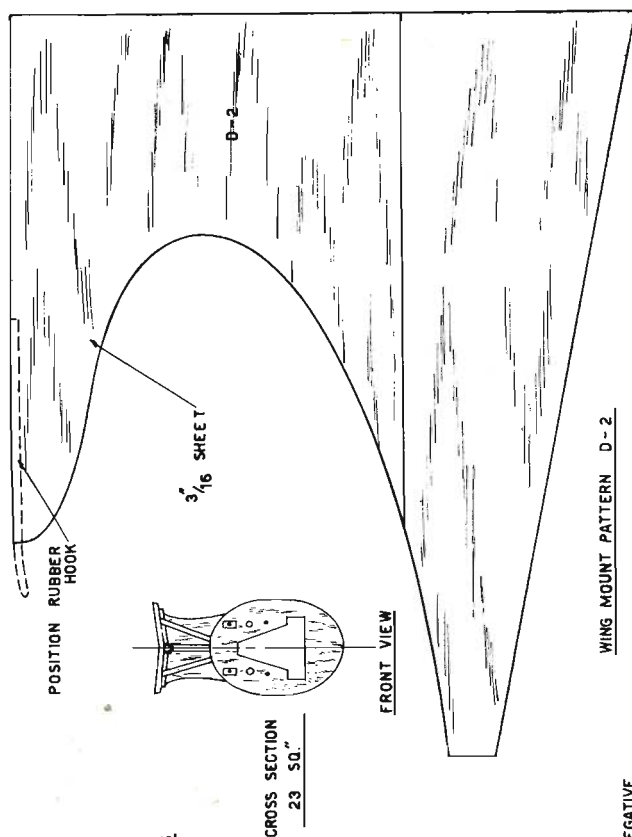


PLATE VI

ALL
BULKHEADS
 $\frac{1}{8}$ SHEET

POSITION
PYLON
FLOOR

F-2
SHOWN BY
BROKEN
LINES

F-1
SHOWN BY
SOLID LINES,
 $\frac{1}{16}$ PLWOOD

PATTERNS
FULL SIZE

F-8

F-6

F-7

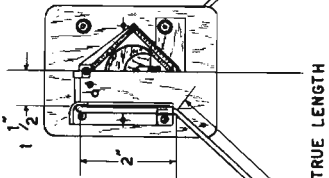
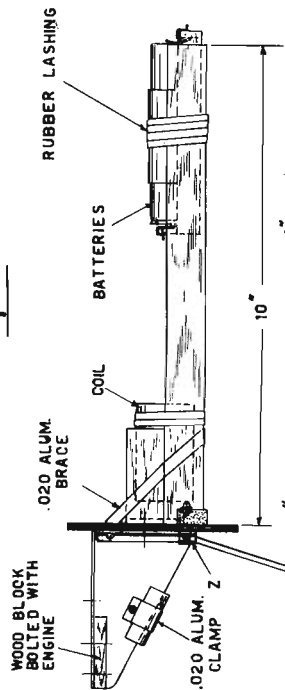
F-5

F-10

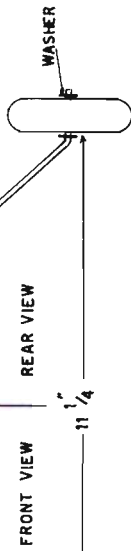
F-9

#TRUCK

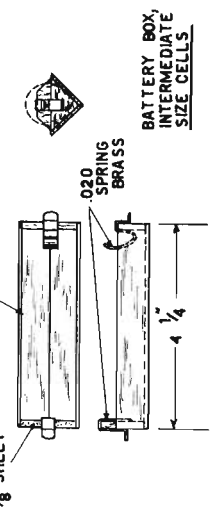
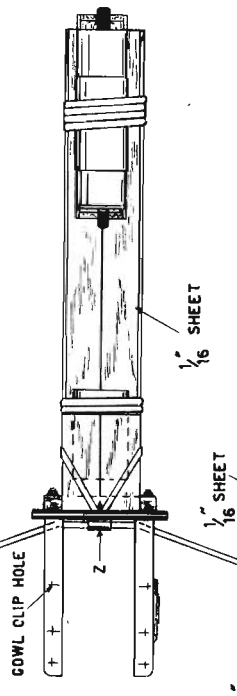
SCALE $\frac{1}{4} = 1"$ EXCEPT PATTERNS FULL SIZE



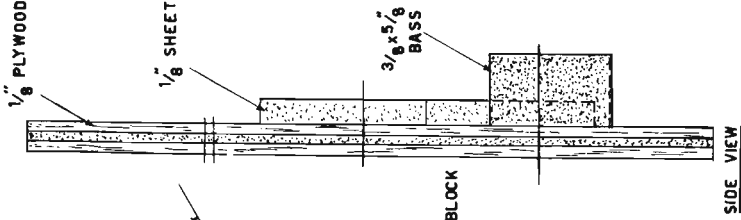
MOTOR MOUNT BENDING



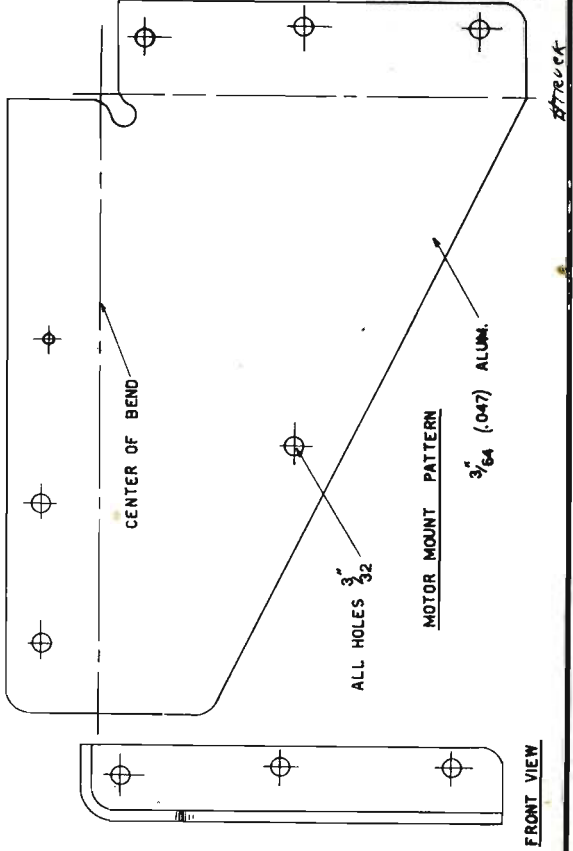
MOTOR UNIT
WGHT. BARE 4.5 OZ.
INCLUDING
BATT. COIL, ENGINE, 21 OZ



PATTERN
FITTING Z
.020 ALUM.



MOTOR BULKHEAD



MOTOR MOUNT PATTERN

3 1/64 (.047) ALUM.

ALL HOLES 3/32

CENTER OF BEND

FRONT VIEW

Sheet

The K.G. Lives Again

(Continued from page 14)

Install the motor mount retainers formed of bicycle spokes, and reenforce 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 3/8" 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 bulkheads. 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 autoknips 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" square 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 taut using pins to hold it if necessary. (C) Then draw in each end, pulling lengthwise, doping and pinning the silk in place in a similar manner. When the water has evaporated apply two or three more coats of dope to prevent the silk from springing 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 similar 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 fillet 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" bass, which fits snugly into F-1, to the bulkhead. Glue the battery trough of 1/16" hard sheet balsa into the Vee-shaped notch 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 3/64" 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 mounting 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, cowl 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 circles slightly larger 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 of it when you give the timer the full run of twenty seconds and open the engine wide. The K-G has come back,— "and how!"

PLATE VIII

G-3 SHOWN BY
SOLID LINES,
1 1/2 SHEET, OTHERS 1 1/8 SHEET

TIMER SWITCH

BATTERIES

IGNITION HOOK UP

COIL

JACKS

COND.

GRND

POINT

BOOSTERS

LARGE FACE
BUSHINGS

SOLDER

AUTOKNIPS
TIMER
CONVERSION

.014
WIRE,
SPRING FIT

.010 BRASS

FRONT

COWL
1 1/4" = 1"

G-2
BROKEN LINES

.028 WIRE
RUBBER BAND

CLIPS
IN MOTOR
MOUNT

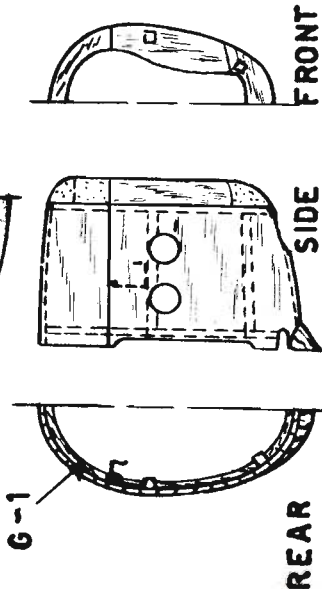
1/16 ALUM.
TUBE

ALUM.
VENT.

TRIM G-1 TO
BROKEN LINE
AFTER COMPLETION

FULL SIZE

G-1 G-2 G-3



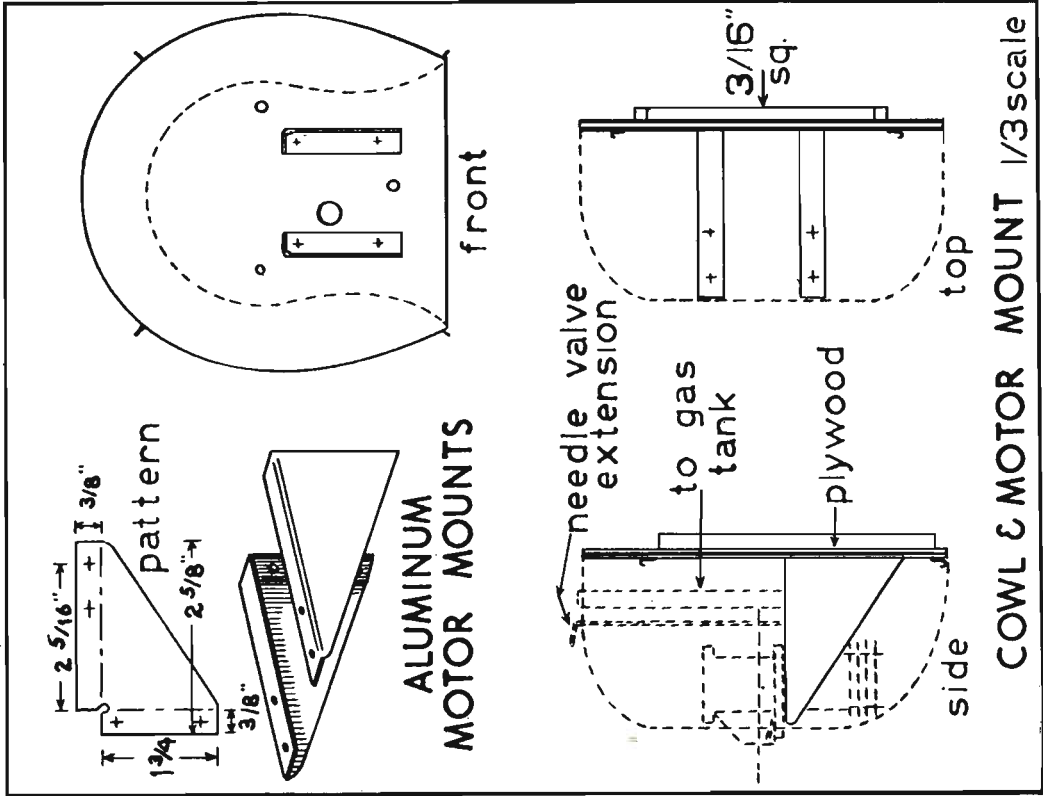
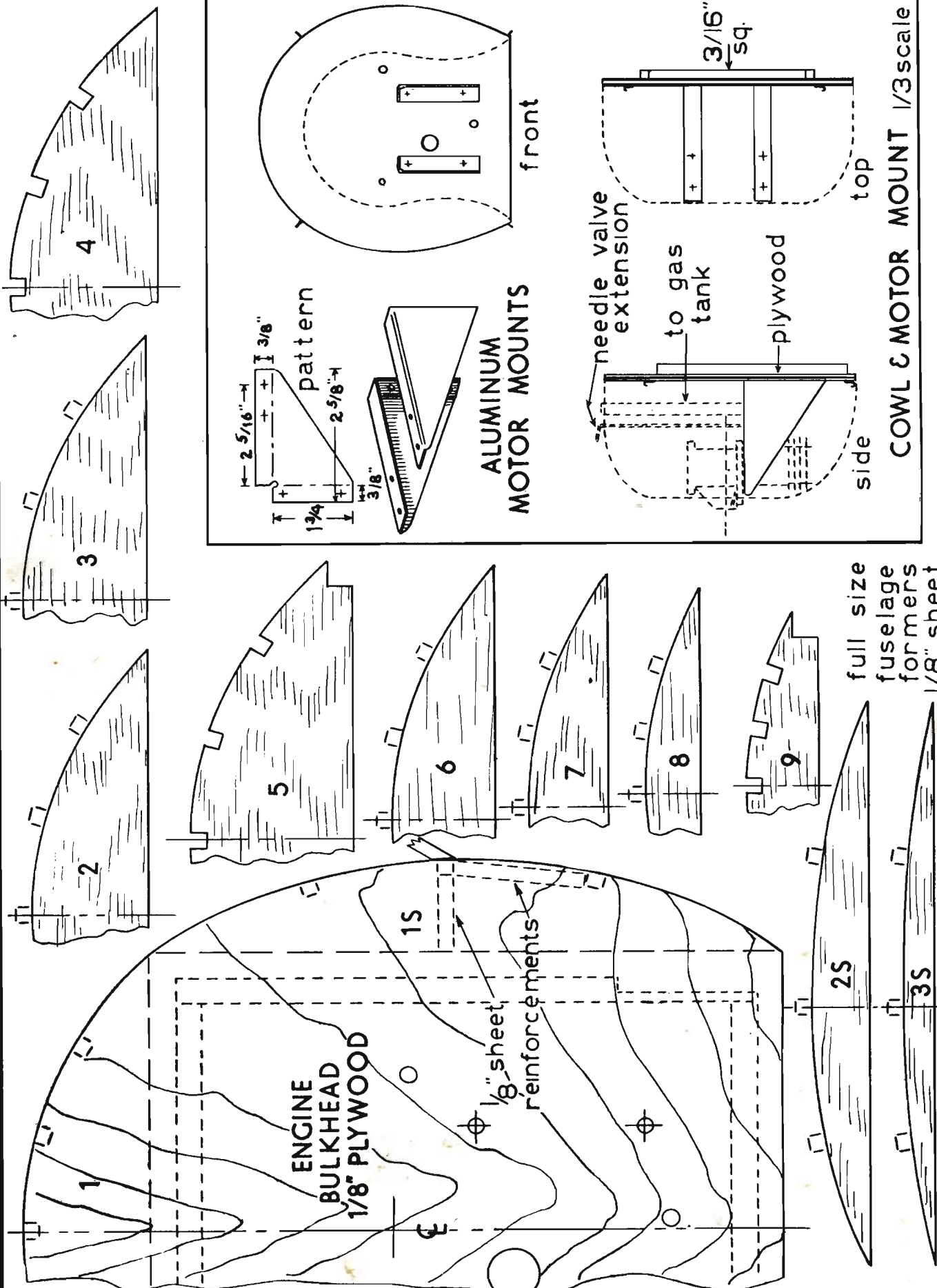
REAR

SIDE

FRONT

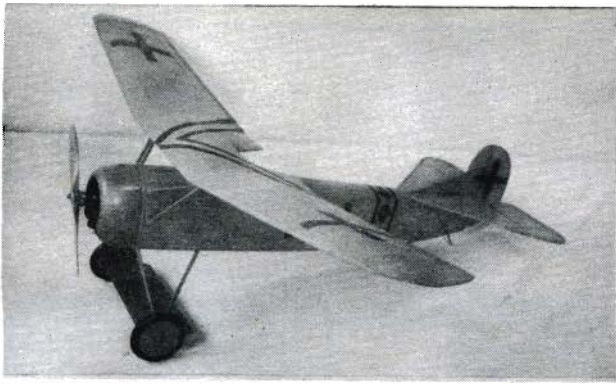
TOP

4/20/64

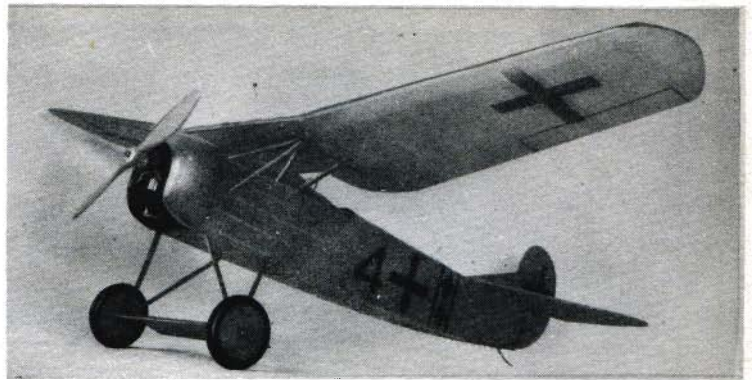


COWL & MOTOR MOUNT 1/3 scale

full size
fuselage
formers
1/8" sheet



It is of contest type, though a scale model



A perfect high-performing miniature of the full-scale plane

FOKKER D-8 CONTEST SCALE

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

DURING the closing weeks of the first World War there appeared over the front lines a nimble little monoplane that is generally credited as being the finest fighter of its day. This was the famous Fokker D-8 of the German Imperial Air Force. Powered by a rotary Oberursel engine of 110 horsepower, the D-8 had a speed of 115 m.p.h. It climbed at a rate of 1,500 ft. per min. and could ascend over four miles. In the ability to maneuver and dive it was un-

By EARL STAHL

excelled. 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 a 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 engine is neatly cowed



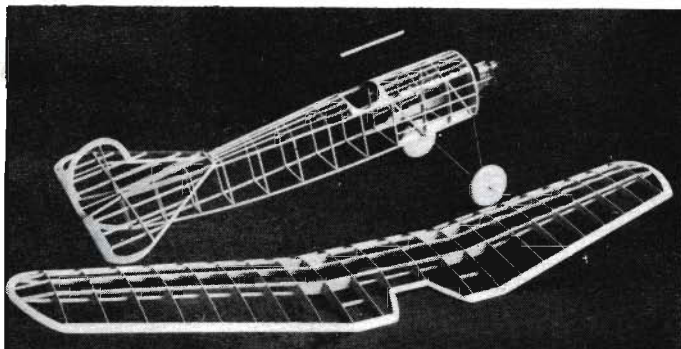
The author with completed model, ready for a flight

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 climb is fast and steep



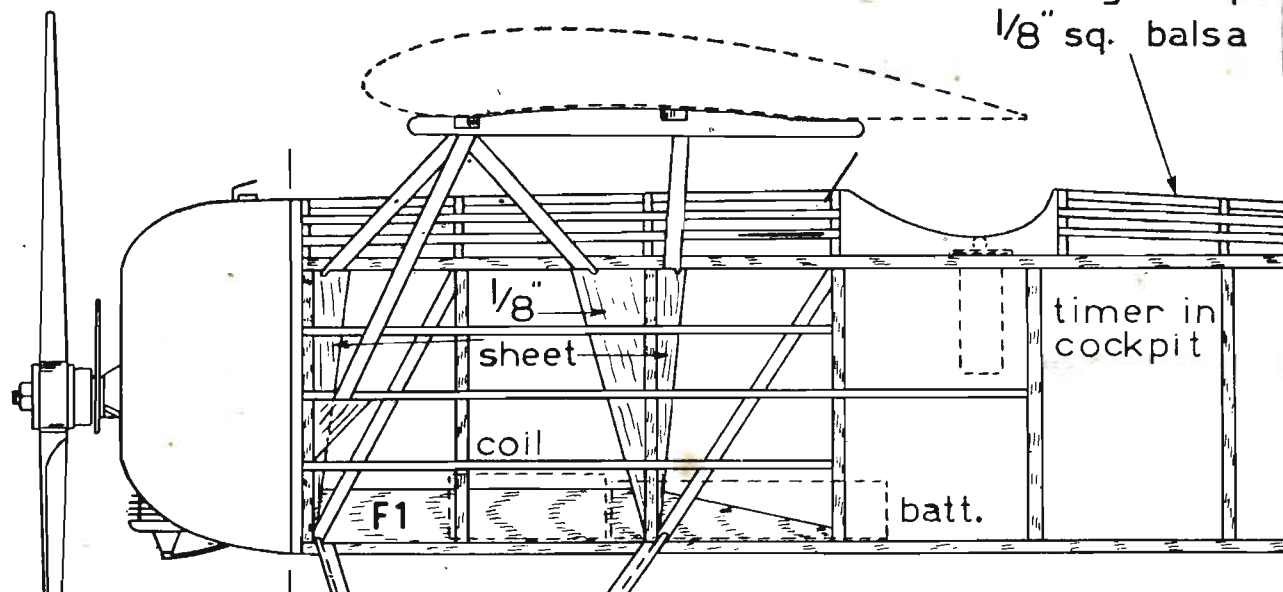
The uncovered framework shows strength and simplicity



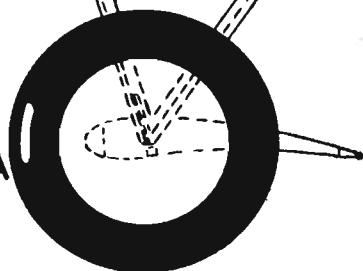
Carefully detailed, it closely resembles the full-scale plane

12" prop

fairing strips
1/8" sq. balsa



4 1/8" Balsa
WHEELS



engine unit
removes here



front
3/32"

LANDING GEAR
STRUTS

6 1/4"

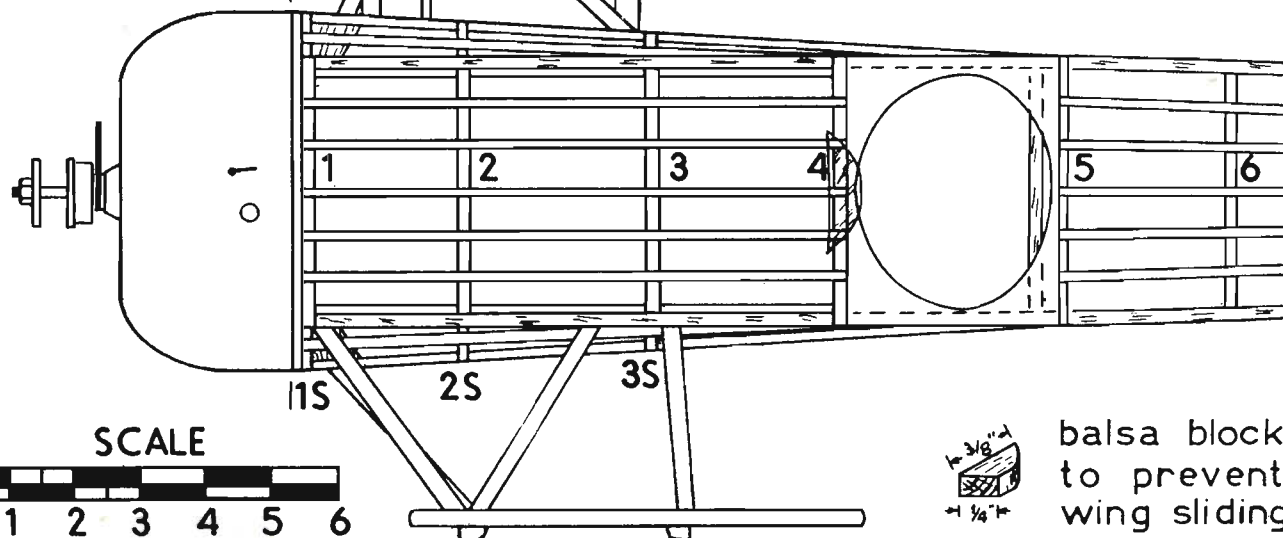
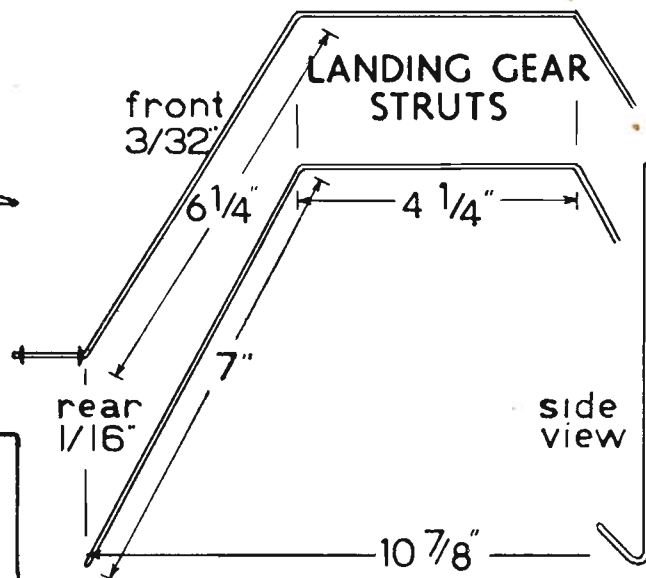
4 1/4"

rear
1/16"

7"

side
view

10 7/8"

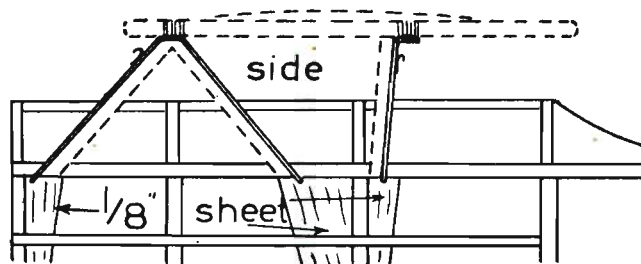
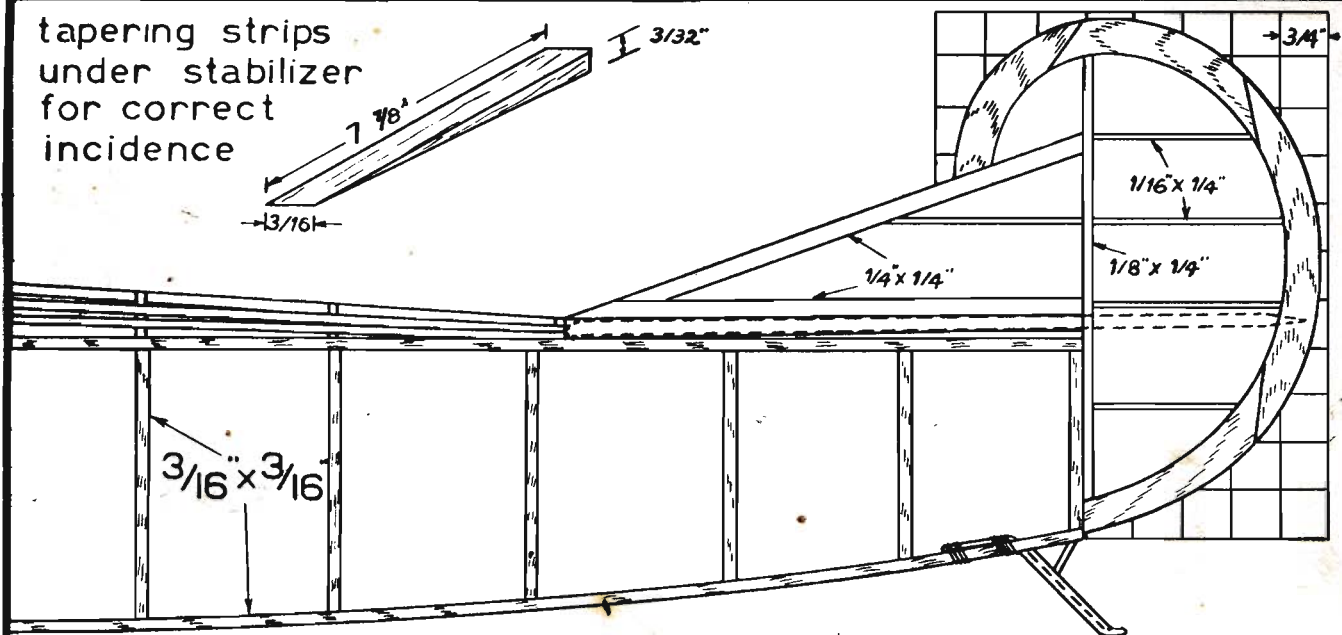
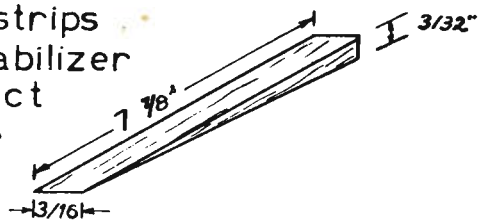


SCALE

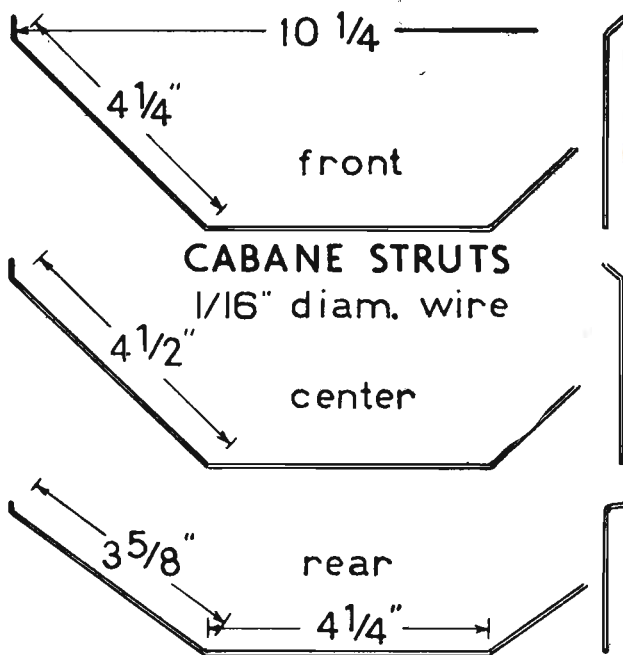
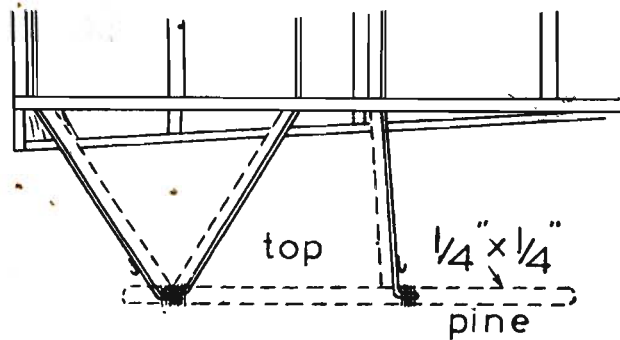


balsa block
to prevent
wing sliding

tapering strips
under stabilizer
for correct
incidence



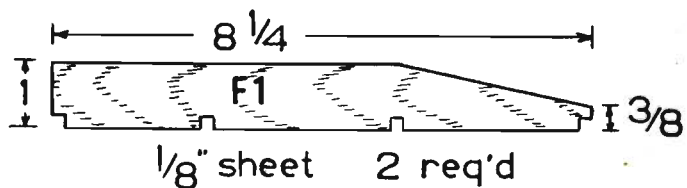
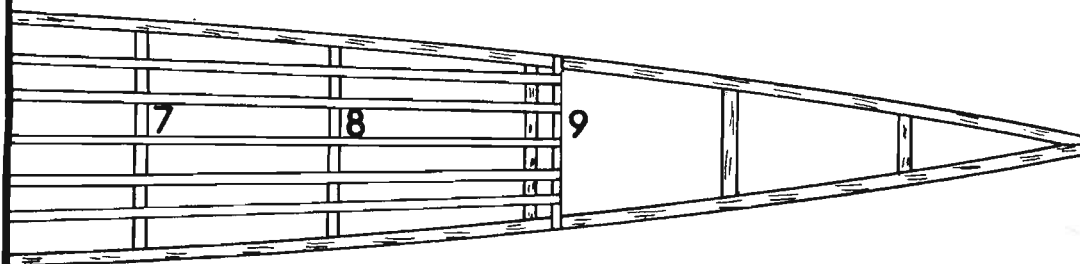
CABANE DETAIL



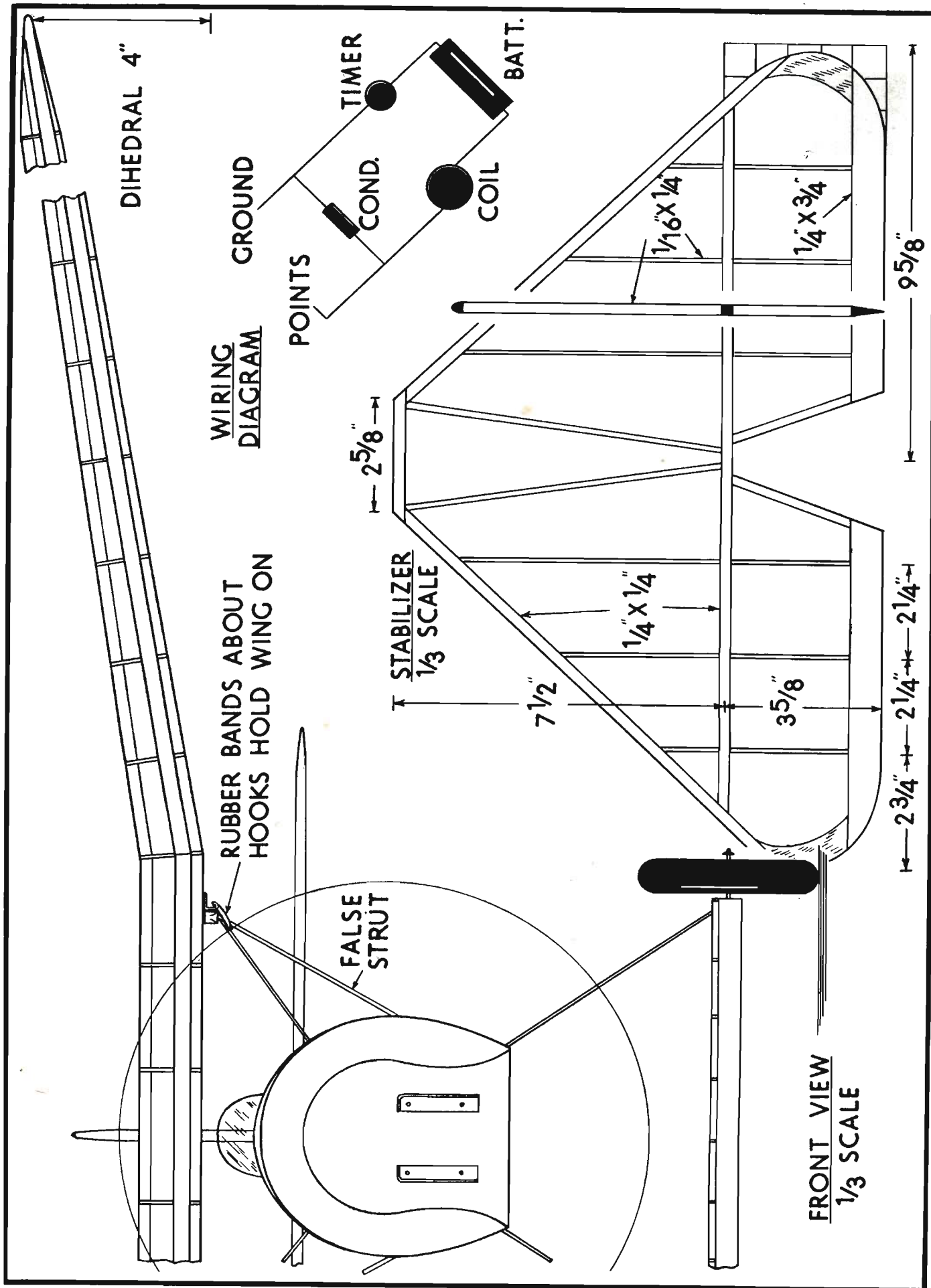
CABANE STRUTS
1/16" diam. wire

.040 wire hook
soldered to
cabane

4 req'd



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 "scale-up" 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. 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 patterns of each and then 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 1/16" sheet. Cement several sheets 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 to join with the front.

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 ce-

mented to place once the landing gear is attached. Join the two landing struts with solder. Two No. F-1 reinforcements are 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 simply soft strips of 1/16" sheet balsa, attached to the wire by strips of tissue wrapped spirally around both. These should not be attached until the fuselage is covered, however.

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 accurate 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 removed and 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 pattern for the fuselage formers. 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 full size bulkhead is shown on the plan. 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 bend them from 1/32" sheet 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 for 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.

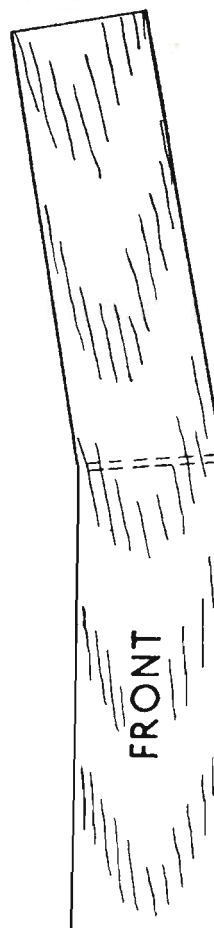
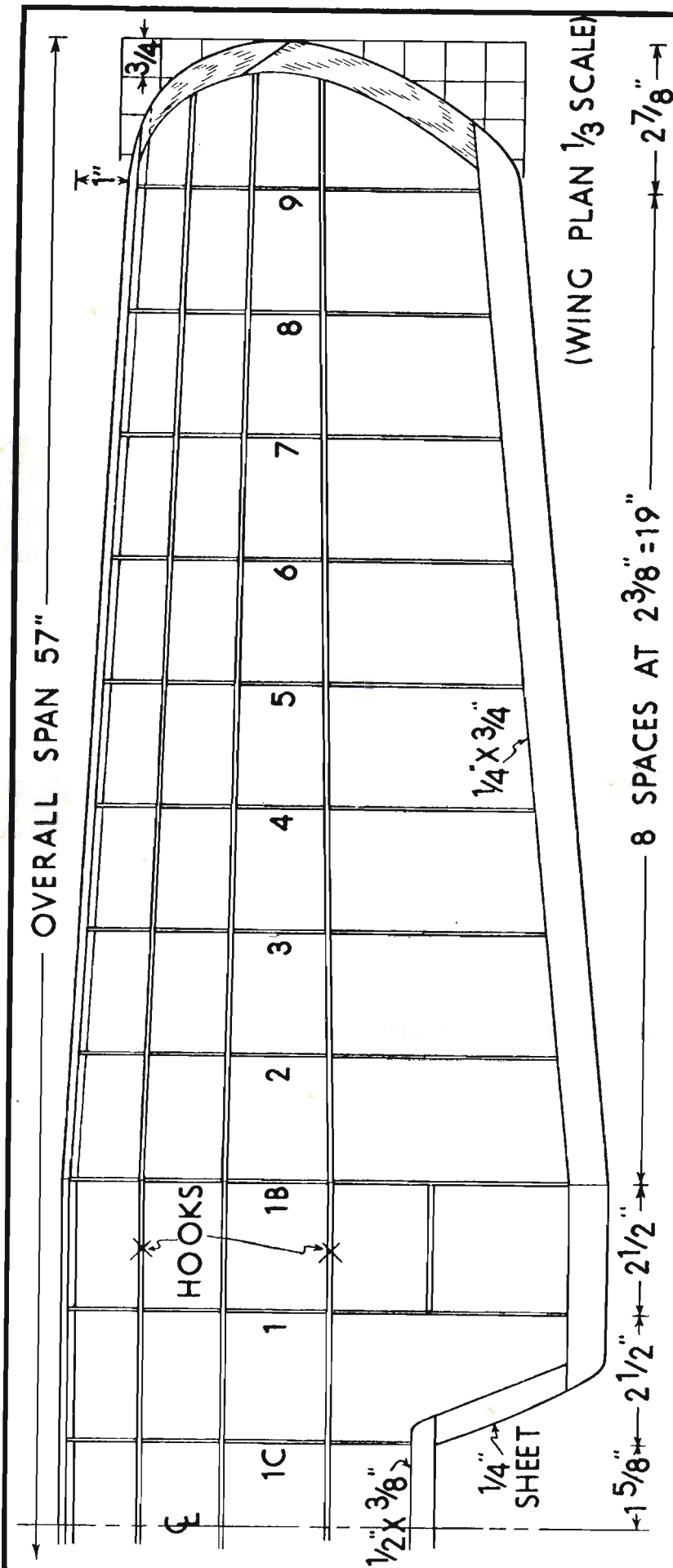
Because of the very short cowling it is necessary to mount the engine close to the fire wall. For this reason a hole must be made in the bulkhead into which the intake tube can be fitted. Naturally this makes it impossible to choke the engine as usual; on the original model we simply primed it through the exhaust port 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 cowl 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 cowl 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.

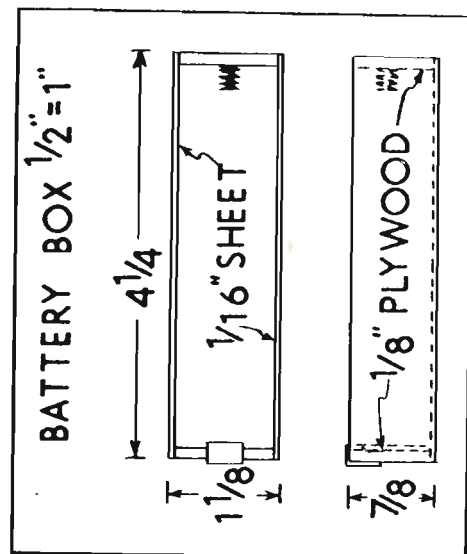
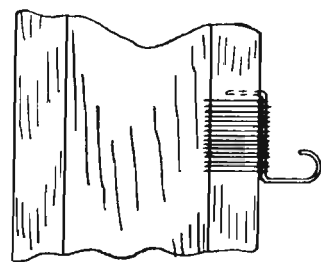
Use of a cowling will naturally require that extensions be added to the needle valve, gas tank and possibly the spark control. Depending on the engine used, these items must be worked out to suit each individual case. Four small hooks bent from .040 music wire are cemented to the front of the engine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

Wing

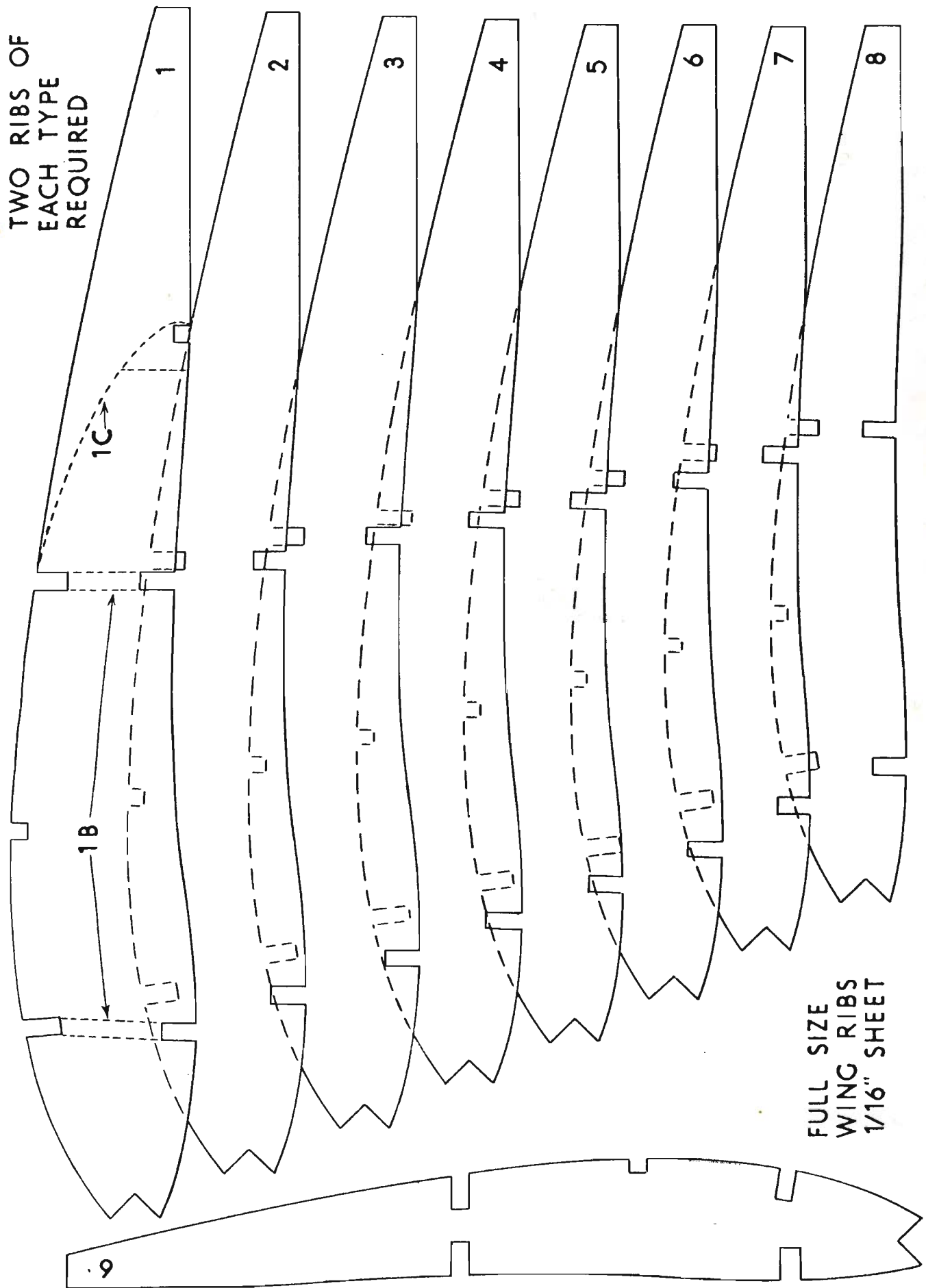
Begin constructing the wing by cutting the various ribs from 1/16" sheet balsa. Two of each type are required. Rib No. 1-B is identical to No. 1 except that the area between the spars is removed; No. 1-C has the trailing edge removed to extent indicated by the broken lines. Sand all ribs smooth and cut notches for spars—with the exception of the 1/8" square upper spar; all others are 1/8" x 1/4".



1/8" SHEET DIHEDRAL REINFORCEMENT
2 OF EACH REQ'D (FULL SIZE)



TWO RIBS OF
EACH TYPE
REQUIRED



FULL SIZE
WING RIBS
1/16" SHEET

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. Recement all joints for added strength. 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 cov-

ered 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 wing 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 streamline by strips of soft 1/16" x 3/16" balsa which are attached by spiral wrappings 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 to keep the wing from 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 cowl, 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 to place over the incidence strips and rudder is cemented on next. Off-set the rudder a bit so the model will glide 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 secure. Bolt 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 wing on the pine rests and secure its position by wrapping small rubber bands around the hooks.

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

Ignition

To install the ignition system it will be necessary to remove the engine unit. Details of the battery box for intermediate 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 batteries' correct position by changing them until the plane rests 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 produc-

ing 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.

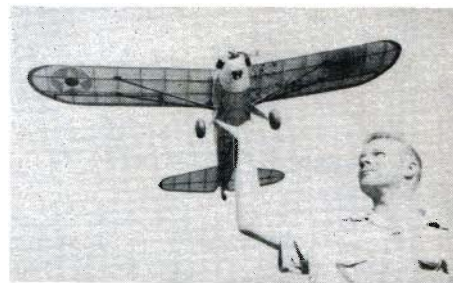
Now what do you say if we get busy and build ourselves a model of this here airplane just to see if I ain't right.

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 grained. This constitutes the basic



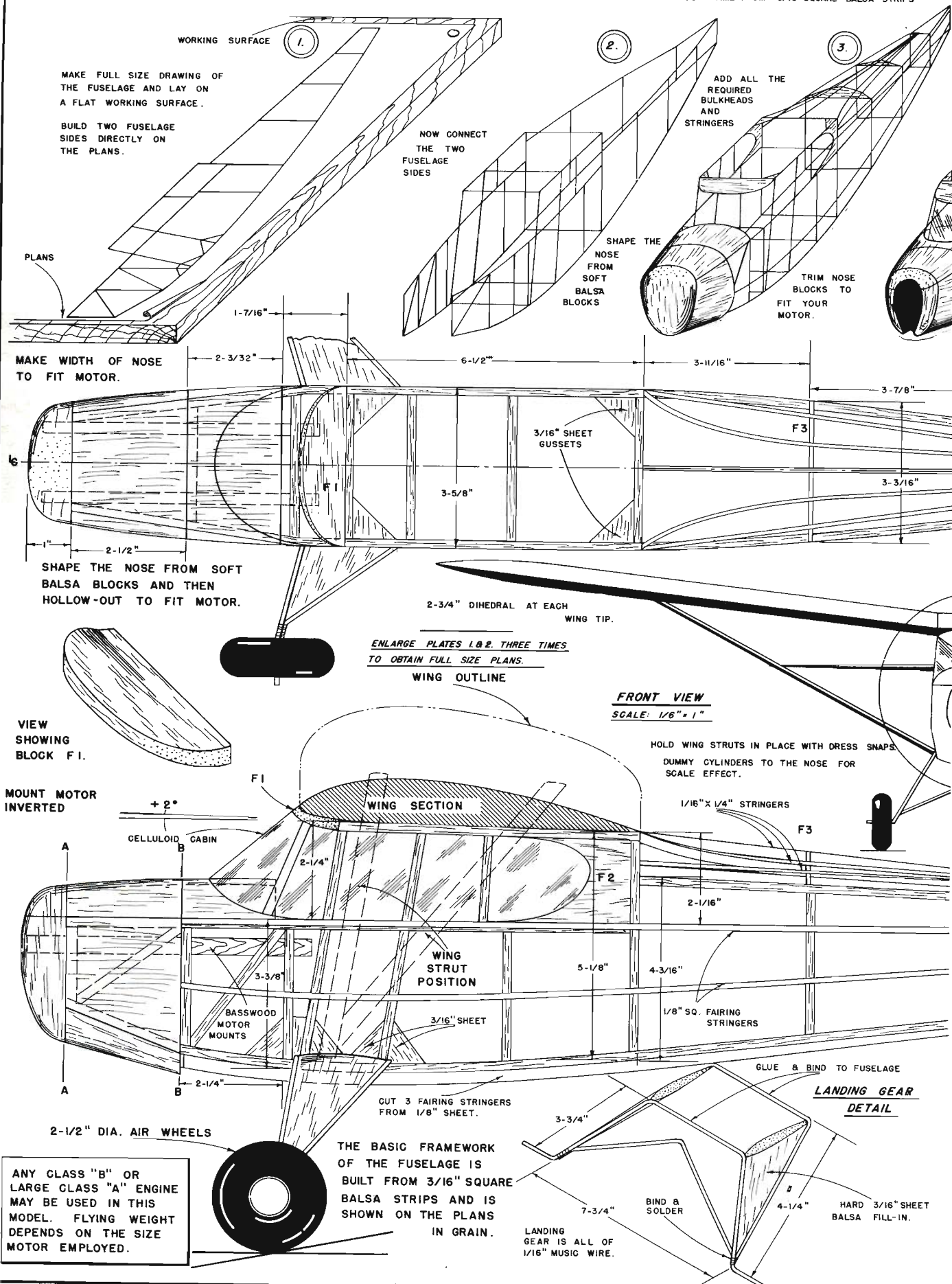
The pilot ready to test his model

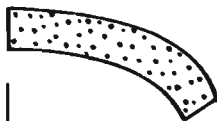
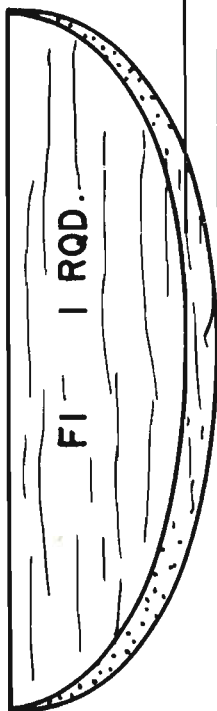
The model "grasshopper" on the airport ready to take off



It climbs like its full scale prototype





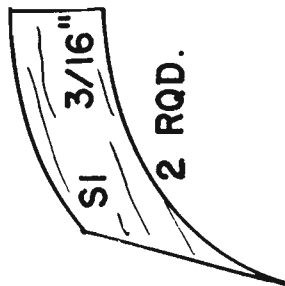
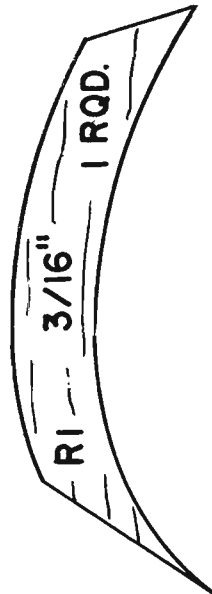
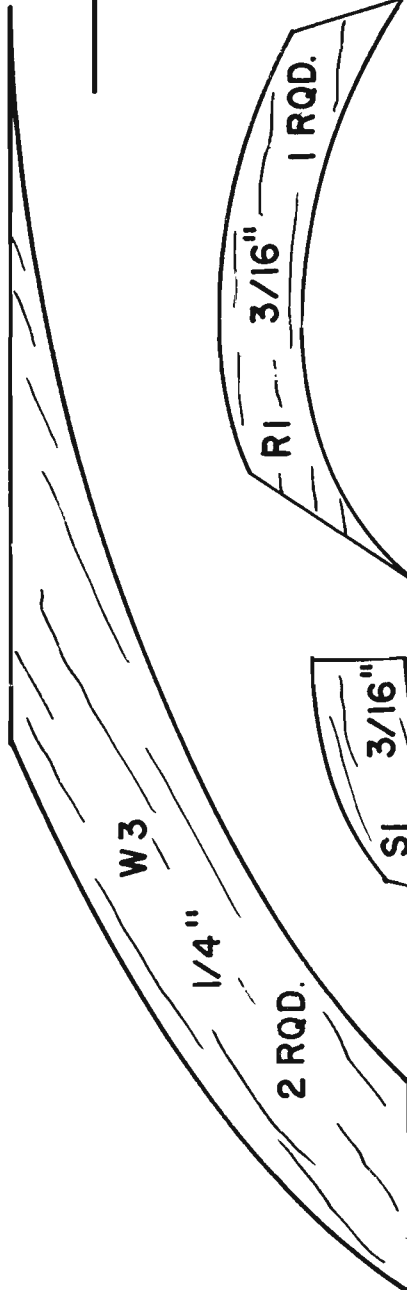


SYDNEY R. STRUHL

F2

2 RQD.

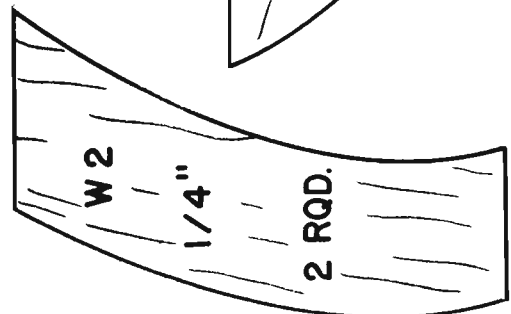
3/16"



ALL PARTS ON THIS PAGE SHOWN

FULL

SIZE.



RIB NO.2. 1/16" SHEET 2 REQUIRED

PLATE 3.

SYDNEY R. STRUHL

FUSELAGE FORMERS

ALL 1/16" SHEET



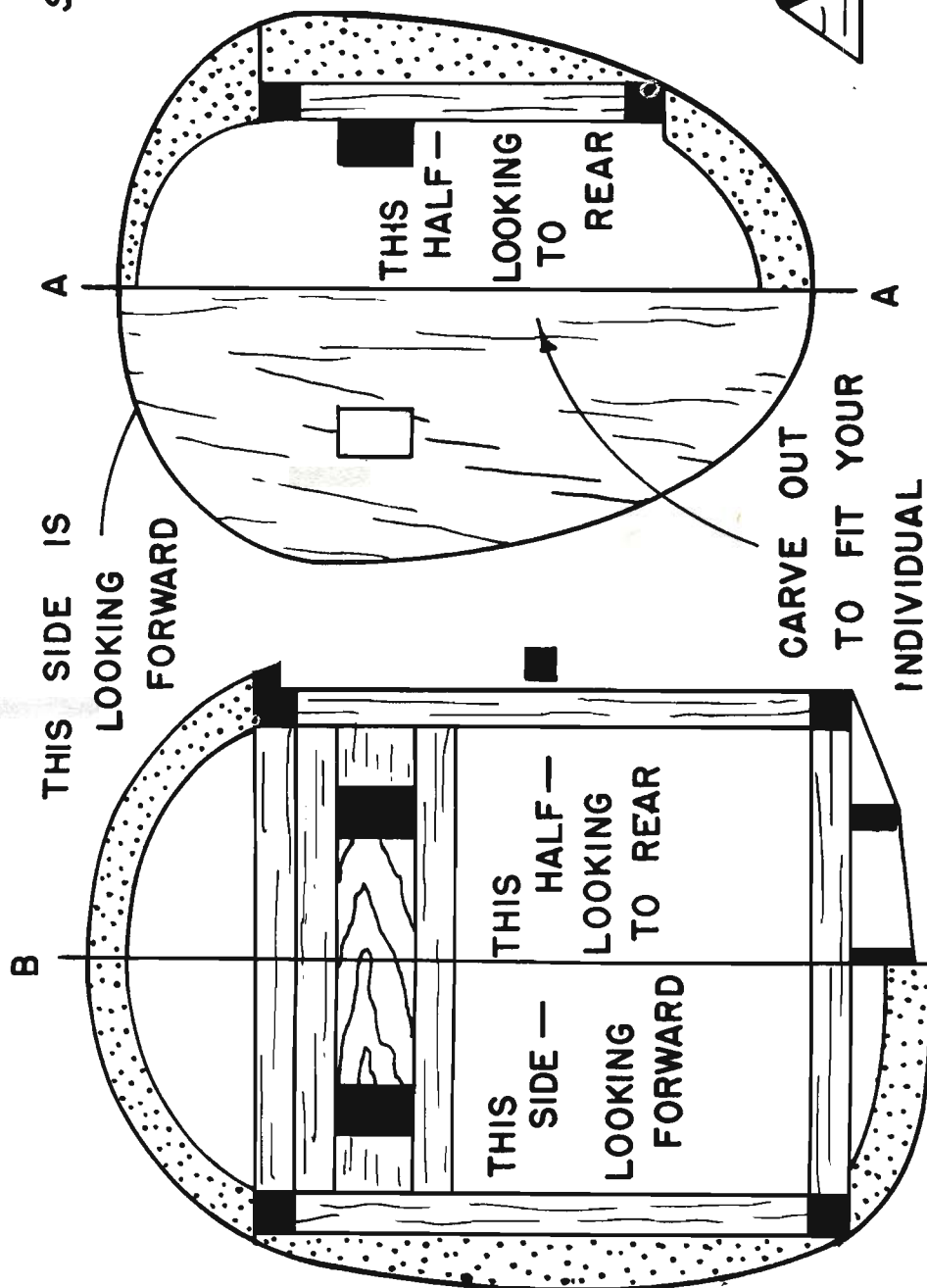
F5 1 RQD.



F4 1 RQD.



F3 1 RQD.



RIB NO.3. 1/16" SHEET 2 RQD.



MAIN WING RIB NO.1. 1/16" SHEET 13 REQUIRED

ALL PARTS SHOWN
FULL SIZE.

PLATE 4.

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 turning in one direction in flight.

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" x 3/8" 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 cowlings are made from balsa blocks cut to the required shape and crosssection. Five blocks are necessary, one for the top cowlings, two for the sides, one for the bottom and one for the very 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 cowlings 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 with heavy thread and cement to the fuselage longerons 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 sponge rubber wheel. Bend the strut as shown 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 2-3/4" 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 Silkspar for covering rather than color dopping 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 turtle-back. The cowlings and similar wood parts such as landing gear struts are tissue covered, too. 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 cowlings 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 strands.

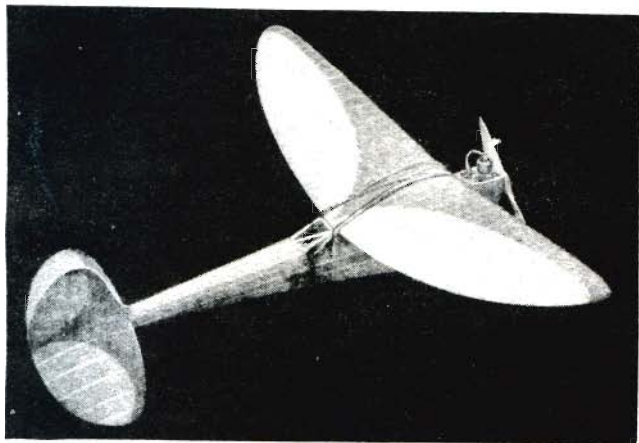
Flying

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 reacts well on the 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 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 afford you many hours of satisfaction, and what's 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



A simple but perfectly designed soaring ship

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 many 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 limitation 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 1.99 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" $1\frac{1}{2}$ 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 Dennykite.

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.

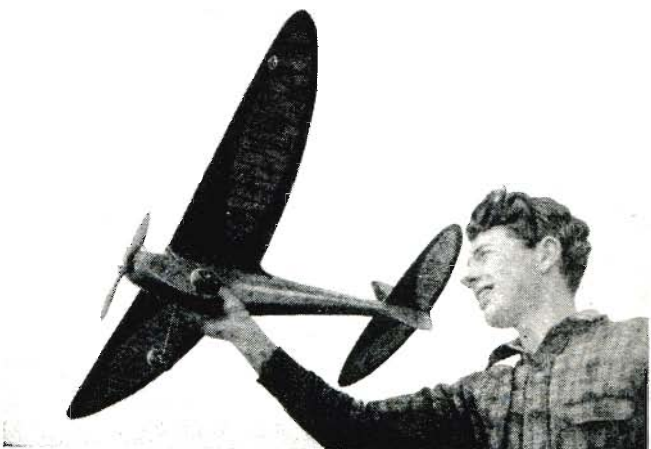
The construction of the wing is shown on plate 3, and is really

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-

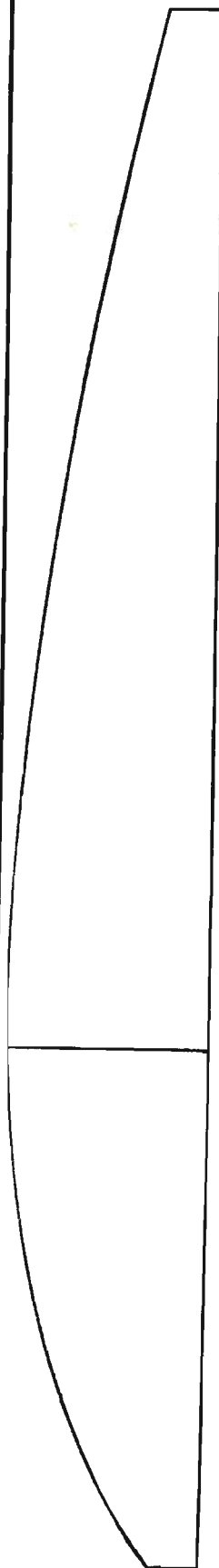
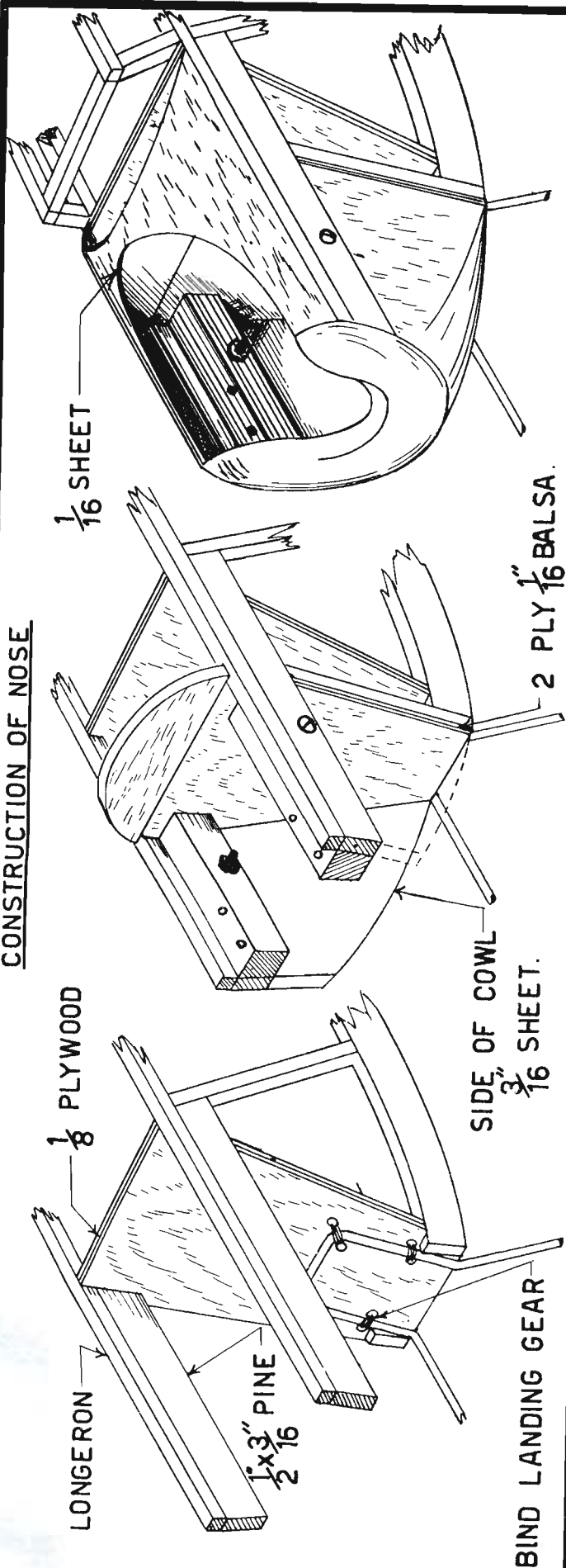


The ship in flight shows great stability



The author and the plane with sparless wings

CONSTRUCTION OF NOSE



WING RIB TEMPLATE (See Inst.)

FORMER NO. 1 3/16 BALSA.

FORMERS FULL SIZE

1/16 SHEET BALSA.

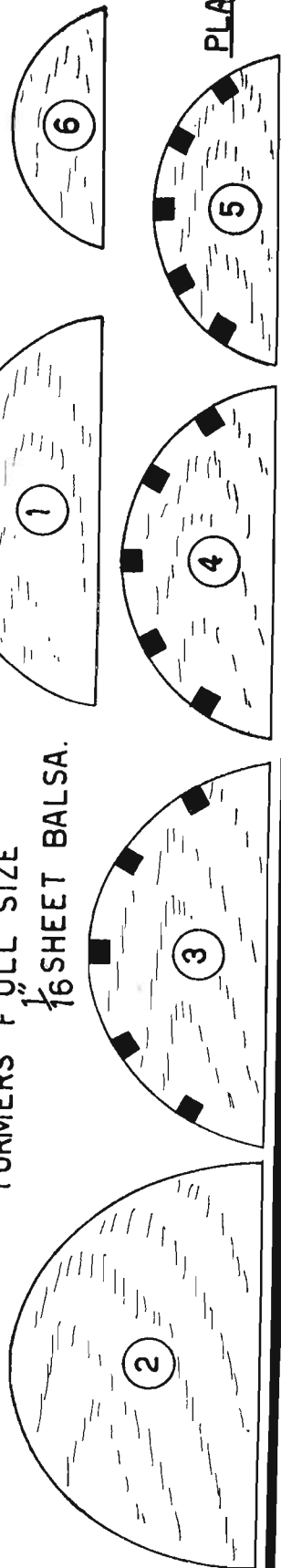
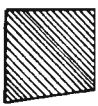


PLATE 2

GM.



TOP



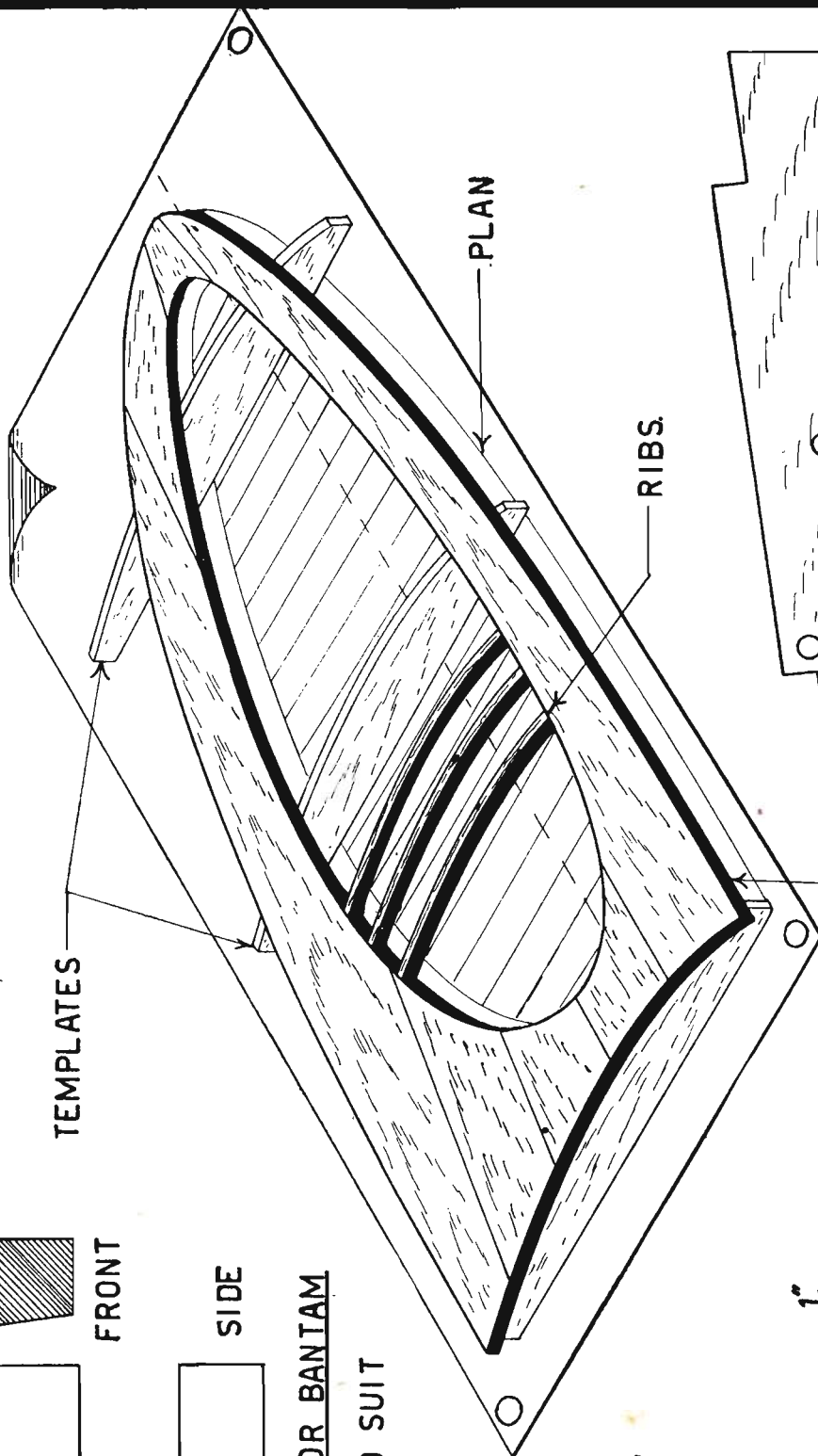
FRONT



SIDE

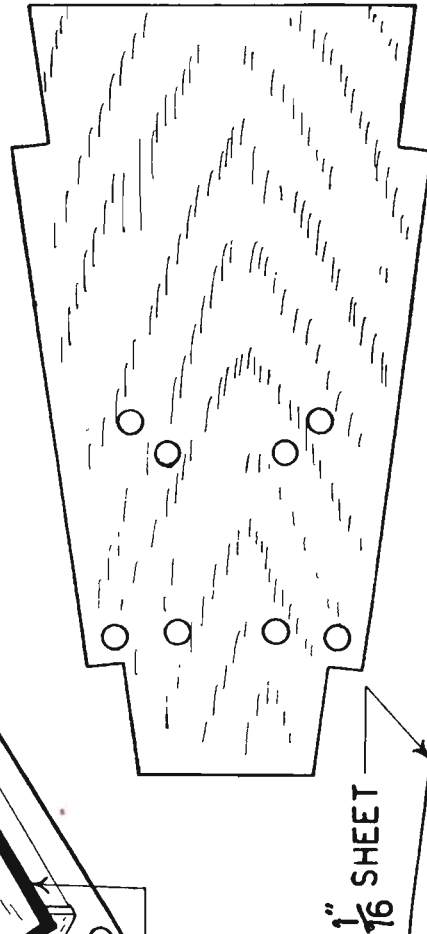
MOTOR MOUNT FOR BANTAM

CHANGE SIZE TO SUIT
MOTOR USED.

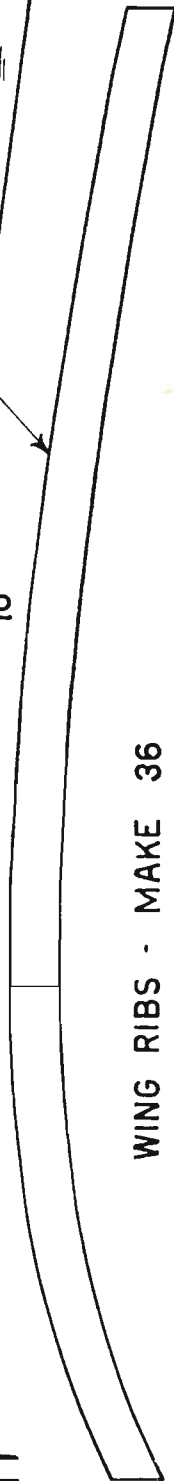


1/4 Balsa Outline
Wing Construction

1/16 Balsa Formers



1/16 SHEET



WING RIBS - MAKE 36

PLATE 3

G.M.

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 at the center section, 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 from which you are cutting the ribs, draw a vertical line about 3 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 down 1/4" 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. Bevel these halves at 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. In covering the top it is only 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 long-erons and uprights, except where noted. See plate 2 for construction of the motor mount. The motor mount bearers are of pine, cemented directly to the top longeron and are made with each side 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, which are of 3/16" soft sheet, cement to the motor bearer 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" 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 longerons. 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 inserted 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 1/8" by 1/2", 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 bearers. Note that only one bolt is used for each, this being sufficient for Class A or B motors. Holes are drilled to fit the motor used. The nuts for the bolts which hold 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, stall 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.

Additional adjustment, tried successfully, is to "wash in" the left wing and give the ship left rudder. The wing may be "washed in" by steaming the assembly after completing.

Properly 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 effectively eliminates that well known dip when the power is cut, so evident in straight flight 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."

*

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Technical drawing of a boat hull, showing the side elevation and a detail of the landing gear retainers.

Side Elevation Labels:

- MOVABLE TAB
- WIRE HOOK
- R-1
- R-2
- R-3
- R-4
- R-5
- 1" SHEET
- 1" x 3" BOTTOM STRINGER
- DOVEL
- STABILIZER POSITION

Detail Labels:

- LANDING GEAR RETAINER BLOCKS

Scale: SCALE $\frac{1}{4}$ " = 1'0"

SPACE MOTOR
BEARERS TO
FIT YOUR MOTOR

TOP LONGERON

BOTTOM
LONGERONS

STRINGERS & BULKHEADS
NOT SHOWN ON THIS VIEW
FOR CLARINESS

WING	MOUNT	POSITION
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
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361	362	363
364	365	366
367		

Top View

END OF IGNITION
RACK FITS IN
FORMER "H"

HARD BALSA

CEMENT BATTERY
BOX IN PLACE

HI - TENSION WIRE
KEEP IT AWAY FROM
TIMER & OTHER WIRES

BIND TINSER, 1' COIL
TO RACK WITH RUBBER
BANDS.

NOTE: USE THE STANDARD WIRING DIAGRAM SUPPLIED WITH YOUR MOTOR.

PERSPECTIVE SKETCH OF FUSELAGE
FRAMEWORK. USE AS AN ASSEMBLY
GUIDE.

$\frac{1}{4} \times \frac{1}{2} \times 2\frac{3}{4}$ BEARS -
(FOR BANTAM)

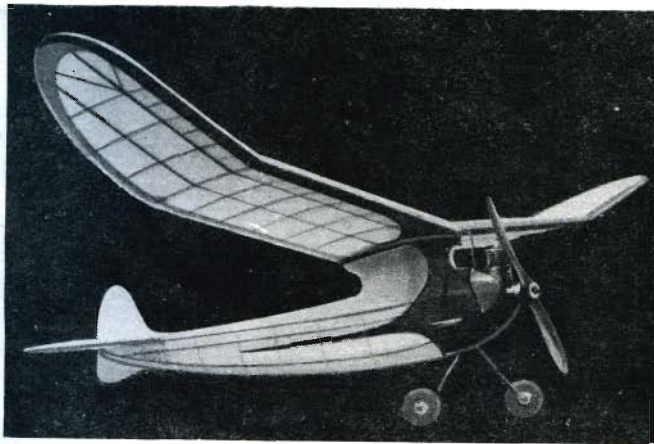
SECTIONAL SKETCH OF MOTOR COWLING

CEMENT BEARERS
TO FIREWALL & SIDE
PAIRING BLOCK.

HOLLOW FLOOR
GAS TANK
-FIRE WALL

PLATE 1

DR. J. NOONAN 5-1-42



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

THE WINGED YANKEE

A high performance Class A gas model that is easy to build and operate

by **SAL TAIBI**

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 of the other and fill in the crossbraces; 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 the bottom longerons 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 out 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 bearers 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 anchorage 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.

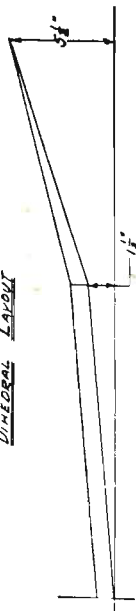
Now you are ready to cover the model. The fuselage of the original model was covered with silk but gas model Silkspan will do if silk is not obtainable. Work very carefully when attaching the covering to the wing mount, pull out all the little wrinkles. To make the silk or Silkspan fit around curves 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 10-0 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.

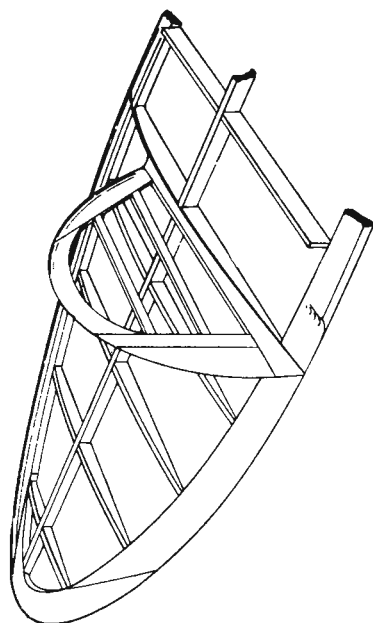
Let your model dry a day or so and then prepare it for flight.

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!

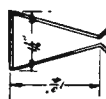
DIMEDRAL LAYOUT



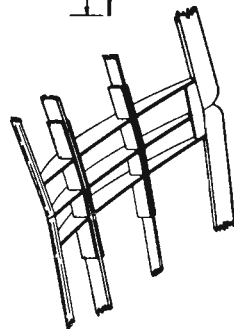
RUDDER F-STAB. BUILD ROUGH & SAND TO SHAPE.



RUDDER F-STAB UNIT IS REMOVABLE
HOLD IN PLACE WITH RUBBER BANDS.



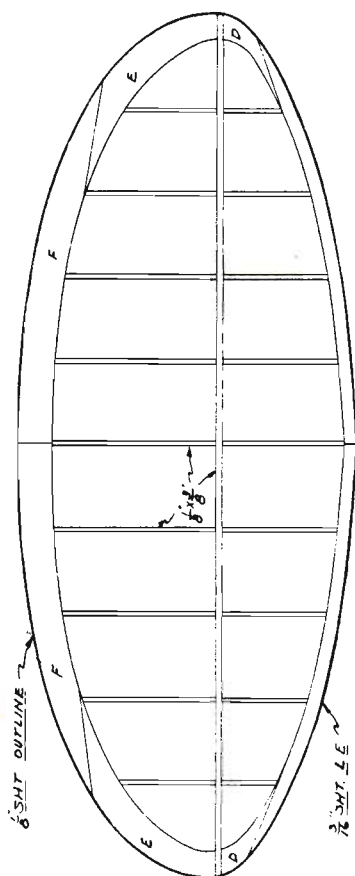
LAMINATE
LAYOUT
FOR
ANODE WIRE



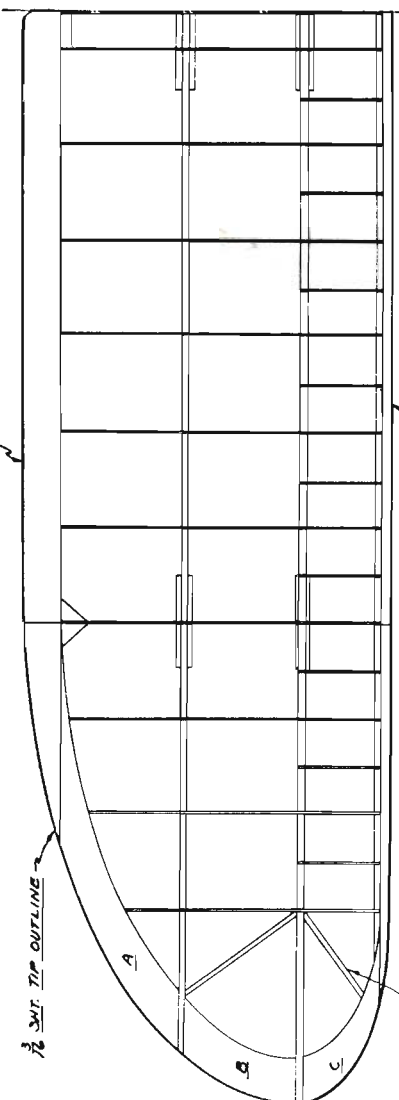
SKETCH SHOWS CENTER WING JOINT

SCALE: SAME AS PLATE 1

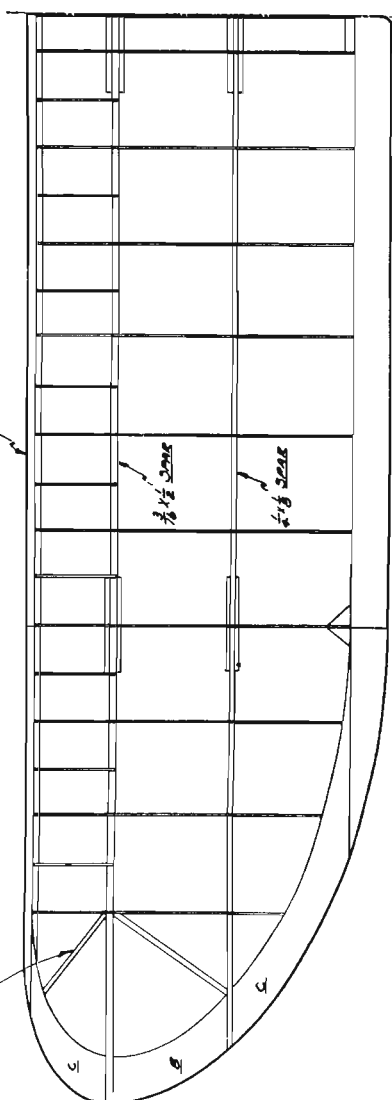
PLATE 2



1/2\"/>



1/2\"/>



FULL SIZE

TOP STRINGER $\frac{3}{8}$ " SHIT

JOIN

WING SADDLE
 $\frac{3}{32}$ " SHIT

CUT 2 LIKE THIS
1/2 CROSS GRAIN

TYPICAL STAB.

RIB

WING MOUNT
 $\frac{3}{16}$ " SHIT

FRONT FORMER
 $\frac{1}{8}$ " SHIT

FORMER "A"
 $\frac{1}{8}$ " PLYWOOD
TO THIS
OUTLINE.

LANDING GEAR
POSITION

FORMER "B" $\frac{1}{16}$ " 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.

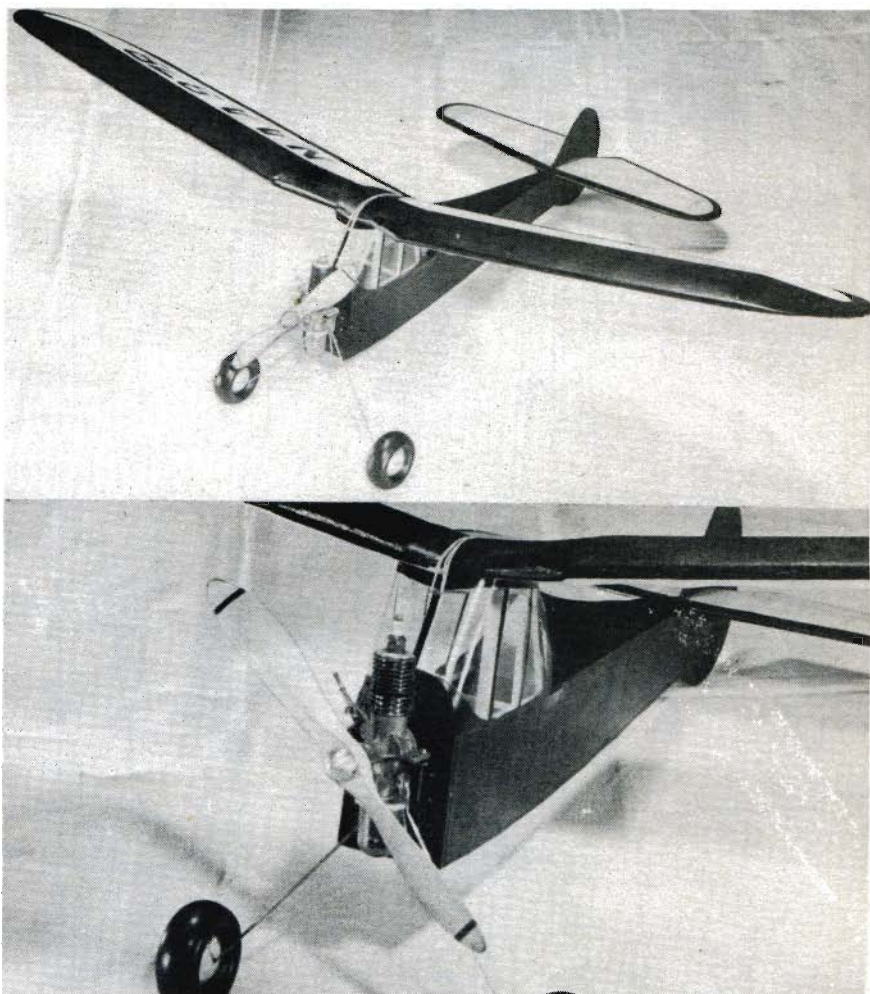
This model fulfills the need of a realistic looking plane that will give a good account of itself when flown in any kind of weather.

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.

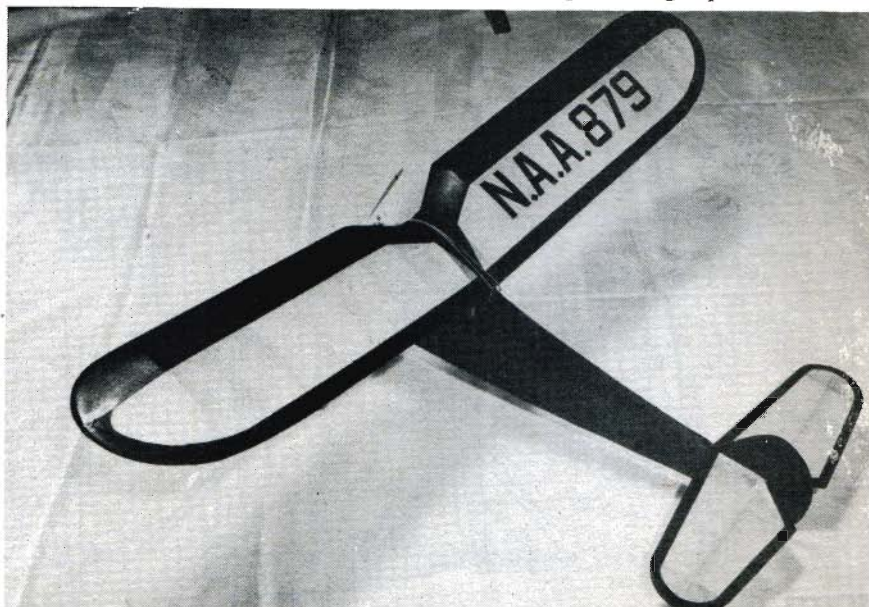
The plans are shown half size. Any measurement not given can be determined by merely doubling the size shown. The whole plan should be drawn up first; this is easily done with a pair of dividers and ruler. If you prefer, the plans can be enlarged for a class B ship. One of this size has been built and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

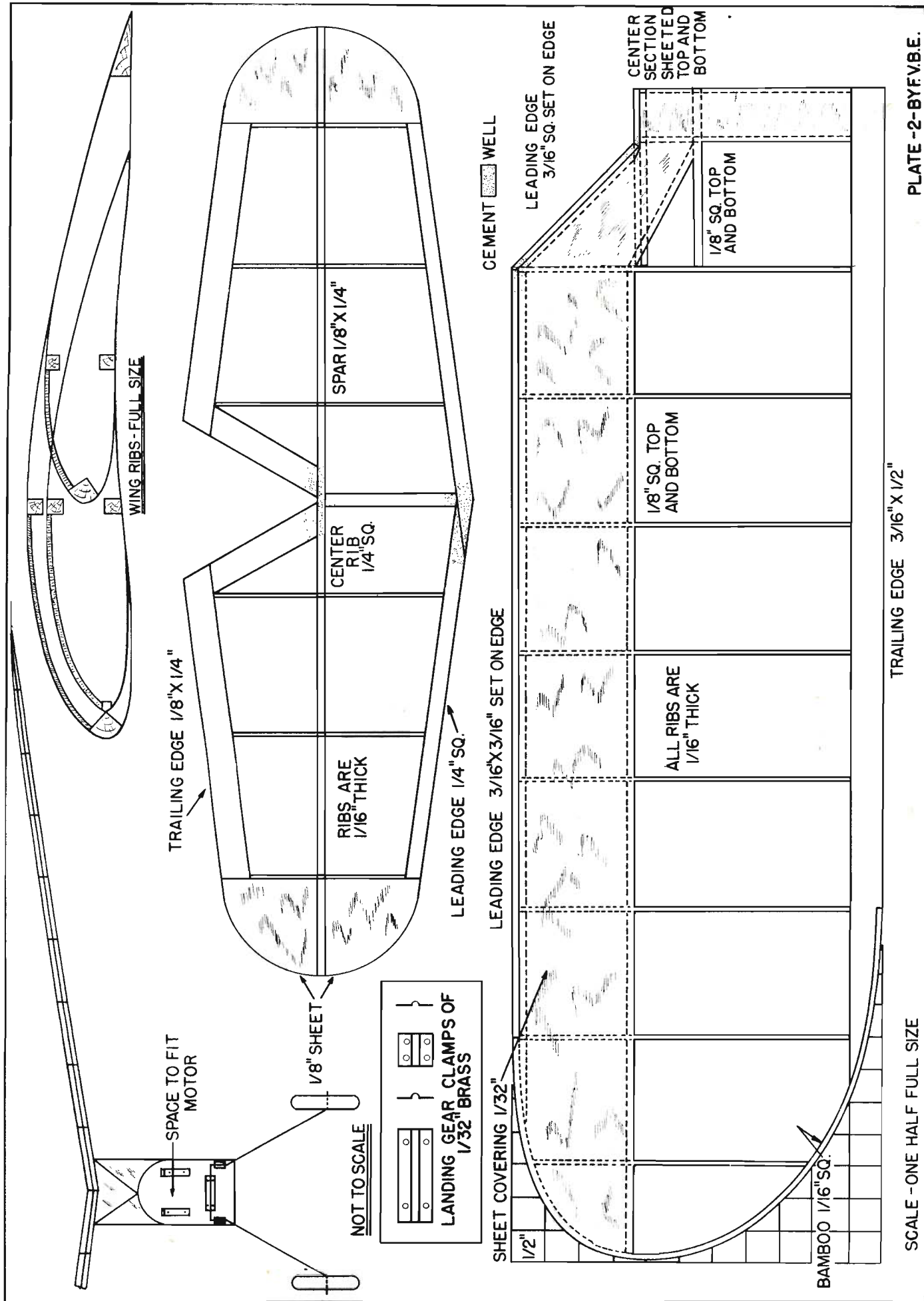
Start the construction by assembling the fuselage sides. The longerons and struts are pinned in place over the full size drawing, placing the pins on both sides of the members but not through them. After the joints are cemented and dry remove the side assembly from the plan. Make both sides in a similar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



No larger than some rubber powered models and of simple construction but with the looks and zip of large planes





frame is not warped and that the whole structure is in proper alignment.

Next cement the cabin celluloid windows in place, after which the landing gear and motor mounts can be properly formed and assembled to the front bulkhead. The ignition then can be installed, located as shown in the drawings. When this is done sand the whole structure lightly. The paper covering may then be applied.

When building the wing first cut out all parts to the proper shape, including the spars, ribs, leading and trailing edges and miscellaneous parts. Assemble half the wing at a time by mounting the ribs on the spars at the proper place.

Next cement the leading and trailing edges and curved tips in place. When both halves are done join them together with the splices shown in the drawing, making certain that the wing has the proper dihedral; that is, each wing tip should be raised 2-3/4" from a horizontal line through the leading edge at the wing center. The tips are made from 1/16" sq. bamboo, both tips being made at the same time to insure uniformity.

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 by 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 crosssection. 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 fuselage.

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 50 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.

Model Airplane ENGINE DIRECTORY

NAME	CLASS	WEIGHT IN OZ.		DISPLACEMENT IN CUBIC INCHES	BORE	STROKE	CYCLE	PORTS	RATED H.P.	R.P.M. MIN - MAX.	FUEL GAS WHITE	PARTS OIL SAE-70	PROPELLER		TYPE OF MOUNT	TYPE OF GAS FEED	MINIMUM WEIGHT OF PLANE IN OZ.	
		BARE	FLYING										DIAM.	PITCH				
AJAX	C	6.5		.363	3/4	13/16	2		1/6	500-8000	3	1	13	7	BEAM-RADIAL	SUCTION	29.0	
ALTERNATE FIRING TWIN	C		19	.326	5/8	17/32	2	4	1/5	500-8000	4	1	14	8	BEAM	SUCTION	26.1	
AVION "MERCURY"	C	19.5	28	1.53	1-1/4	1-1/4	2		3/4	500-3800	4	1	20	10	BEAM	SUCTION	122.4	
ATOM	A	2.0	3.5	.097	1/2	1/2	2	9	1/101/8	250-17500	3	1	10	6	BEAM	SUCTION	7.76	
BANTAM	A	3.2	7.1	.165	19/32	19/32	2	3	1/8	500-8000	3	1	10	6	BEAM	SUCTION	13.2	
NEW BANTAM	A	3.2	7.1	.199	.656	.590	2	DISC VAL.	1/7	250-9350	3	1	9-11	6-7	BEAM	SUCTION	16.0	
BARKER "A"	C	12	18	.69	15/16	1	2	3	1/4	1000-7000	3	1	15	10	BEAM	GRAVITY	55.2	
BARKER "B"	C	12	18	.69	15/16	1	2	3	1/4	1000-7000	3	1	15	10	BEAM	SUCTION	55.2	
BARKER "C"	C	10	16	.69	15/16	1	2	3	1/4	1000-7000	3	1	15	10	BEAM-RADIAL	SUCTION	55.2	
BRAT	A	3.3	8	.152	9/16	5/8	2	4	1/8	500-8000	3	1	9	6	BEAM	SUCTION	12.4	
BROWNIE "E"	B	5.5	8.75	.291	.77	.625	2	3	1/7	900-8000	3	1	10-12	6-7	BEAM	SUCTION	23.3	
BROWN "B", "C", "D"	C	6.5	21.5	.6	7/8	1	2	4	1/5	500-7000	3	1	14	8.5	BEAM	SUCTION	48.0	
BELMONT	C	9	22	.564	7/8	15/16	2	4	1/7	— 8600	4	1	14	8.5	BEAM	SUCTION	45.1	
BULLET (PHANTOM)	B	4.5	8	.276	3/4	5/8	2	2	1/4	300-7000	2.5	1	11	7	BEAM	SUCTION	22.1	
CHAMPION	C	10	21	.6	.925	.9	2	ROTARY V.	1/4	500-12000	2.5	1	13-16	8	BEAM	OPTIONAL	48	
CYCLE "SUPER"	C	7.25	20	.647	15/16	15/16	2	" VALVE	1/4	1000-7300	3	1	13-14	6-8	BEAM	SUCTION	51.8	
DENNYMITE	C	10	21	.563	9/8	9	2	4	1/4	500-6500	3	1	13-14	7.5-8	BEAM	SUCTION	45.0	
DEMON	A	3.5	8	.152	9/16	5/8	2	2	1/10	250-12500	3	1	10-12	6-7	BEAM	SUCTION	12.7	
DRAGON	B	5.5	11	.211	5/8	11/16	2	2	1/7	500-6500	4	1	10	6	BEAM	SUCTION	16.9	
DRIMMIE "10"	C	8.5	18.5	.6	7/8	1	2	4	1/5	500-10000	4	1	14	8-10	BEAM	SUCTION	48.0	
DWARF	B	4.5	9	.255	11/16	11/16	2	3	ROT. VAL.	1/7	500-10000	2.5	1	11	8	BEAM	SUCTION	20.4
ELF "SINGLE"	A	3	6.24	.097	15/32	9/16	2	4	1/14	— 7500	4	1	8-9	5-6	BEAM	SUCTION	7.76	
ELF "TWIN"	A	5	8.75	.198	15/32	9/16	2	4	1/7	— 7500	3	1	8-9	5-6	BEAM	SUCTION	15.52	
FEENEY "A"	C	15	24	1.18	1-3/16	1-1/16	4	OVERHEAD VALVES	2/3	300-9000	80-90 OCTANE	18	8	RADIAL	SUCTION	94.4		
FEENEY "B"	C	13.5	22.5	.914	1-1/16	1-1/32	4	2/3	2/2	300-9000	STRAIGHT GAS	15	6	RADIAL	SUCTION	73.1		
FEENEY "C"	C	12	21	.617	15/16	7/8	2	"	1/3	300-9000	"	12	6	RADIAL	SUCTION	49.4		
FORSTER SUPER 99	C	15	25	.997	1-1/16	1-1/8	2	4	1/2	AT 6000	10	1	15-18	6-10	BEAM	SUCTION	79.8	
FORSTER "29"	B	5.75	10.75	.297	7/50	.672	2	ROT. VAL.	1/5	500-9400	4	1	11-12	6-7	RADIAL-BEAM	SUCTION	23.96	
G.H.Q.	C	10	20	.518	15/16	3/4	2	4	1/5	300-7000	5	1	14	8	BEAM	SUCTION	41.45	
GNAT	A	4.5	8	.152	9/16	5/8	2	4	1/10	AT 7500	3	1	10-12	6-7	BEAM	SUCTION	12.7	
GWIN AERO	C	7.25	10.75	.45	7/8	3/4	2	4	1/5	AT 8500	2	1	13	6.5	BEAM	SUCTION	36	
HURLEMAN	C	6.7	21	.46	7/8	13/16	2	4	1/5	500-8000	4	1	14	8.5	BEAM	SUCTION	36.8	
HUSKY JV	A	2.75	6	.192	5/8	5/8	2	4	1/8	250-8000	3	1	11	8	BEAM	SUCTION	15.35	
IMP G-9	C	9	14	.565	7/8	15/16	2	4	1/5	300-7000	3	1	13	7.5	BEAM	SUCTION	45.2	
JAMES	C	8	22	.647	15/16	15/16	2	4	1/4	AT 7000	4	1	13	7.5	BEAM	SUCTION	51.8	
KAYDET	A	4	8	.163	5/8	17/32	2	4	1/7	500-8000	3.5	1	10-12	6-7	BEAM	SUCTION	13.05	
LITTLE DYNAMITE	C	6.5	21.5	.375	.781	.781	2	ROT. VAL.	1/5	AT 6000	3	1	14	8.5	BEAM	OPTIONAL	30.0	
MARVIN	A	5	8	.140	9/16	9/16	2	3	1/10	250-12000	4	1	9	6	BEAM	SUCTION	11.2	
MAY "SILVER KING"	C	7	12.5	.454	13/16	7/8	2	2	1/5	600-12000	3	1	13	6	BEAM	SUCTION	36.3	
MADEWELL	A	4	8	.192	9/16	9/16	2	4	1/8	400-8000	3	1	9	6	BEAM	SUCTION	11.2	
MEGOW	A	3.5	6.5	.104	33/64	5/8	2	2	1/2	2000-10000	4	1	9	4	BEAM-RADIAL	SUCTION	15.4	
MINIATURE	A	2	4.5	.292	23/32	23/32	2	2	1/2	300-3500	4	1	10	8	BEAM	SUCTION	8.32	
M&M	B	4.5	11	.197	11/16	17/32	2	3	1/6	500-8000	3	1	11.5	8.5	BEAM	SUCTION	23.39	
OHLSOHN "19"	A	4.75	8.5	.193	11/16	17/32	2	3	1/7	500-7000	3	1	9-10	5	BEAM-RADIAL	SUCTION	15.8	
OHLSOHN "23"	B	5	9	.232	11/16	5/8	2	3	1/6	500-7500	3	1	10-11	6	BEAM-RADIAL	SUCTION	18.4	
OHLSOHN "60"	C	10	19.5	.617	15/16	7/8	2	3	1/4	500-7500	3	1	14-15	10	BEAM-RADIAL	SUCTION	49.4	
O.K. TWIN	C	18	33.5	1.209	.9	.95	2	3	1/2	500-5500	4	1	18-20	10-12	RADIAL	GRAVITY	96.7	
O.K. DELUXE	C	7.25	18.5	.616	.9	.969	2	3	1/5	500-10000	3.5	1	14-15	8.5-10	BEAM-RADIAL	SUCTION	49.3	
O.K. STANDARD	C	7.75	18.5	.604	.9	.95	2	3	1/5	500-10000	3.5	1	14-15	8.5-10	BEAM-RADIAL	SUCTION	48.3	
O.K. SPECIAL	C	7.25	18	.493	.9	.95	2	3	1/5	500-10000	3.5	1	14-15	8.5-10	BEAM-RADIAL	SUCTION	48.3	
O.K. 49	C	8	14	.493	.9	.95	2	3	1/5	500-12000	3.5	1	13-14	8	BEAM-RADIAL	SUCTION	39.44	
PRICE MIDGET	B	3.5	7.5	.243	11/16	21/32	2	3	1/5	500-7500	2.5	1	11	8	BEAM	SUCTION	19.2	
PERKY	A	3	8	.191	39/64	5/8	2	3	1/8	700-12000	3	1	10	7	BEAM	SUCTION	15.28	
REBEL	B	4.5	8	.23	5/8	3/4	2	4	1/7	350-5000	3	1	10	11	6-7	RADIAL	SUCTION	18.4
RANGER	B	3.8	7.75	.292	.69	.682	2	4	1/6	250-10750	4	1	13	7	BEAM	SUCTION	23.4	
SKY CHIEF	C	10	14	.526	7/8	7/8	2	4	1/5	1800-9000	4	1	14	7	BEAM	SUCTION	42.1	
SYNCHRO "ACE"	A	10	21	.564	7/8	15/16	2	4	1/5	AT 10000	4	1	13	7	BEAM-RADIAL	SUCTION	45.1	
SYNCHRO "BEE"	A	3.5	8	.122	1/2	5/8	2	4	1/8	1000-8000	4	1	9	6	BEAM-RADIAL	SUCTION	9.76	
SYNCHRO B-30	B	5.5	8	.292	13/16	9/16	2	4	1/7	700-10000	3	1	11	8	BEAM	SUCTION	23.36	
TIGER AERO	C	7.25	10.75	.45	7/8	3/4	2	4	1/4	AT 10000	2	1	12	6.5	BEAM	SUCTION	36	
TORPEDO	B	4.75	8.5	.299	7/8	7/8	2	4	1/4	300-8000	2.5	1	11	8	BEAM-RADIAL	SUCTION	23.92	
TROJAN	B	5	9	.232	11/16	5/8	2	4	1/7	AT 6500	2.5	1	10	6	BEAM	SUCTION	18.56	
MANUFACTURER'S FIGURES FOR BORE AND STROKE HAVE BEEN USED TO CALCULATE THE DISPLACEMENT OF ALL ENGINES.																		

MANUFACTURER'S FIGURES FOR BORE AND STROKE HAVE BEEN USED TO CALCULATE THE PISTON DISPLACEMENT BY MEANS OF THE FORMULA $CU = (0.7854) B^2 S N$; IN WHICH B = BORE, S = STROKE, AND N = THE NUMBER OF CYLINDERS. NOTE: ALL ENGINES LISTED IN THIS DIRECTORY ARE BLOCK-TESTED BEFORE SHIPMENT.



The little pursuit plane showing movable rudder



Wires to operate control pass under right wing



CONTROLLED LIGHTNING

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 sharp

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.

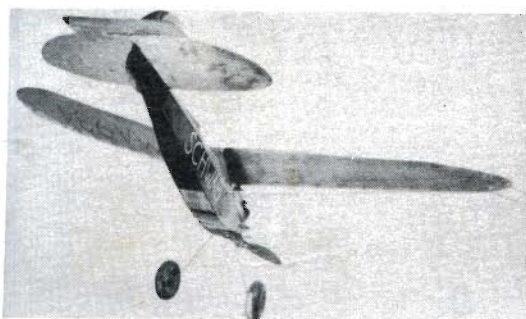
We kept flying for many months in this manner, until one fine day the motor was opened up just a little too much. The ship took off and began to climb to a good fifty feet, and the end of the string. We didn't want to lose the ship, because of a full tank of gas; and then too we didn't have automatic 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

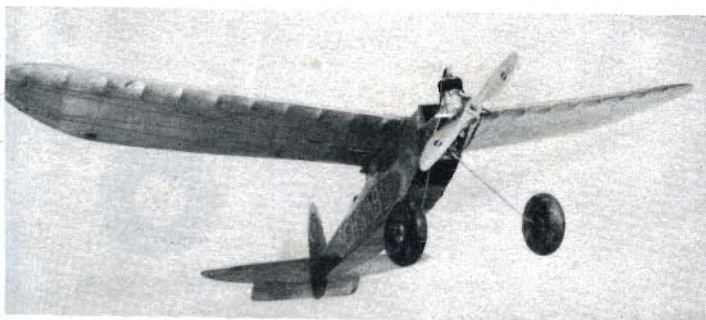


The little plane is tethered and controlled with this joy-stick and rudder-bar

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,



Here's how it looks speeding overhead

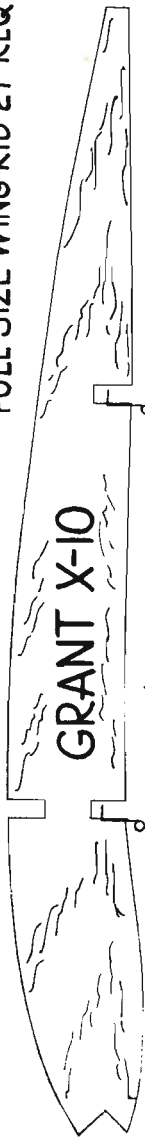


The deflected elevator is shown on the stabilizer rear edge



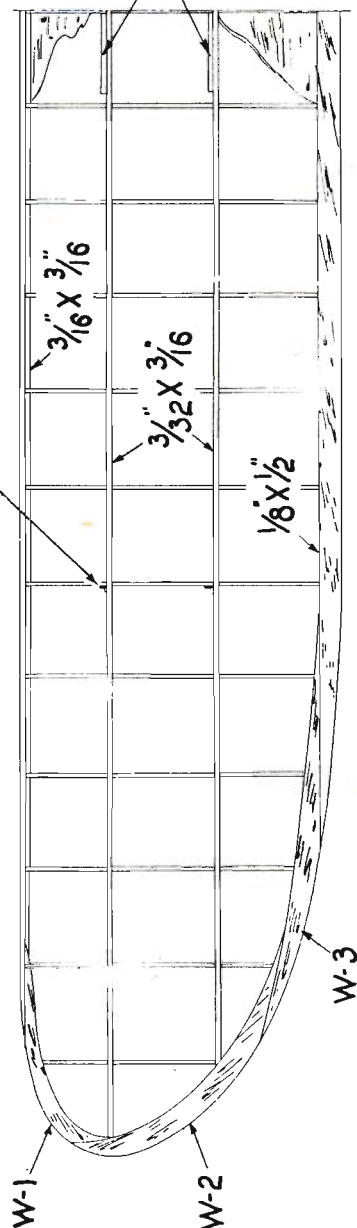
Controls on the tail operated by wires

FULL SIZE WING RIB 21 REQ'D



GRANT X-10

CONTROL LINE GUIDES (PIN)



COVER ENTIRE CENTER SECTION OF WING AND STABILIZER WITH 1/16.

GUSSETS

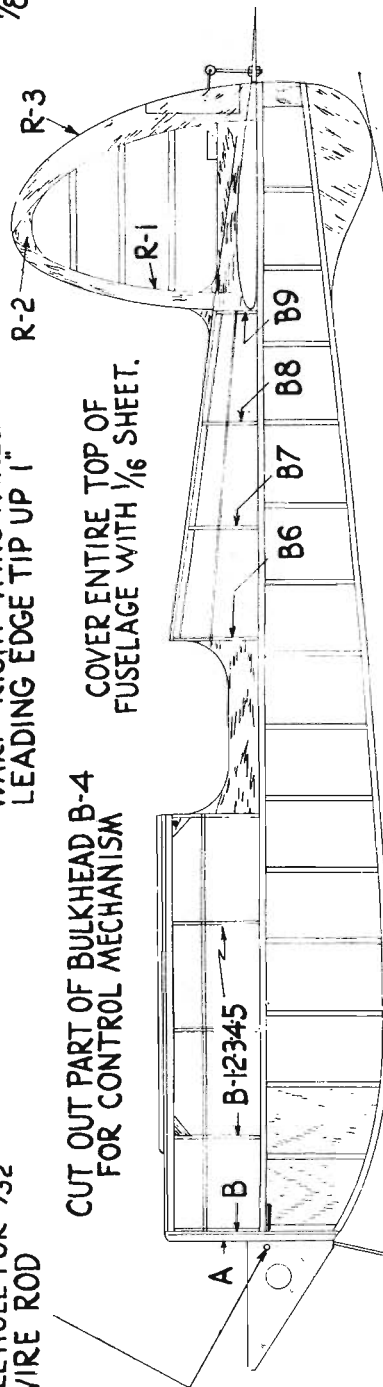
3/16 x 3/16

WARP RIGHT WING PANEL LEADING EDGE TIP UP 1"

DRILL HOLE FOR 3/32 WIRE ROD

CUT OUT PART OF BULKHEAD B-4 FOR CONTROL MECHANISM

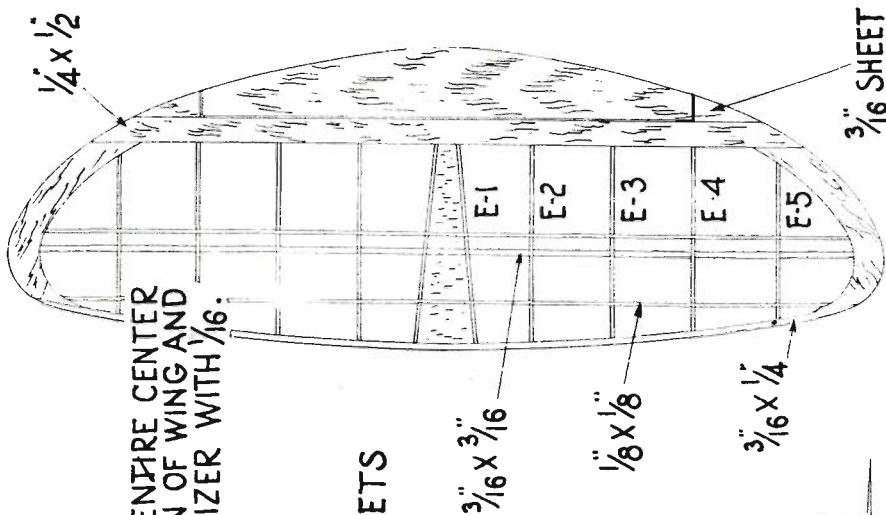
COVER ENTIRE TOP OF FUSELAGE WITH 1/16 SHEET.



FILL IN TOP WITH PLYWOOD

COVER ENTIRE SHIP WITH SILK

MOTOR MOUNT HOOKS



SCALE 1/4" = 1"

REMOTE CONTROL FLYING

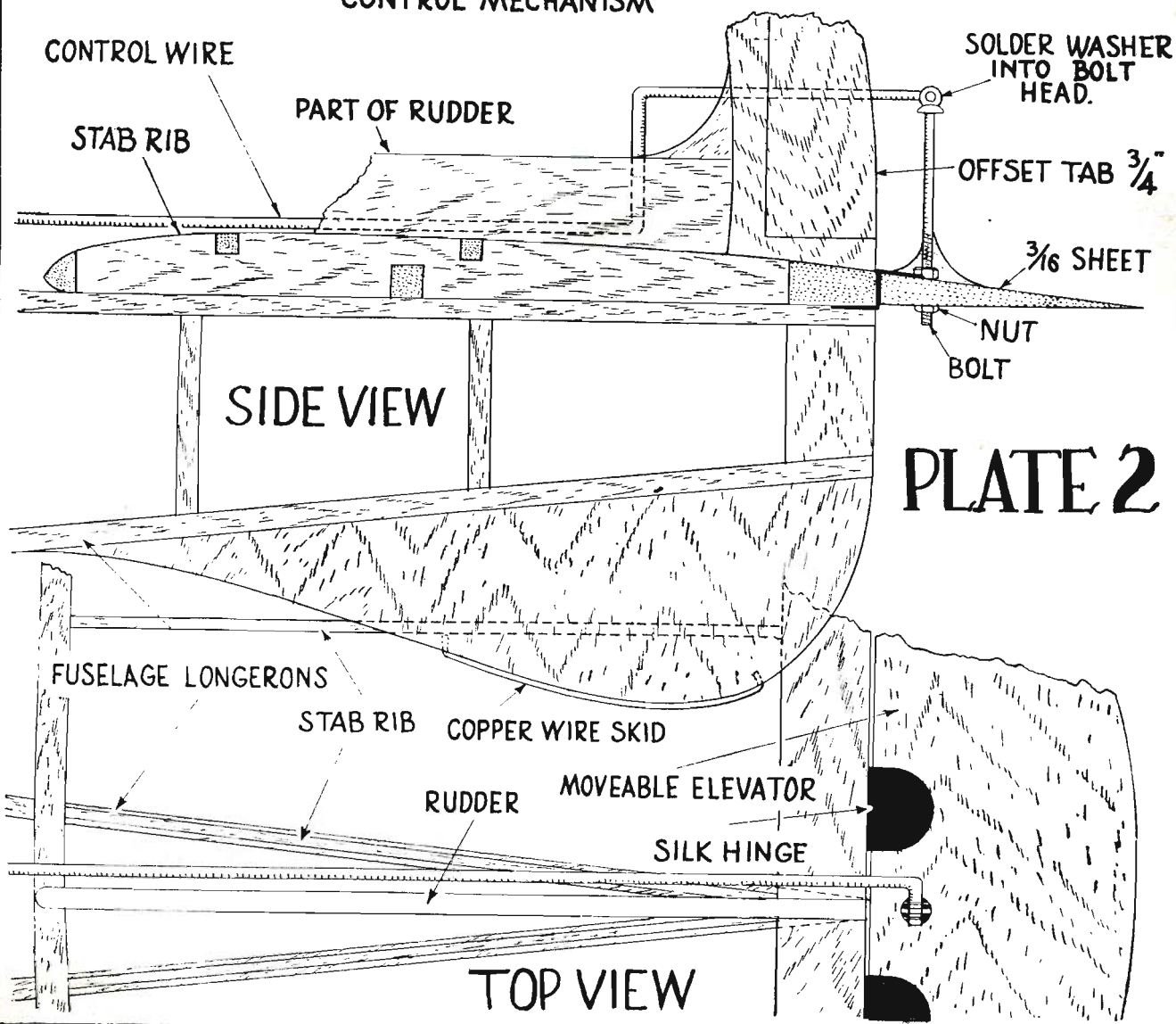
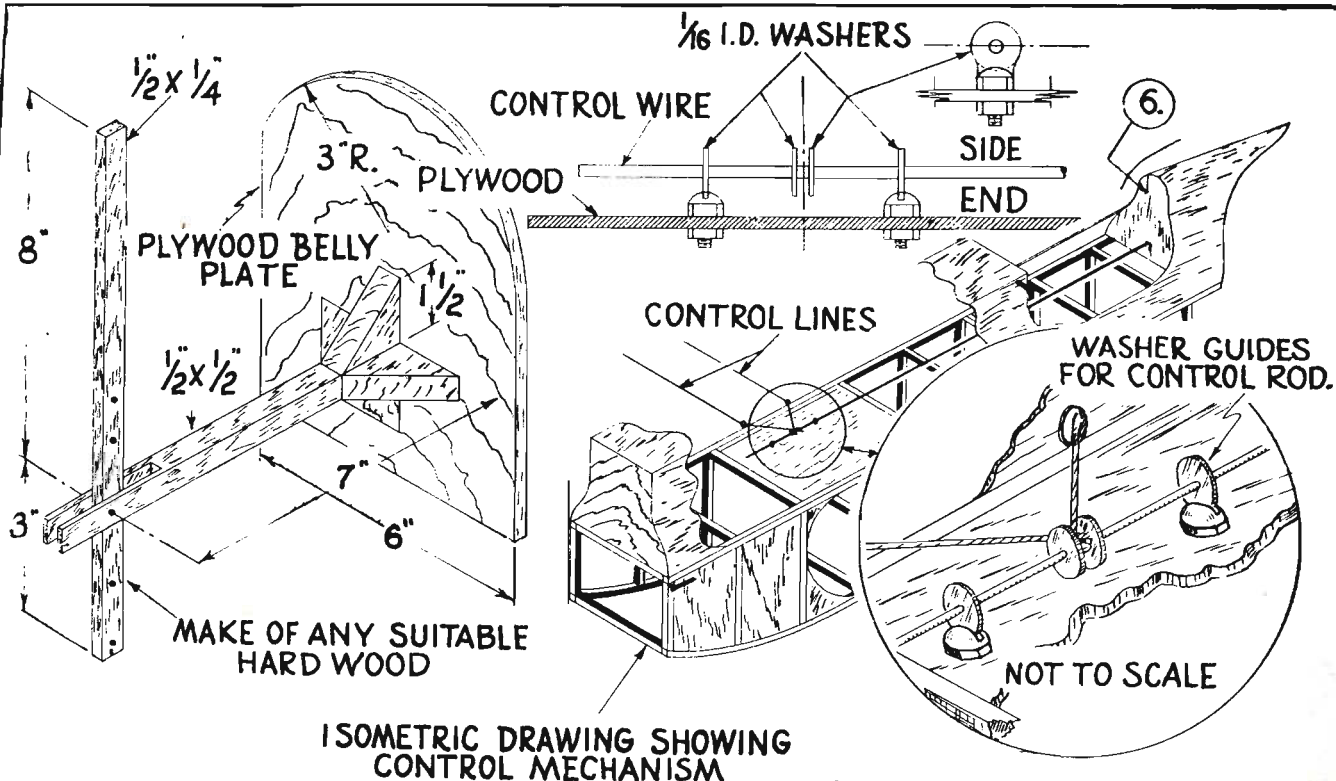
BY

WILLIAM SCHWAB DRAWINGS

BY

WALTER SCHULTZ

PLATE 1



Controlled Lightning

(Continued from page 49)

raise the tail up in flying position, pull 'er 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 crate a million miles every flight. You don't need the great wide open spaces. 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've 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 out 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. So if you want to remote-control 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 cord.

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. Con-

nect up the rest 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 copied from 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 doubled 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 silk to the bottom of elevator section and to the top of stabilizer section. 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-horn 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. Longerons and up 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 remove from the plans and cement on bulkheads, adding necessary longerons and stringers, and install 1/8" diameter wing dowel mounts. The dowels can be braced 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 the 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 permanent 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. Strips of sandpaper are glued to bulkhead B to prevent shimmy 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 fire-wall 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, W-3 from 1/8" sheet.

Dihedral: Lay one wing panel flat on the work bench and raise opposite panel 4". Inlay center section of wing with 1/16" flat 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.

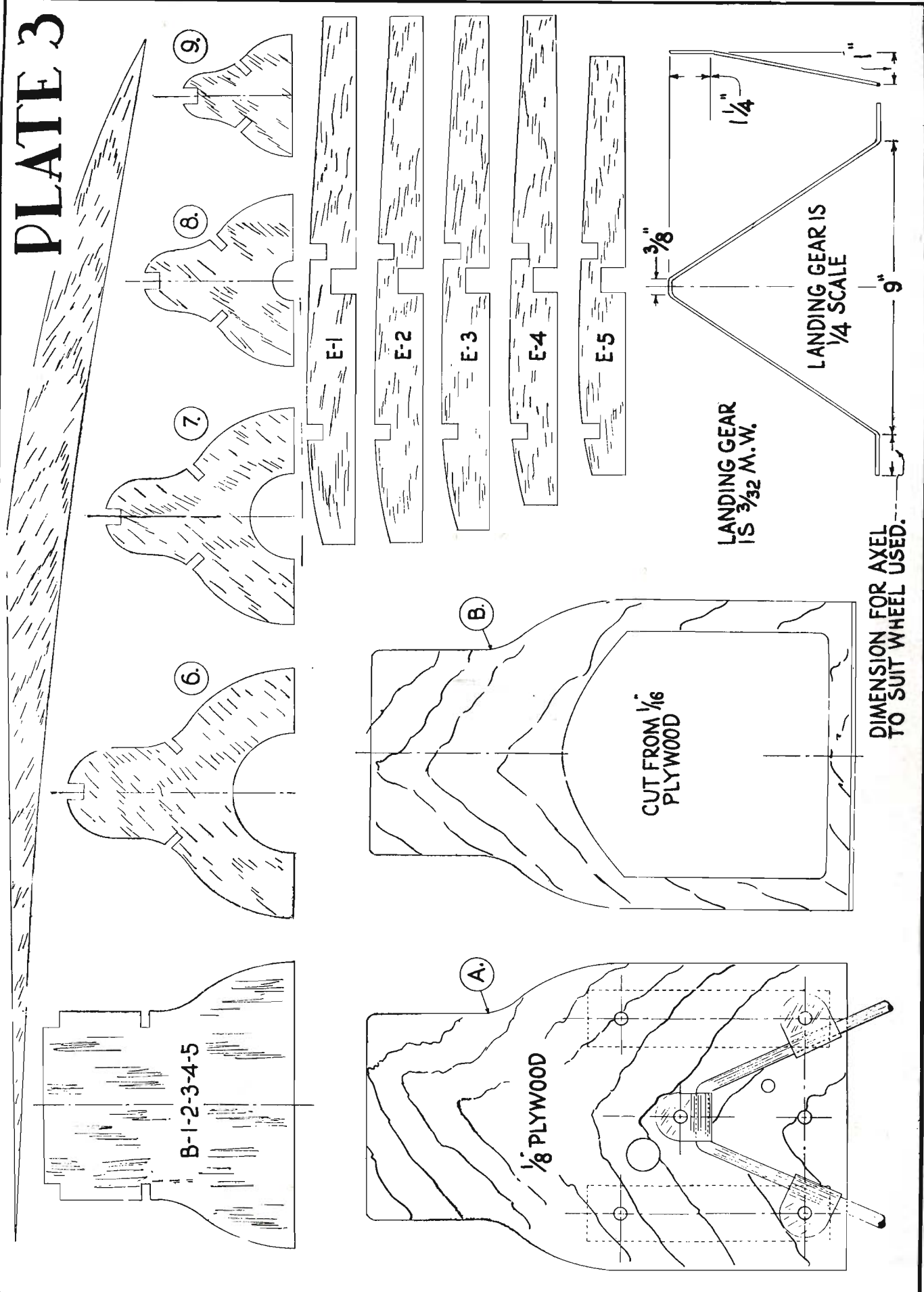
Covering

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 any suitable hard wood, is screwed to the belly plate and braced up with hardwood gussets. Slot out the front of the support stick to receive the joy-stick. Cut the joy-stick to shape and drill in five holes,

PLATE 3



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 closer 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 joy stick perfectly straight. Then connect up your control strings, 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 lines.

It is necessary that the motor be opened almost full in order 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 be not 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 taunt; 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 taunt; 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, hedge-hop, zooming or zazzing 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 your own 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 .034 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 big gas event, you heard of model builders wanting to compete in gas speed events, 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 the 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.

ELLIPSE AREA CHART.

TO FIND THE AREA OF AN ELLIPSE, PICK OUT ANY SPAN IN THE VERTICAL COLUMN AND ANY CHORD IN THE HORIZONTAL COLUMN; GO RIGHT FROM SPAN COLUMN AND DOWN FROM THE CHORD COLUMN. IN THE SQUARE IN WHICH THESE TWO INTERSECT WILL BE FOUND THE AREA OF THE GIVEN ELLIPSE. FOR THE AREA OF ANY ELLIPSE NOT ON THE CHART THE FOLLOWING FORMULA SHOULD BE USED:

$$\text{AREA} = \text{SPAN} \times \text{CHORD} \times .7854$$

Russell Henke.

		AREAS ARE GIVEN IN SQUARE INCHES, CORRECT TO HUNDRETHS.																Russell Henke		
		CHORD: IN INCHES.																		
FT.	IN.	3	3.5	4	4.5	5	5.5	6	7	8	9	10	11	12	13	14	15	16		
SPAN: RIGHT COLUMN INCHES, LEFT, FEET	6	14.14	16.49	18.85																
	12	28.27	32.99	37.70	42.41	47.12	51.84	56.55												
	16	37.70	43.98	50.37	56.55	62.83	69.12	75.40	87.96	100.53	113.10									
	20	47.12	54.98	62.83	70.69	78.54	86.39	94.25	109.96	125.26	141.37	157.08								
	22	51.83	60.48	69.12	77.75	86.39	95.03	103.67	120.95	138.23	155.51	172.79	190.07							
	24	56.55	65.97	75.40	84.83	94.25	103.67	113.10	131.95	150.80	169.85	188.50	207.35	226.20						
	30	70.69	82.47	94.25	106.03	117.81	129.59	141.37	164.93	188.50	212.06	235.62	254.18	282.74	306.31					
	36	84.83	98.96	113.10	127.23	141.37	155.51	169.65	197.92	226.20	254.47	282.74	311.02	339.29	367.57					
	40	94.25	109.96	125.66	141.37	157.08	172.79	188.50	219.91	251.33	282.74	314.16	345.58	376.97	408.41	439.82				
	42	98.96	115.45	131.95	148.44	164.93	181.43	197.92	230.91	263.89	296.88	329.87	362.85	395.84	428.82	461.82				
	44	103.67	120.95	138.23	155.51	172.78	190.07	207.35	241.70	276.46	311.02	345.58	380.13	414.69	449.25	483.81	518.36			
	46			144.51	162.58	180.64	198.71	216.77	252.90	289.13	325.16	361.28	397.41	433.54	469.67	505.80	541.93			
	48			150.80	169.65	188.50	207.35	226.20	263.89	301.59	339.29	376.97	414.69	452.39	490.09	527.79	565.49	600.19		
	54					212.06	233.26	254.47	296.88	339.29	381.70	424.12	466.53	508.94	551.35	593.76	636.17	678.59		
	60					235.62	259.18	282.74	329.87	376.97	424.12	471.24	518.36	565.49	612.61	659.74	706.86	753.98		
	66								311.02	362.85	414.69	466.53	518.36	570.20	622.04	673.87	725.71	777.55	829.38	
	72								339.29	395.84	452.38	508.94	565.49	622.04	678.59	735.13	791.68	848.23	904.78	
	78										490.09	551.35	612.61	673.87	735.13	796.40	857.66	918.91	980.18	
	84											593.76	659.74	725.71	791.68	857.66	923.63	989.60	1055.6	
	90												706.86	777.55	848.23	918.91	989.60	1060.3	1130.9	
	96														904.78	980.18	1055.6	1130.9	1206.4	
	102																	1201.7	1281.8	
	108																1187.5	1272.4	1357.2	
	114																	1253.5	1343.0	1432.6
	120																	1319.5	1413.7	1507.9



GAS MODEL ARMY SCOUT

**A scale model of the Curtiss O-52 observation plane
that is easy to build—and a most consistent flier**

by **SYDNEY STRUHL**

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 plan

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.

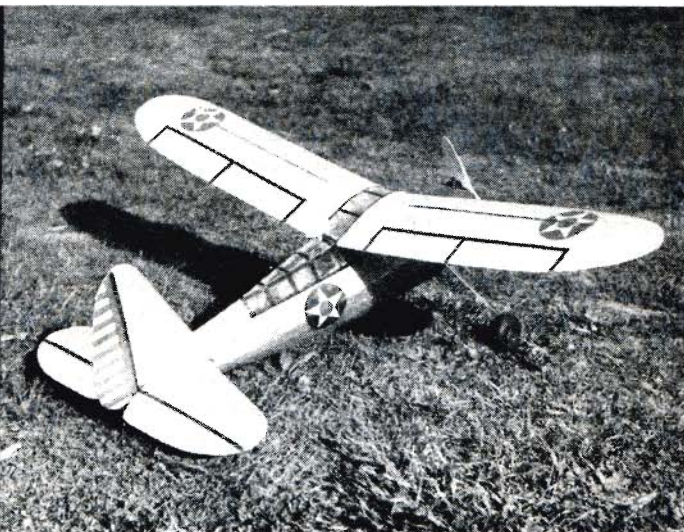
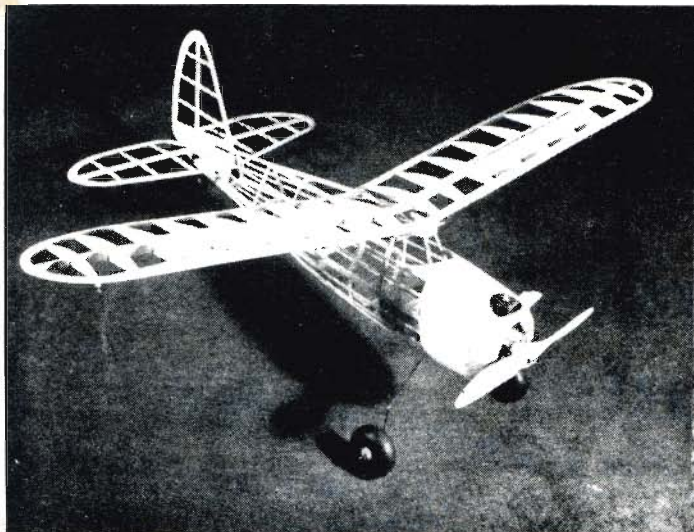
The O-52's construction may appear rather difficult at first glance, but after a little study of the plans you will realize that this model is amazingly easy to build. We have tried to keep construction easy

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

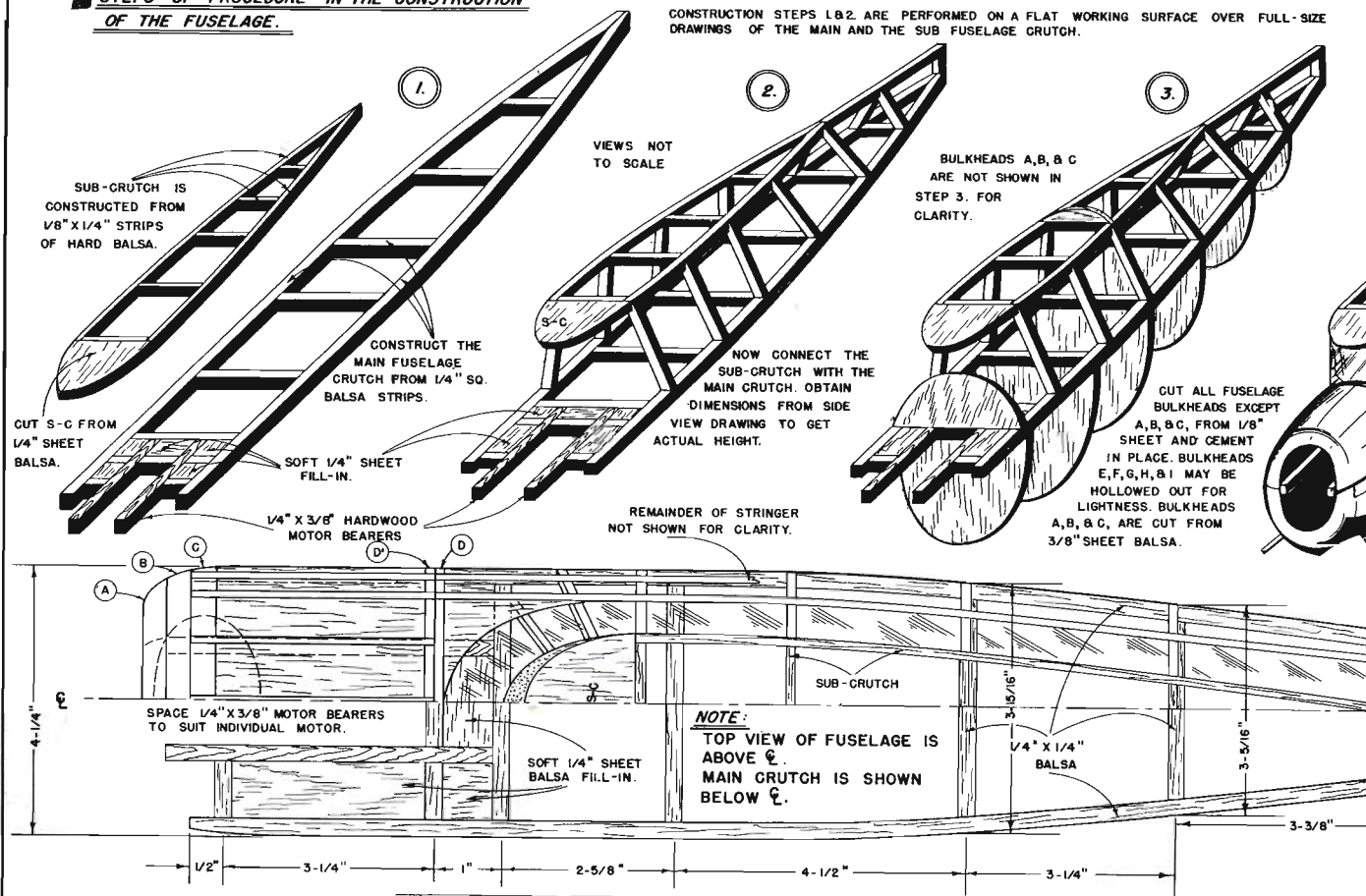
(Continued on page 60)

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



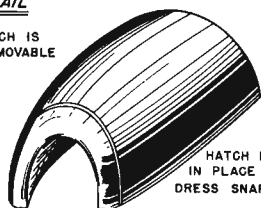
STEPS OF PROCEDURE IN THE CONSTRUCTION OF THE FUSELAGE.

CONSTRUCTION STEPS 1 & 2 ARE PERFORMED ON A FLAT WORKING SURFACE OVER FULL-SIZE DRAWINGS OF THE MAIN AND THE SUB FUSELAGE CRUTCH.

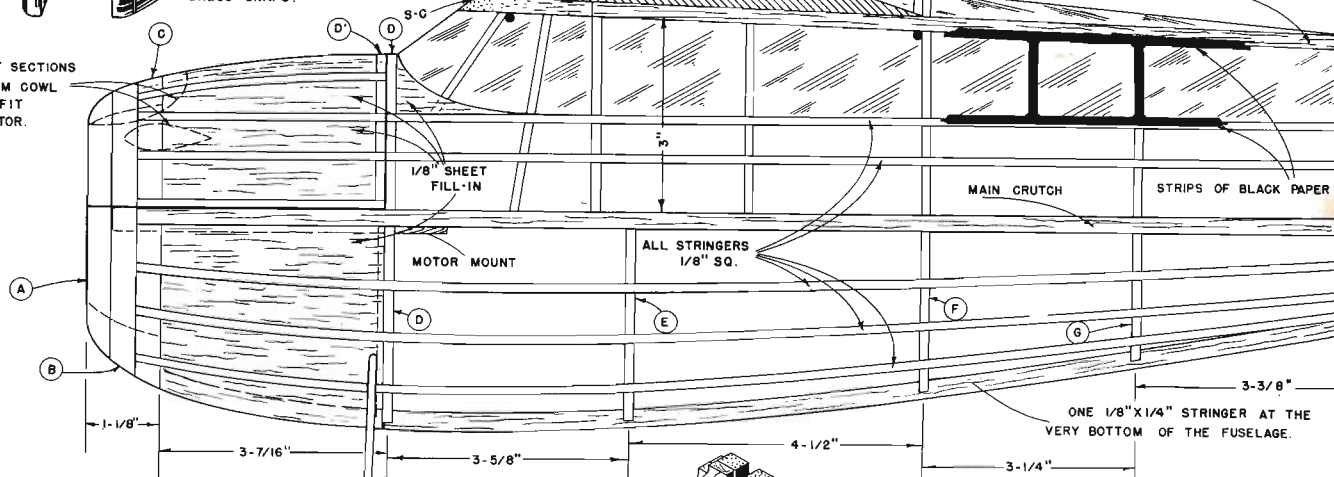


COWL HATCH DETAIL

HATCH IS REMOVABLE



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

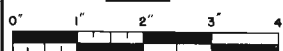
LANDING GEAR IS MOUNTED TO 1/16" PLYWOOD CUT TO THE SHAPE OF "D" WITH STRING AND SEVERAL COATS OF CEMENT.

BULKHEAD "D"

NOT TO SCALE

TO FIT WHEEL

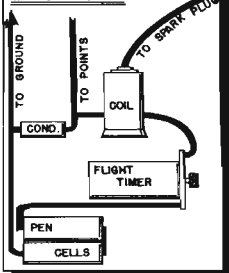
SCALE



NOTE THAT TAIL IS REMOVABLE.

INSTALL LANDING
GEAR AND THEN
COVER WITH WET
SILKSPAN.
COVER CABIN WITH
GELLULOID.

WIRING DIAGRAM



1/4" SQ. ROUNDED
ON TOP

1/8" FILL-IN

3" DIHEDRAL AT EACH WING TIP.

A SINGLE STRUT 13" LONG IS USED FOR SCALE PURPOSE ONLY. NOT ADVISABLE TO USE STRUT ON FLYING VERSION.

LOCATE COIL AND
BATT. BOX IN THE
FUSELAGE TO
BALANCE THE MODEL

FRONT VIEW

ONE-HALF DESIGNATED SCALE

VIEW SHOWING
HOW BULKHEAD (J)
IS USED TO FAIR
THE CELLULOIDE CENTER
SECTION INTO THE
FUSELAGE CABIN.

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

1/8" X 5/8"
CENTER SPAR

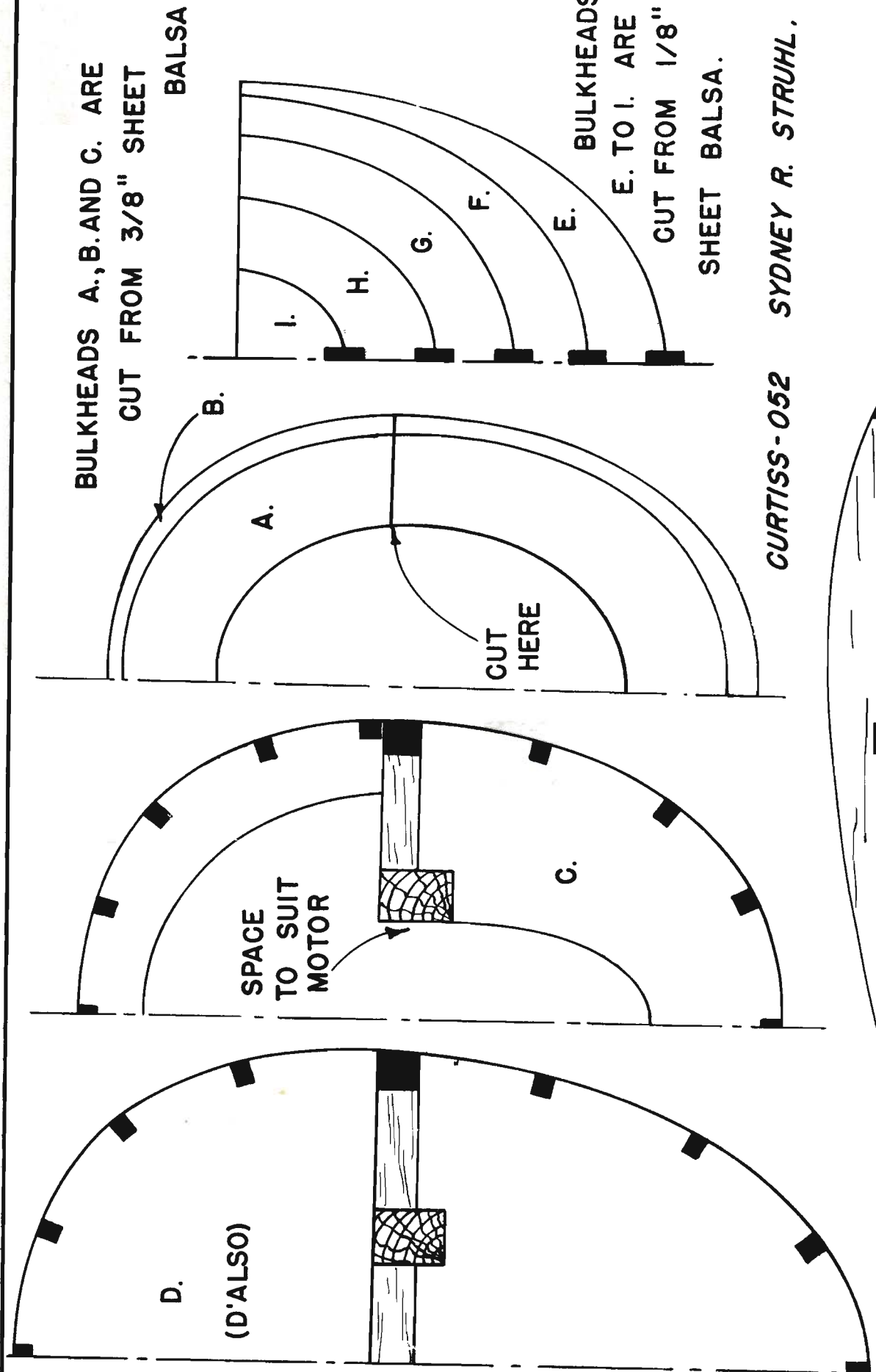
7/32" X 11/16"
TRAILING EDGE

"CURTISS O-52"

BY SYDNEY R. STRUHL

SCALE -- PLATE 1&2, 1/3"=1" PLATE 3&4, 1"=1"
WING SPAN ----- 42-5/8"
LENGTH OVERALL ----- 30-1/2"
MOTOR ----- CLASS 'A' OR 'B'
PROPELLER DIAMETER ----- 9"

PLATES 1 & 2.



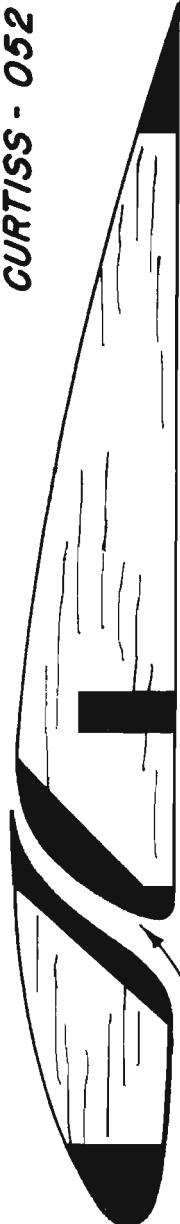
ALL PARTS SHOWN
FULL SIZE

CENTER SECTION RIB - 2 REQUIRED 1/16" SHEET

PLATE 3

CURTISS - 052

SYDNEY R. STRUHL.



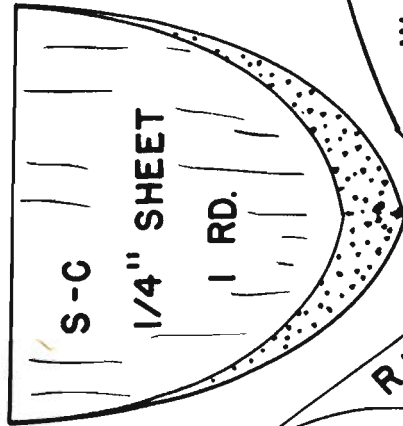
WING SLOT
WING RIB - 14 REQUIRED 1/16" SHEET



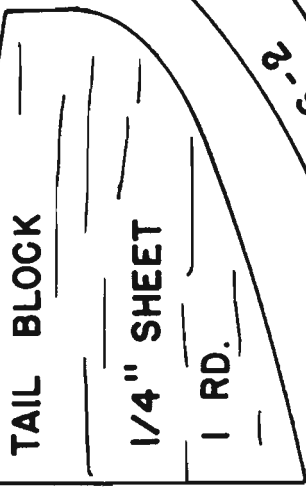
WING TIP RIB - 2 REQUIRED 1/16"



J & J
TWO REQUIRED
1/8" SHEET



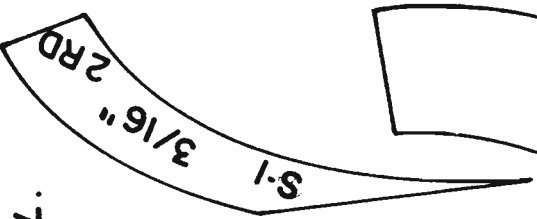
ALL PARTS ON
THIS PLATE ARE
SHOWN FULL
SIZE



TAIL BLOCK

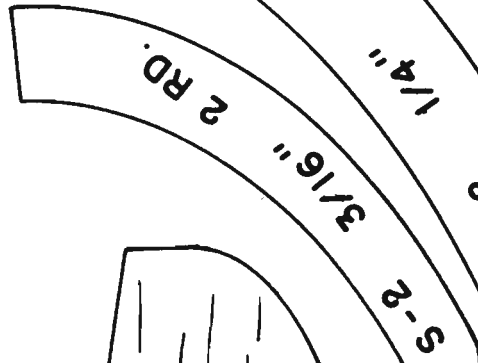
1/4" SHEET

1 RD.



S-1

3/16" 2 RD.



2 RD.

3/16"

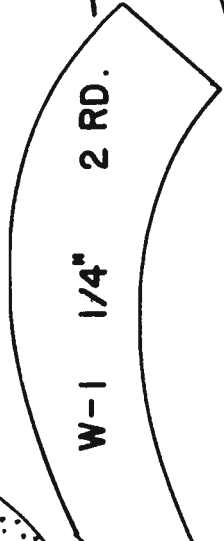
2 RD.

1/4"

W-2

S-2

1 RD.



W-1 1/4" 2 RD.



R-1

1 RD.

3/16"

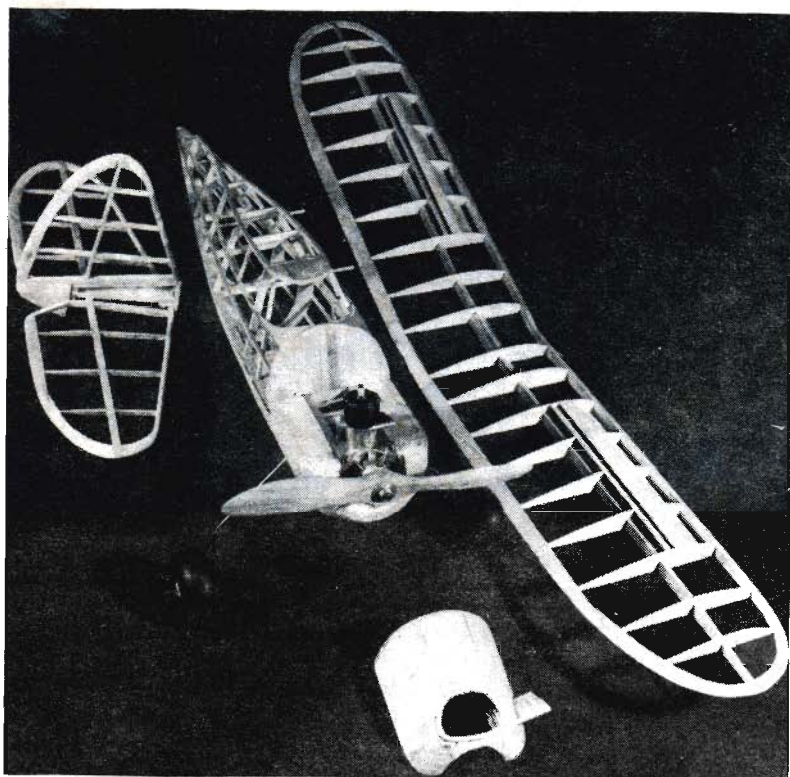
3/16"

R-2

PLATE 4



Just like the full scale plane when properly decorated



Plane is composed of separate units which are conveniently detachable, facilitating transportation

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 buckling 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 strands 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 cross-section in them. Cover the wing in the usual manner; cut the covering away from the slot openings on the top and bottom 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 on the plans. Naturally you will have to block up the leading edge to meet the rib leading edge. Insert all ribs 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 cross-section 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-crutch. Check for any warps in the wing; recement 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 dowls to wrap the rubber strands upon in the proper positions.

COVERING—The author covered his Curtiss O-52 with gas type Silkspan 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 Silkspan 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

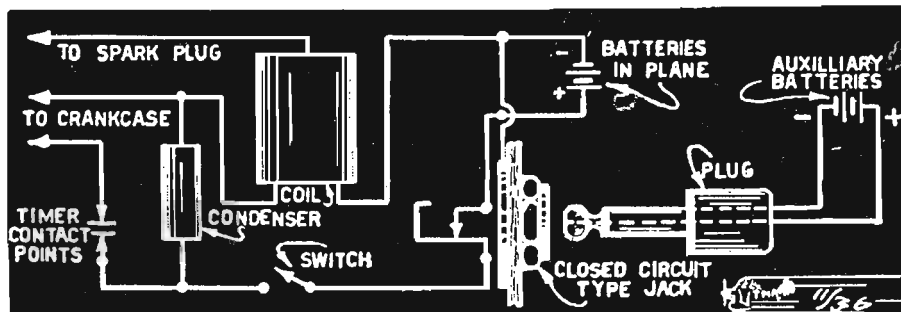
celluloid cabin.

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.



A diagram of the wiring system for auxiliary starting batteries

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.

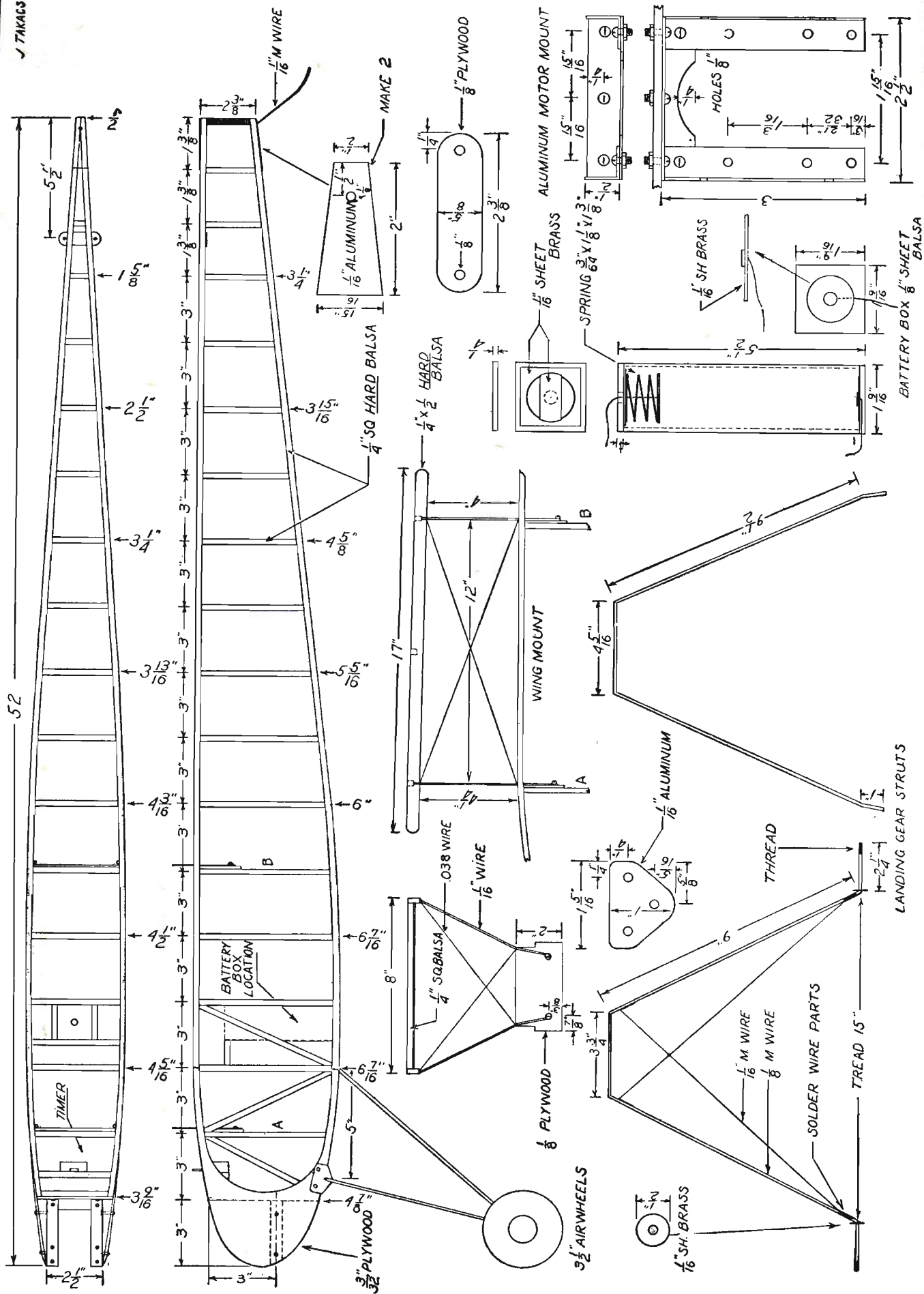
To apply it, use model cement of rather

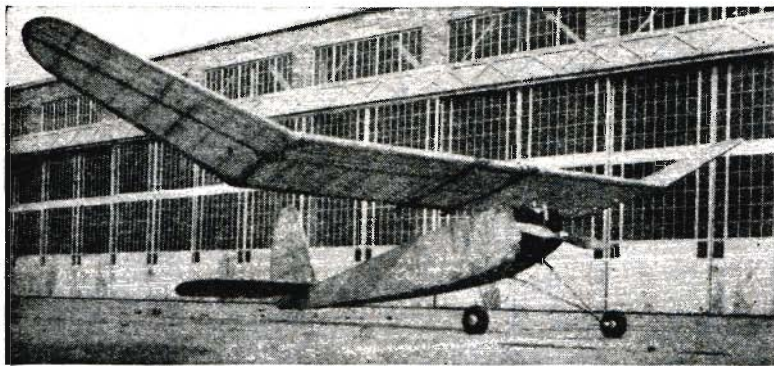
thick consistency. Spread the cement over the wood and lay on the crinoline, rubbing it out flat. Go over the outside of it with cement on the finger, spreading it around and flowing it into the mesh. The cement softens the starch in the crinoline and when dry the unit which has been covered becomes 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 noth-

ing has harmed it to date, there being merely several slight scratches on the surface. If 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

A RECORD BREAKING Gas Model

Here's a Gas Model That Made a World's Record for Duration and Weight Lifting—How You Can Build It

By CHESTER LANZO

er: Utilize every erg of energy in the motor to make the most of the limited run. Every foot of altitude gained in the climb is minutes added to the total length of the flight. Get the model high enough where the more active air currents will affect the ship.

This model has proven to have both of these characteristics to an amazing extent, plus an extreme in stability. In fact it is so stable that it can be made to circle right or left under power or in the glide without having to warp or twist the wings. As a weight-lifting or a radio-control job it cannot be beaten. This model won the Scripps-Howard contest for lifting the greatest weight and then remained in the air for the greatest length of time.

During a recent gas duration contest, with a motor run of 21 seconds, the plane remained aloft for 25 minutes. Upon returning to the field the ship was sent up again with a motor run of 25 seconds. This produced a flight of two hours covering a distance of 25 miles, and incidentally established a new world record.

This plane also incorporates the following desirable features: detachable wing, adjustable

rudder and elevator, crash-proof wire 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.

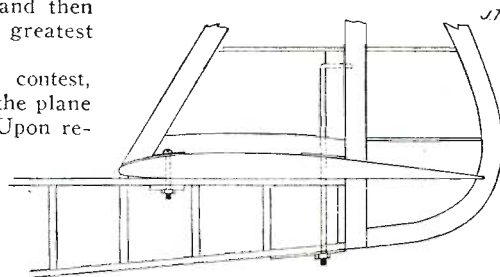


The author, at right, waits to have his record breaking ship "gassed up"

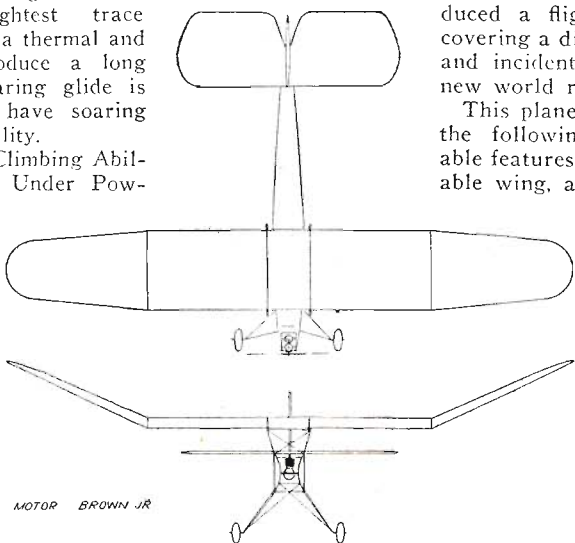
TO PRODUCE a consistent champion-ship gas model, a ship must possess these two main flight characteristics.

Ability to Soar: Any ship will climb with a powerful riser "slamming it skyward," but to have a model take advantage of the slightest trace of a thermal and produce a long soaring glide is to have soaring ability.

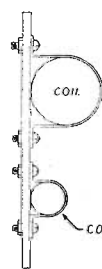
Climbing Ability Under Pow-



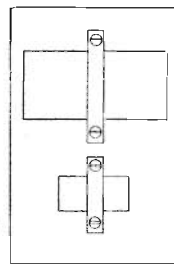
STABILIZER & RUDDER MOUNTING



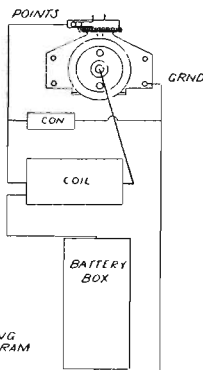
MOTOR BROWN JR



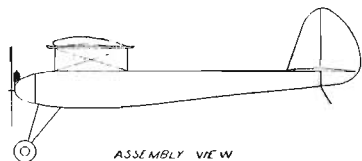
MOUNT COIL & CONDENSER ON No 1 BULKHEAD



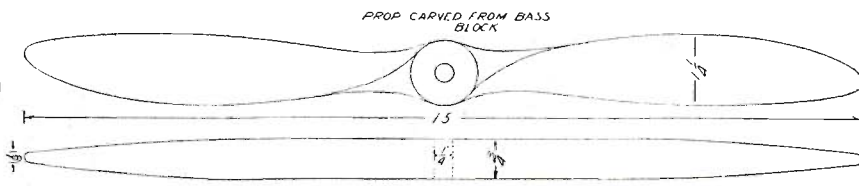
WIRING DIAGRAM



GRND



ASSEMBLY VIEW



PROP CARVED FROM BASS BLOCK

Make an accurate full size drawing of the side view of the fuselage on drawing paper. Place this on a large flat piece of soft wood and hammer one inch brads along the outside edges at close intervals. The longerons are one-quarter inch square very hard balsa. Hold these over the mouth of a steaming tea kettle and bend to the approximate fuselage outlines. Cut the fuselage uprights, making a duplicate of each and place them between the longerons, using plenty of cement.

Pull out all of the brads after the sides have dried. Remove them from the drawing and split the sides apart with a thin double edged razor blade. Obtain a large sandpaper block and sand both sides of the fuselage until very smooth.

Pin one side of the body to the work bench, cut two of the longest cross pieces in the top view to the correct length and cement them in their proper place. Then lay the other side of the body on top of this making sure that all sides are square. After this has dried glue the tail posts including the tail skid together, wrapping well with silk thread. The rest of the

top cross pieces are easily glued in place.

Trace the outlines of the nose on a piece of 3/32" plywood and cut to shape with a coping saw, gluing them between the longerons. The 1/8" plywood firewall is also formed. Before assembling the firewall be sure all of the holes are drilled and the coil and condenser are mounted securely on the back of it. Dope the firewall and fuselage nose with two coats of "black" followed up with two coats of "clear." This is to make it resistant to the destructive action of gas and oil.

Prepare the metal motor mount from half-inch angle duraluminum. Also make the landing gear fittings, tail skid and tail mount fittings out of duraluminum. After assembling these to the fuselage the structure will be ready for covering.

Wing

All of the ribs in the center section are the same shape and size but the rear of the tip ribs are cut off to fit flush with the trailing edge. The wing is assembled in three sections, and upon completing, the two tips are joined to the center section, adding the twelve inches of dihedral.

Double Paper Covering

The wing, fuselage, and tail assembly are all double paper covered. Covering in this manner produces a strong and durable coating for the plane which will not split into long tears when punctured.

Place the tissue on the parts to be covered with the grain of the tissue running lengthwise. Spray with water and follow with two coats of clear thin dope. Add another layer of tissue with the grain running crosswise to the first covering. Spray the second coat with water and apply two coats of heavy clear dope.

Tail Unit

Try to make the tail units as light as possible, so that the wing may be placed closer to the nose. This will increase the longitudinal and directional stability. Fill in around the metal mounting parts with 1/8" sheet balsa to produce a more rigid assembly.

That's all there is! Hope you have a winner!

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

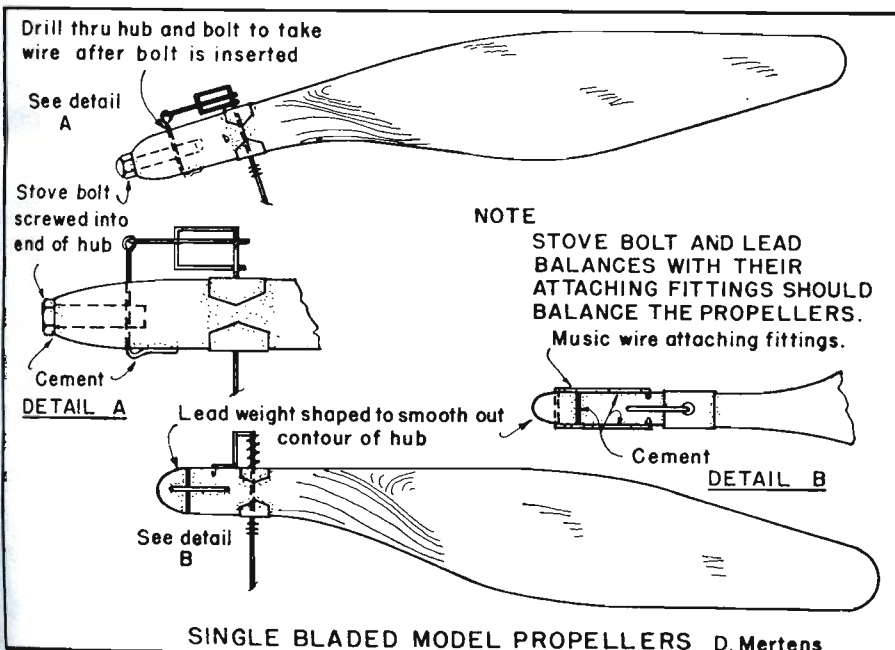
propeller would be upon the performance of the ship. It created a great surprise when the model climbed much better than before the break took place. There was of course a terrific amount of vibration which at the time was thought could not be overcome, so nothing was done about it.

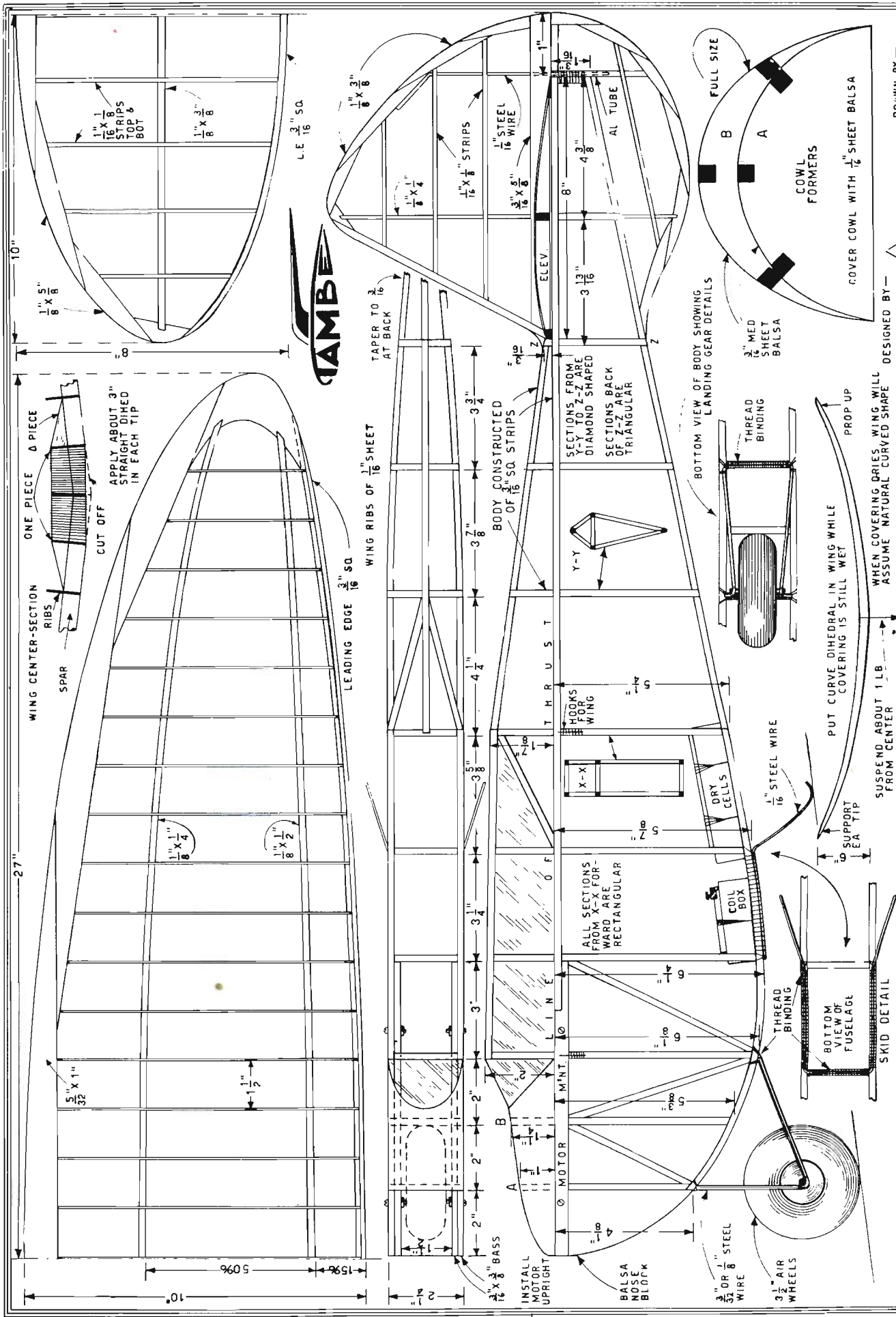
On one other occasion, a lad who broke his propeller and not possessing a spare one flew his model with half a propeller in the contest and lo—he won first place. Many modellers who witnessed the flight considered it a freak one, but some gave the strange phenomena serious thought. To the author the 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 stove 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 depth, 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 stove 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 wire 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 to 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



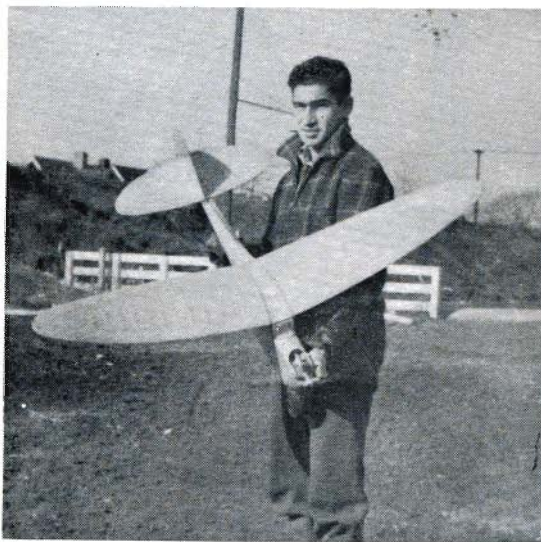
Unusual in design but a plane that climbs fast and has great soaring qualities. A wing section of the latest design is used

By LEON SHULMAN

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 $1\frac{1}{2}$ 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



The author with the completed plane. Note the compact but efficient design

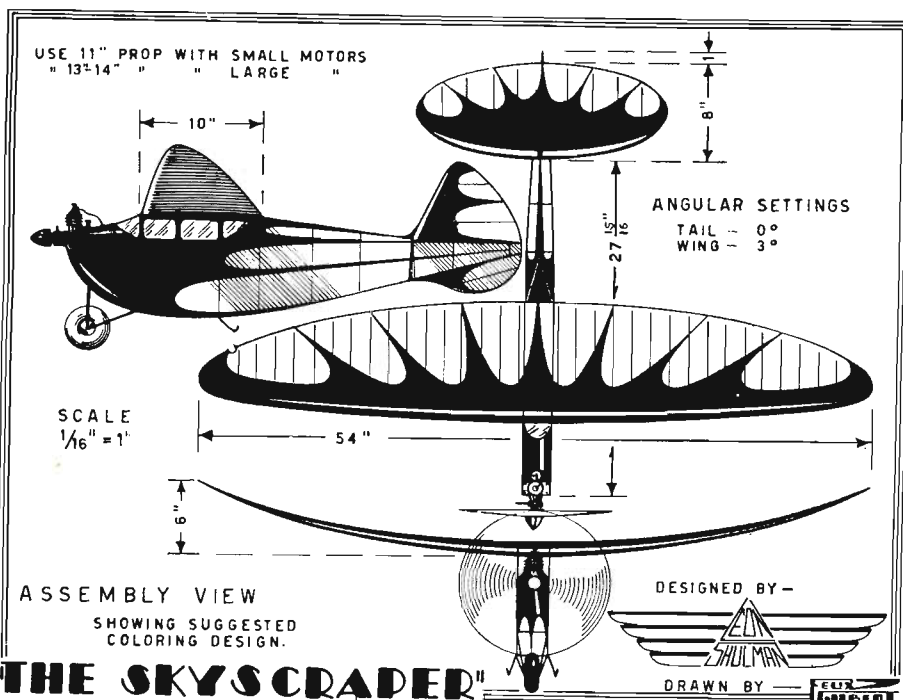
joints running into the motor mount especially accurate and strong, as this part of the body must absorb a great deal of strain. The two sides are completely joined from X-X forward before the rear of the body is built up. Then the two side longerons are joined at the back.

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 construction.



"THE SKYSCRAPER"

ROOT RIB OUTLINE
10" " "
14" " "

SEE ARTICLE

CHORD LINE

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

$\frac{1}{8} \times \frac{3}{8}$ "

4TH ELEV SECTION FROM CENTER

2ND RUDDER SECTION FROM TIP

SOLDER USE INTERMEDIATE CELLS

SPRING
STEEL
STRIP

THIN
BRASS
PLATE

WIRE CONNECTIONS.

$4 \frac{3}{16}$ "

BATTERY BOX
OF $\frac{1}{8}$ " HARD SHEET

CIRCUIT
DIAGRAM

TIMER

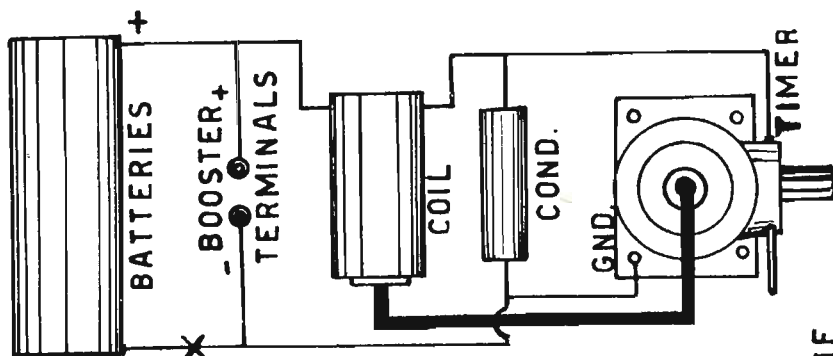
NOSE
VIEW

$\frac{31}{32}$ "

HOOKS FOR RUBBER

USE REMOVABLE
INNER MOUNTS FOR
SMALL MOTORS. IN —
STALL THIRD SET IF
NECESSARY TO FIT MOTOR.

OUTSIDE MOUNTS FOR $\frac{1}{5}$ HP MOTORS.



"THE SKYSCRAPER"

SCALE
FULL SIZE

PLATE 2

DESIGNED BY—
LEON
SHULMAN

DRAWN BY—
FELIX
GILBERT

structing the rest of the tail sections. The bent strips will assume a natural curve. In building the elevator, first do the bottom, which is straight.

Wing

Oil the stock is labeled. The wing outline is a double-ellipse which is highly streamlined. The front minor axis is three inches at the center, and the back minor axis is seven inches, thus giving the root chord of ten inches. Or else, the drawings may be scaled up to four times the size of those on the page by means of dividers or proportional dividers which would save time.

To cut the ribs, note that they are all derived from the root rib. As the ribs get shorter, they are decreased from the trailing edge, but they must always taper to 5/32" at the back, which is the trail-

ing edge thickness. The wood that is removed is always taken away from the top and at the back, never at the bottom. The drawing at the top of plate two illustrates this method exactly. This system provides a negative angle at the tips, approaching a symmetrical section which offsets stalling tendencies.

The method of putting dihedral into the wing is clearly outlined in the top and bottom center of plate one. This type of dihedral not only enhances the appearance of the wing but provides a much smoother airflow, especially at the tips.

Flying

It is highly recommended that the model be absolutely complete before any sort of testing is undertaken. The model should balance when held by the extreme tips.

The plane should be tested on a calm

evening in a large field. The model should be pushed along the ground by the tail till it lifts a few feet and then glides in gently. If a small motor is used, give it about half-throttle and push it off the ground gently into the wind. The climb should be slow and with the torque, for better flights "rev" up the motor.

For big motors, set the spark to neutral, lean the mixture and close the choke about half then launch the ship the same as with a small motor. With big motors and at this power the model should nose up steeply with torque and climb. The glide on both ships should be flat and slow, and against torque. The skids should keep the model in an upright position. Due to the one wheel on the nose the prop toll is at a minimum, as is the parasite resistance.

Tricky "Props" For Flighty Ships

Two Expert Model Fliers Tell You How

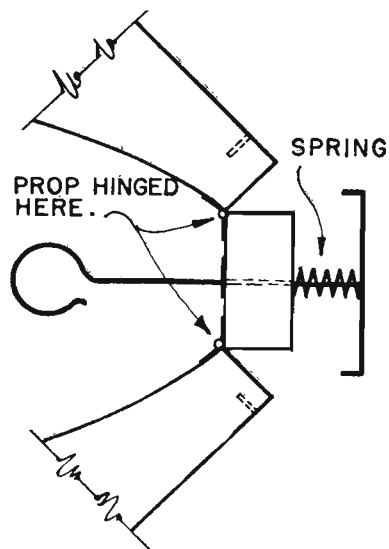
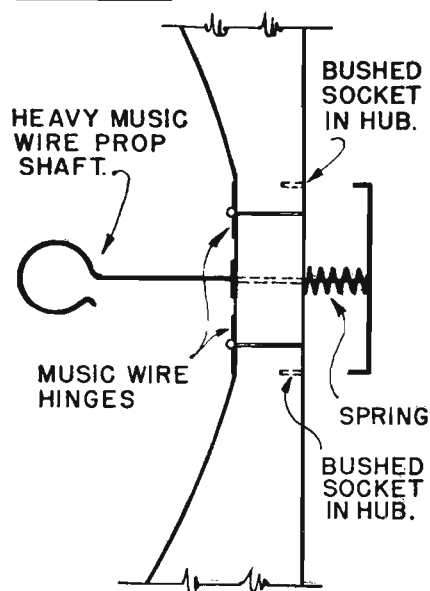
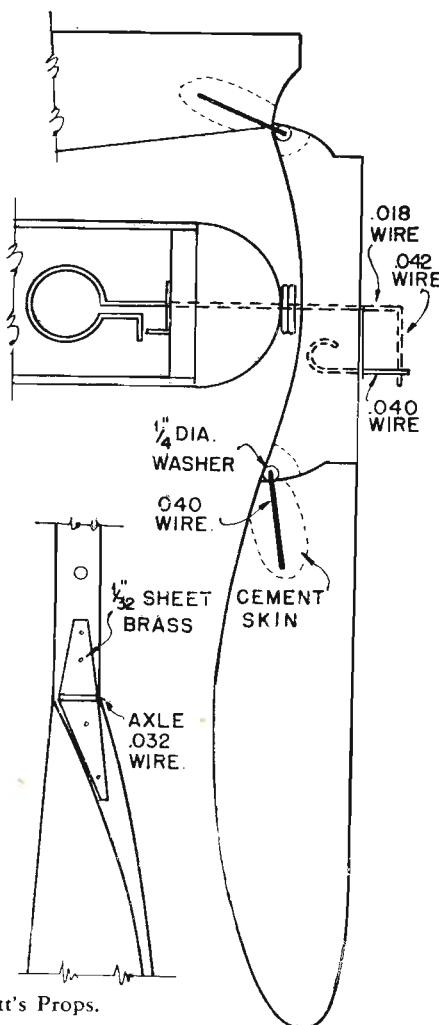
to Make Free Wheeling Folding Propellers and Give Other Suggestions on Model Design

First Author
Dick Everett Says:

By DICK EVERETT and
VERNON BOEHLE

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

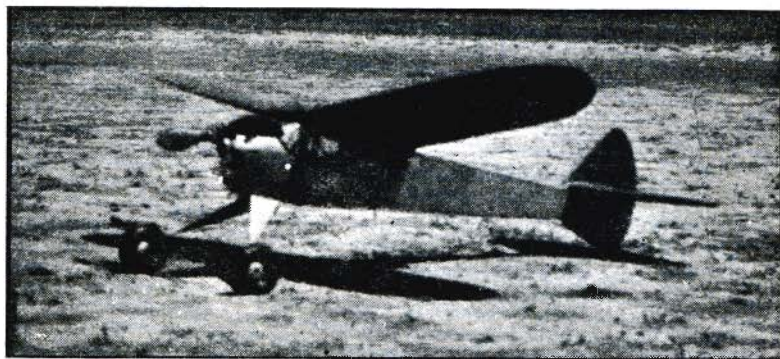
Dick Everett's Props.



USING FREE WHEELING PRINCIPLE, THE MOTOR WHEN WOUND PULLS PROP SHAFT INTO BUSHED SOCKETS IN TOP OF PROP HUB. THIS LOCKS BLADES UNTIL MOTOR IS UNWOUND WHEN THE SPRING FORCES SHAFT OUT OF HUB AND PERMITS THE FORCE OF THE AIR TO PUSH THE BLADE ENDS BACK.

How to Build A Three-Foot Gas Model

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



The completed triangular fuselage model, ready to fly

IF YOU join the large group of gas modelers who are hailing 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 transportation 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 much 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 apparent. 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 progress. 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



Climbing high into the "blue"



It takes off easily. Here it is starting on a flight

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 midgets 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 happen.

Fuselage

In keeping with the general simplicity of the S-4 itself, 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. Getting these angles made correctly is very important 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 bottom of each piece to avoid reversing them.

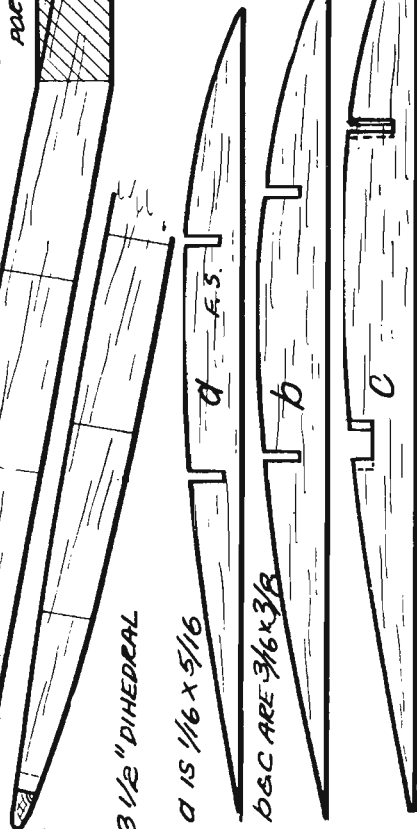
This work can be done while the flat basic fuselage framework is drying. The latter is built of 3/16" square hard balsa on a full size top view lay-out of the fuselage. To judge from the number of requests that a draftsman gets for full size reproductions of the magazine drawings, the job of scaling 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 bottom stringer in place goes on while the base framework is still pinned to the plans. Since the compression members are not exactly 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 former. This is done to prevent breakage while the construction is going on. When the framework is dry it can be taken from the plans and the landing gear may be added.

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 bindings several times with cement. Wrap the



The author adjusts the tail unit

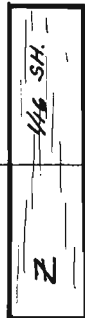
DRAW UP WING-SPAR TO FULL SIZE
~ CUT CENTER ANGLES FOR
ON THOSE PLANS FOR
ACCURACY



3 1/2" DIHEDRAL

a IS 1/16 x 5/16

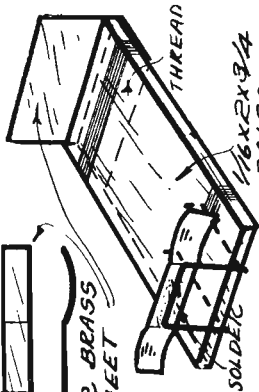
b & c ARE 3/16 x 3/8



CEMENT Z OVER SHADED
PORTION ~ BOTH SIDES

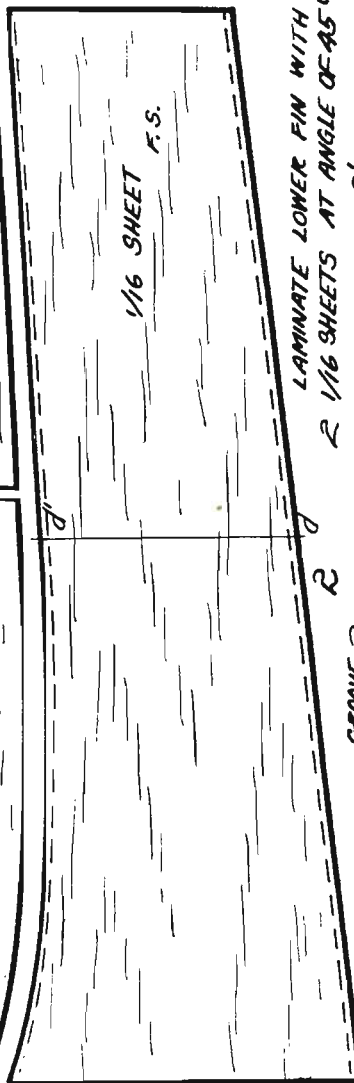


1/32 BRASS
SHEET



1/16 x 2 x 3/4
BALSA

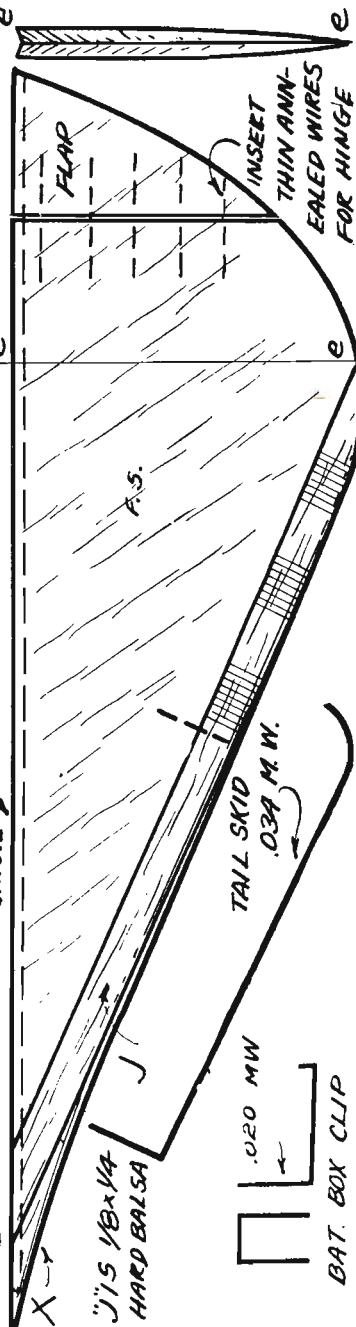
HOLD CELLS IN
WITH RUBBER
BAND



1/16 SHEET F.S.

LAMINATE LOWER FIN WITH
2 1/16 SHEETS AT ANGLE OF 45°

GROOVE D

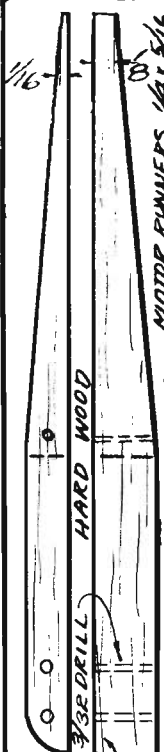


7/16 1/8 x 1/4
HARD BALSA

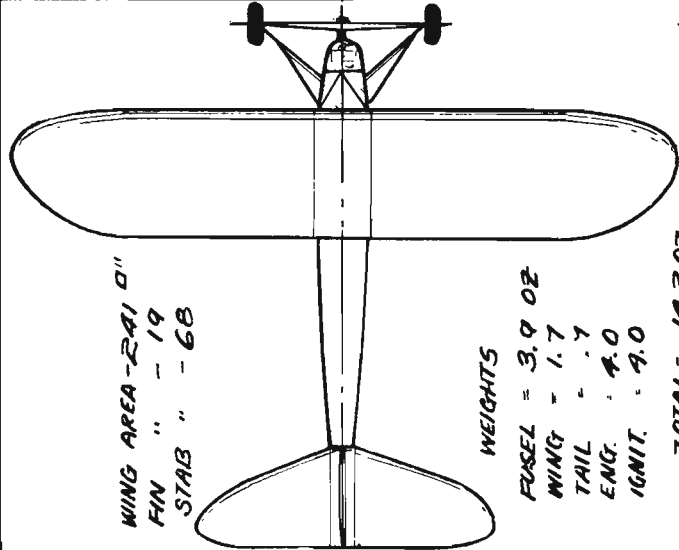
0.020 MW

TAIL SKID
0.034 M.W.

BAT. BOX CLIP



F.S. MOTOR RUNNERS 1/4 x 5/16

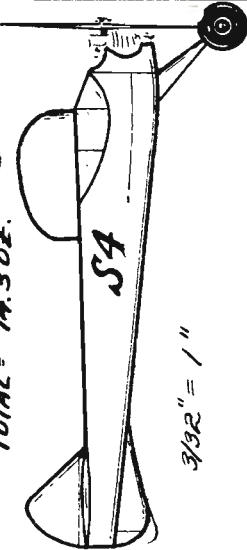


WING AREA - 241 sq
FIN " - 19
STAB " - 68

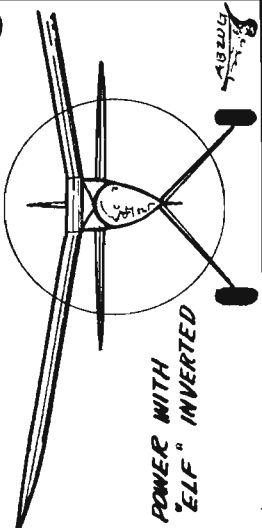
WEIGHTS

FUSEL = 3.9 OZ
WING = 1.7
TAIL = .7
ENG. = 4.0
IGNIT. = 4.0

TOTAL = 14.3 OZ.



3/32" = 1"



POWER WITH
"ELF" INVERTED

landing gear joints near the wheels with fine copper wire and then solder. Place the 1/8" hard sheet balsa fillers in with thread and cement and cover the completed strut with silk. Solder washers on the ends of the axles nearer the fuselage to keep the wheels from riding up. Some copper wire and a gob of solder at the ends of the axles will keep the wheels on.

Since there are no shock absorbers in the landing gear, it is strongly recommended that air wheels be used. These wheels, together with the natural spring of the landing gear, can easily absorb any landing shocks the model is subjected to. A spreader bar should not be necessary. Mounting the landing gear in the fuselage at this time will save considerable trouble later on.

The S-4 sports a removable motor mount, which makes it one of the smallest gas models with this feature. Although the motor mount was originally of the conventional rigid type, the obvious advantages that a removable mount gives brought about the change.

This mount really consists of two separate sections that are firmly glued together. The first carries the motor itself and consists of two 1/4" by 5/16" hard wood motor bearers and the little 3/64" birch plywood motor platform marked "f." The platform is glued, using casein glue, to the motor bearers. The second section is all balsa and carries the ignition system. One great advantage of the removable motor mount is that it allows the builder to keep close tabs on his greatest trouble-maker, the wiring circuit. This should be made next. Determine the lengths of hook-up wire you will need and solder these in place on the coil, condenser and battery box. These three must be bound and glued into place on the motor mount. Provide for a gas tank on the mount, preferably in front of the plywood bulkhead. A few 10c store "C" clamps will be very useful in building the motor mount.

To prevent vibration while the motor is running in the ship, the motor mount must be gripped at several strategic points. The most important of these is the front bulkhead, and the builder must take great care to secure a tight fit at this point. The motor runners themselves are also held in small slots in formers 8 and 9. These slots are cut upon assembly; that is, when the members are already in place in the model and you are fitting the motor mount in place. Finally, the rear of the motor mount slips between two strips of 3/16" square hard balsa that were cemented in front of station 6. The locking device we use consists of two long lengths of .034 wire that sink into the motor runners just behind the plywood engine platform. The exact location of these holes is determined by the position of the motor mount relative to the plywood bulkhead, since the holes must be flush against the rear of the bulkhead with their forward rims tangent to it. Thus, when the pins are slipped into place, they are in contact with the rear of the plywood bulkhead for their entire length, and you can see that it is impossible for the motor mount to move forward. The locking pins pass through member R. To prevent them from wearing an unsightly hole in the latter, we cement a pair of bushings into the balsa where they pass through.

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 cowl 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 plans. Members "h" and "r" 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 one large side window open 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 keep the finish free from oil stains. Sand 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 5/8 inch bore 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, and add the center piece and the two center section places marked "z". 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 bamboo 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 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 reminiscent of tail assemblies on many large rubber-powered fuselage 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 shaped ribs, we slip rectangular strips of 1/16" sheet balsa (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. After the fuselage has been painted, the covered and painted stab-rudder 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 flap that is used to control the model's turn. The main part of this member consists of two laminations of 1/16" soft sheet balsa whose grains are at an angle of 45 degrees. While this lamination 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"

into the fuselage with the balsa strip marked "x." When the lower fin has been assembled, the flap is cut and held in place with a few pieces of annealed wire. The fin has a groove along its top which fits the "V" of the lower fuselage longeron; cement it firmly to this member. The whole tail can be well filleted, using narrow strips of bamboo paper. These fillets should be also placed at the juncture of the landing gear struts and the fuselage.

Flying

This flight adjustment is recommended: a wide right (against torque) circle in the glide, and a rather tight power climb to the left (with the torque). This adjust-

ment can be reached by gliding the ship down a small hill until you are sure that it is in "neutral"; a fast, level, straight glide. At this stage the safest way to start a glide is to shove the model into the wind. Surprising things have been known to happen when new models were thrown down a hill. Next, move the flap to the right to take care of the glide and let the engine torque do the rest. Just to make sure that the last named force doesn't do its job too thoroughly, offset the engine a shade to the right. I said "a shade." This will probably be needed in your model because of the strong effect of engine torque on models with a low aspect ratio wing (5.4 to 1 on the S-4!).

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 each one.

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!

Does Aspect Ratio Increase Duration?

By GEORGE H. TWENEY

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, and that of the air above the wing less than atmospheric, there is a constant tendency for the air to flow around the end of the wing from the lower to the upper surface. This flow sets up vortices, or eddies, at the tip of the wing. In the production of these eddies, a considerable increase in drag is involved, because a definite amount of energy is required to set the air whirling, and this energy must be added to that required to drive the wing through the air. Since the eddies are torn off the wing by the forward motion as rapidly as they are formed, their energy is entirely lost, for they die out behind the wing on account of the internal air friction. As every wing must obviously have two tips, there is no way of avoiding this tip loss entirely and the next best thing is to have as little tip as possible in proportion to the area of the wing. This is accomplished by making the aspect ratio high; that is, by making the span of the wing great in proportion to its chord.

Wind tunnel tests have verified all these theories with respect to the drag of the tips of an airfoil, and even more in detail, have shown the variation in induced drag with aspect ratio. It is interesting to note how much the induced drag is reduced as the aspect ratio is increased, and as the higher lift coefficients are reached. This is very important where model airplanes are concerned, since they usually fly at relatively high lift coefficients and low speeds and any drag reductions become quite favorable.

The effect of the aspect ratio on the lift of a wing has also been demonstrated in wind tunnel tests. The effect on the lift is not as pronounced as the effect on the drag. However, the lift is increased as the aspect ratio is increased, so that 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 commercial practice this is impossible, since large airplanes achieve their best control and best engine-propeller efficiency at a value below the optimum L/D ratio. However, for model airplanes, particularly long endurance indoor ships, the reverse is true. We adjust our models so that they fly at the highest possible lift coefficient, and we build them so the drag will be an absolute minimum. Thus, our models fly at the highest possible L/D ratio. In the face of this fact then, we should incorporate in our model designs those aerodynamic effects which will tend to increase the lift and reduce the drag: We have just discussed how aspect ratio will achieve these results.

Aspect ratio also has an effect on the performance of an airplane. This effect occurs in the region of minimum power, which is exactly the condition in model airplane flight. An increase in aspect ratio will very materially increase the initial rate of climb of an airplane. It is very often that favorable initial rate of climb that puts a model in reach of a favorable thermal with a resulting long flight. The same effect is also noticed in the absolute ceiling of an airplane. Very high power loadings in a design magnify these results and in some cases may even double the effect. This point is still more in favor of the model airplane.

A series of tests were made by the author on a Class B indoor tractor to corroborate the above theoretical deductions. These experiments were inspired by the statements of a large number of model builders that the effects of aspect ratio were reputedly favorable, but the net effect was so small as not to justify the added structural and storage problems. Different wings of exactly the same area and planform were tried on the same model, using the same rubber and propeller characteristics. A very marked increase in both rate of climb and ceiling was noted with an increase in the aspect ratio. Changing the aspect ratio from six to ten enabled the model to increase its ceiling from approximately 75 feet to

95 feet with the same number of turns on the rubber: both these flights being on the same day within one hour, so the atmospheric effects can be ignored. The net result was a corresponding increase in the overall duration.

When it was definitely established that the larger aspect ratio had such a favorable effect on the model's endurance, serious flights were made to determine the best time obtainable. These flights involved adjustment of the model to enable the maximum number of turns to be put on the rubber without having the model lodge in the rafters; the best flight of the day being one of 21 minutes, 33 seconds, which very definitely puts the model in the class of the record holders. The climb and level flight were very steady and the glide was prolonged, the model landing with a completely dead stick. All of these good flight characteristics can be attributed to the wing.

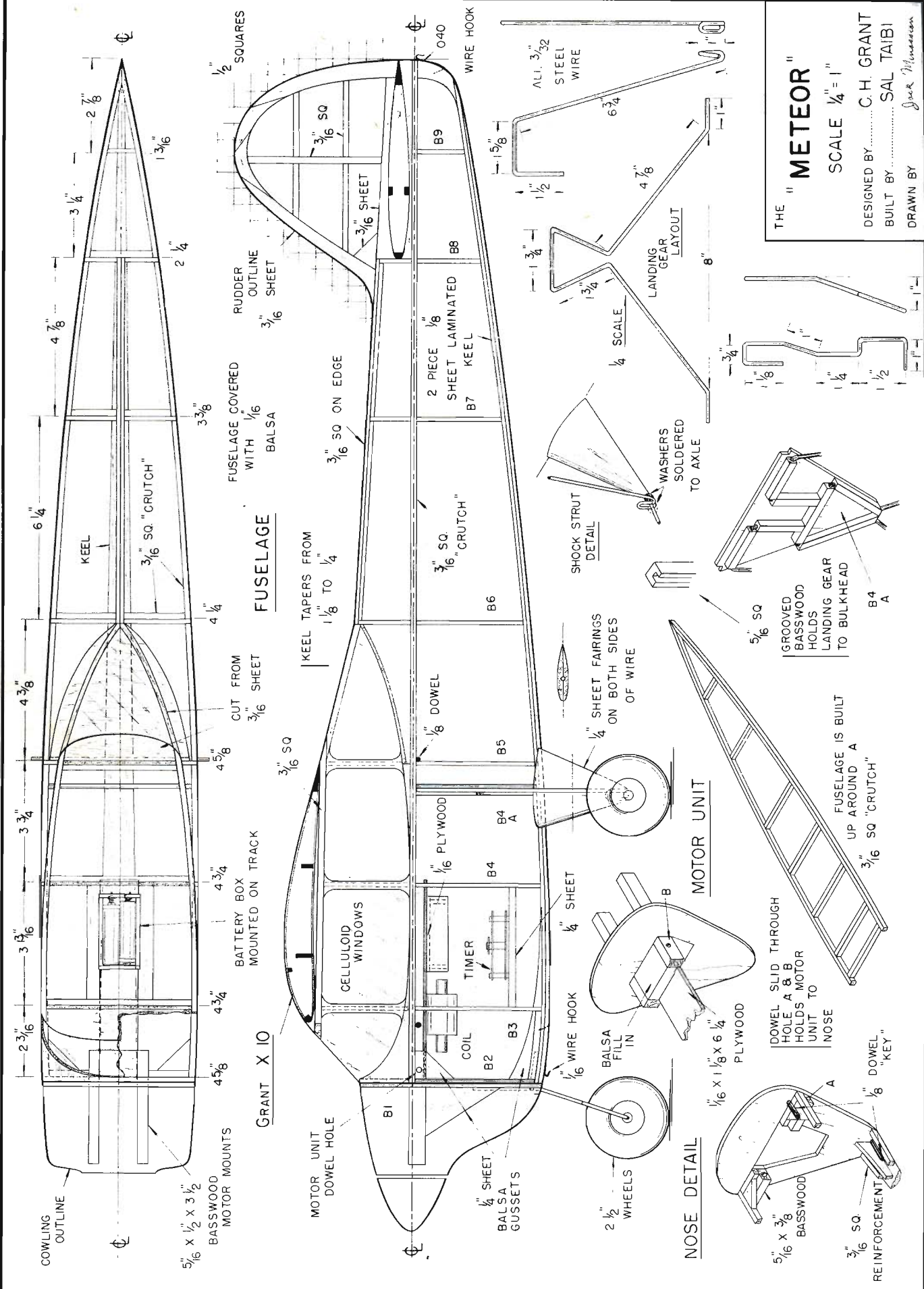
It is admitted that the structural problems in the higher aspect ratio wings are more complex, but these can be solved by a more judicious choice of materials and improved section characteristics. Flapping tendencies in some of the wings used in the tests were noted, but these were eliminated by very careful balancing of the model and rearrangement of the braces in the wing structure. In no case, was the vibration enough to throw the model out of flight control.

Of course, all that has been said in the foregoing applying to the wing, also holds good for the tail. Increasing the aspect ratio prevents the tail from stalling too soon and this improves the longitudinal stability of the model.

The aspect ratio of any wing, either straight or tapered, even in model design, may be computed from one of two formulae. The aspect ratio is in any case equal to the square of the span divided by the wing area, or the span itself divided by the mean chord. That is,

$$A.R. = b^2/S = b/c_m$$

The author believes that any further appreciable increases in the times of indoor models will result from a more thorough understanding and use of certain aerodynamic principles, one of which is the aspect ratio. If any other model builders have conducted tests similar to those described above, the author would welcome correspondence on the subject.



METEOR ON WINGS



A Class A Gas Model That Looks Like a Full Scale Plane and Performs Like a Contest Ship

By **SAL TAIBI**

1941 NATIONAL WINNER

The plans show motor mount without down-thrust. It is suggested by the designer that three degrees down-thrust be used for best performance.

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 I.) The

fuselage is then covered with 1/16" sheet balsa; it is advisable to use three-inch widths for this purpose. The motor mount



In full flight at 60 m.p.h.

is then glued to the firewall, reinforced with 1/4" sheet gussets. A piece of 5/16" x 3/8" basswood is now glued beneath the gusset on B-2 and the crutch. (See nose detail on plate I.)

Drill a 1/8" hole at the top of B-2, at the thrust line and another at the bottom of

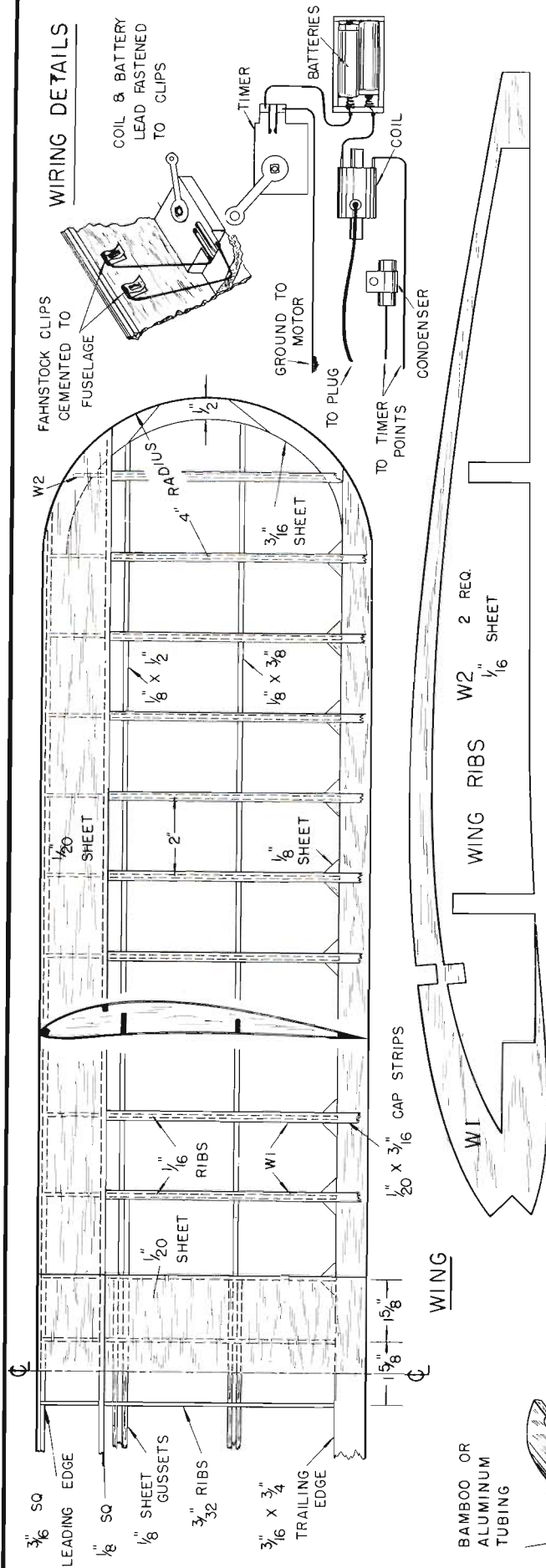
B-2 right above the keel between the 1/4" sheet gusset and the 3/16" sq. reinforcement. A 1/8" dowel is firmly cemented into each hole and allowed to protrude about 1/8"; these serve to keep the removable nose unit from shifting; see nose detail on plate I. The removable nose unit is slipped into place 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 I. 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.

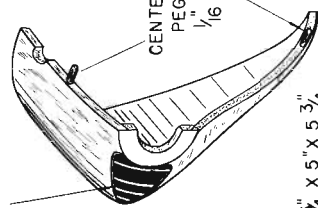
Now glue the Fahnestock clips to the



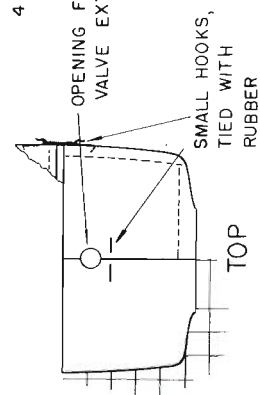
Though of scale proportions, it climbs at 45 degrees



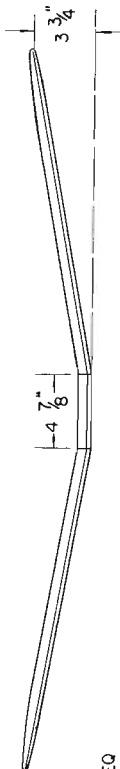
BAMBOO OR ALUMINUM TUBING



COWLING DETAIL



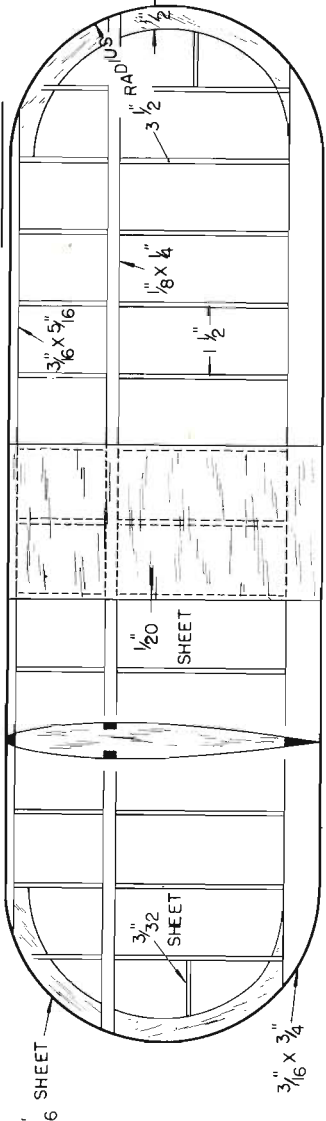
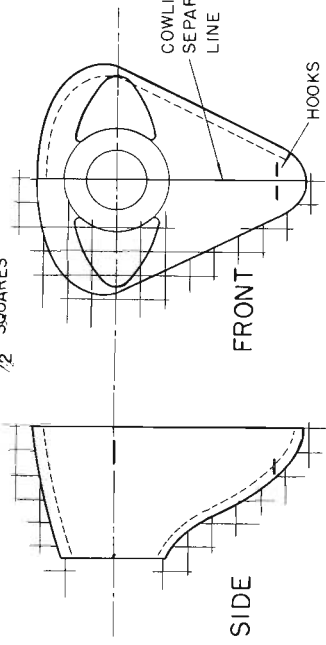
22 REQ.
18 OF 1/16 SHEET
4 OF 3/32 SHEET



S1 - 11 REQ. 3/32 SHEET
S2 - 2 REQ.



1/2 SQUARES

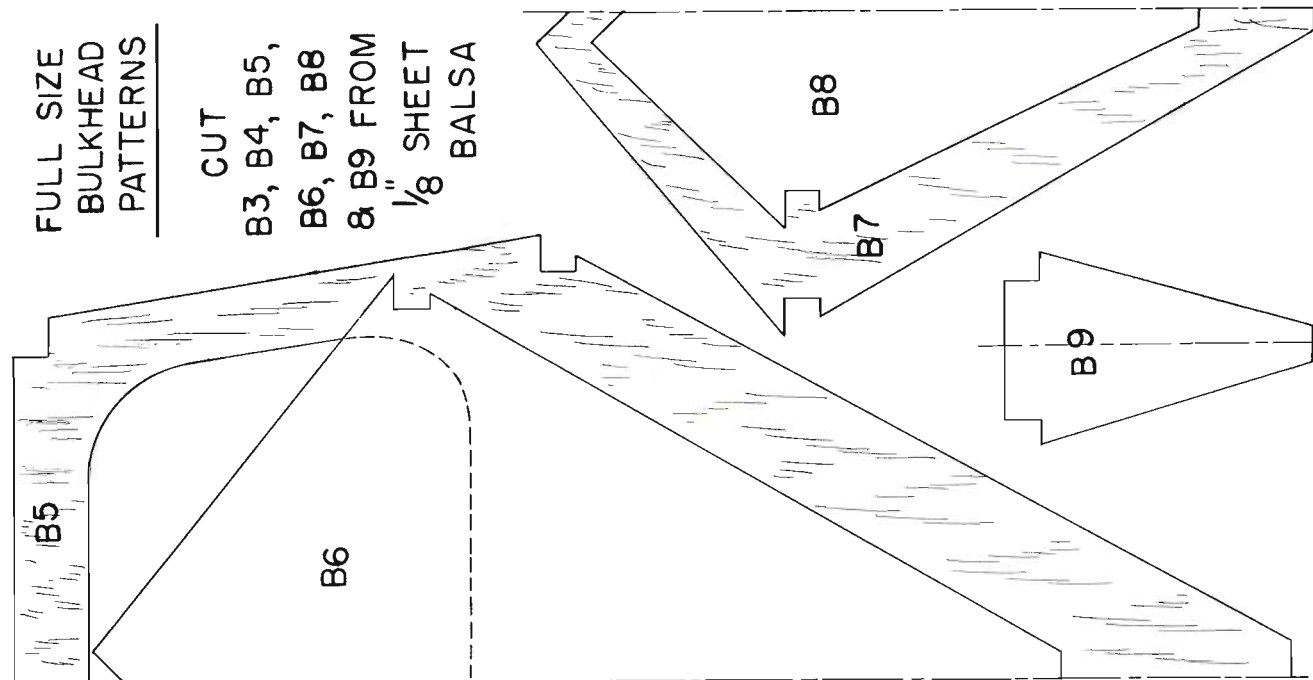


STABILIZER

FULL SIZE
BULKHEAD
PATTERNS

CUT

B3, B4, B5,
B6, B7, B8
& B9 FROM
1/8" SHEET
BALSA



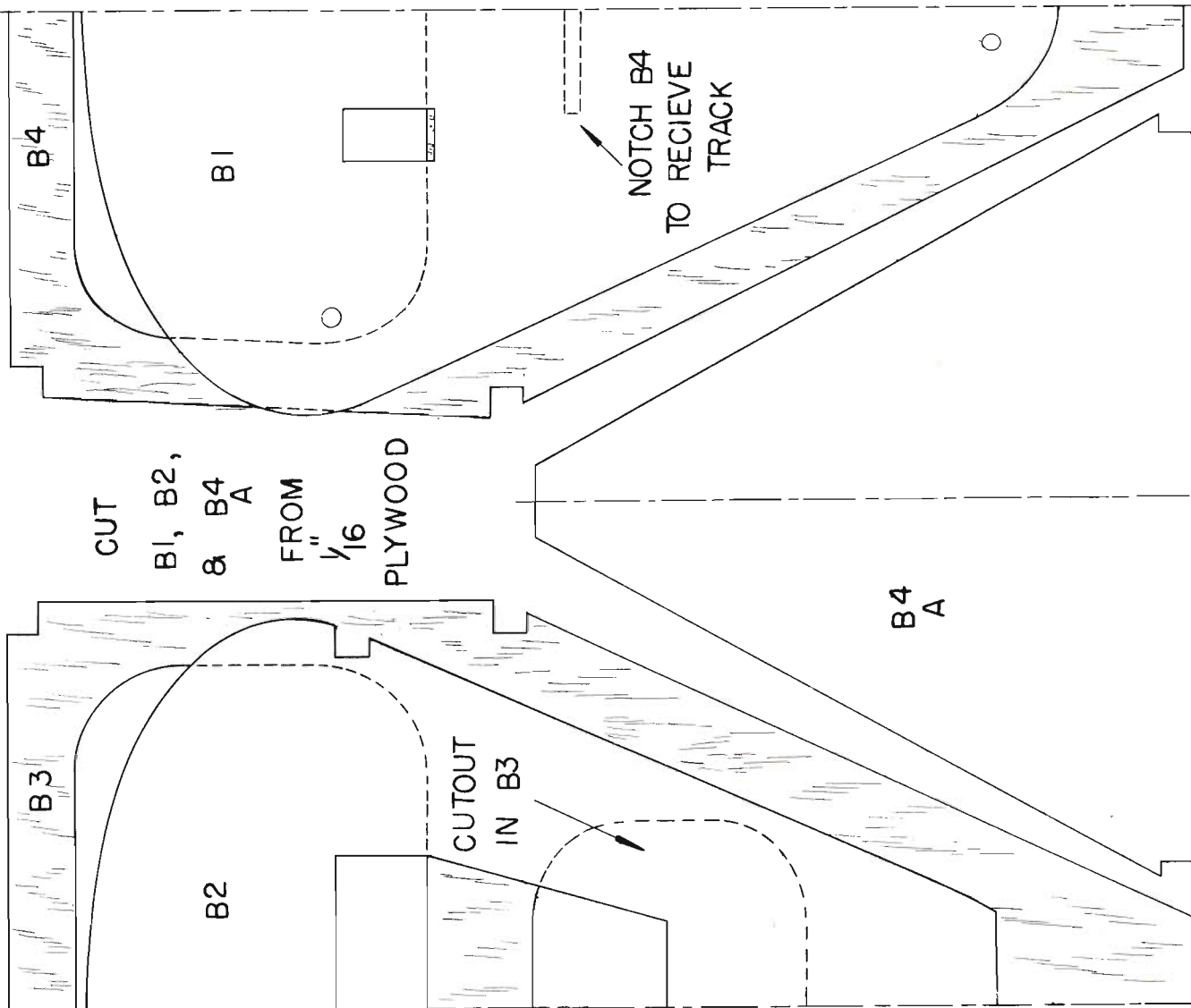
CUT

B1, B2,
& B4
A

FROM

1/16"

PLYWOOD



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 on 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 cowl is cut in half and the 1/16" pegs are inserted in place to properly hold the halves together. The windows are covered with celluloid 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 be-

cause 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 glued 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 test 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 glided 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!

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 .040 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 wire 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 pinholes are then punched in the hinge and

you are ready to cement on the prop. The pinholes in the brass allow an extra holding place. Use the above precautions in regards to cementing.

While this is drying put a rubber tensioner 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 streamlining.

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 straightened out till the power is exhausted, when 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 ounce to every fifty square 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 a 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.

This is 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 together make 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 1-8" 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



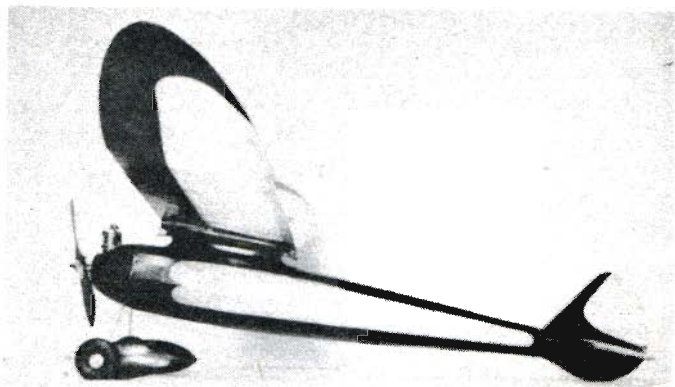
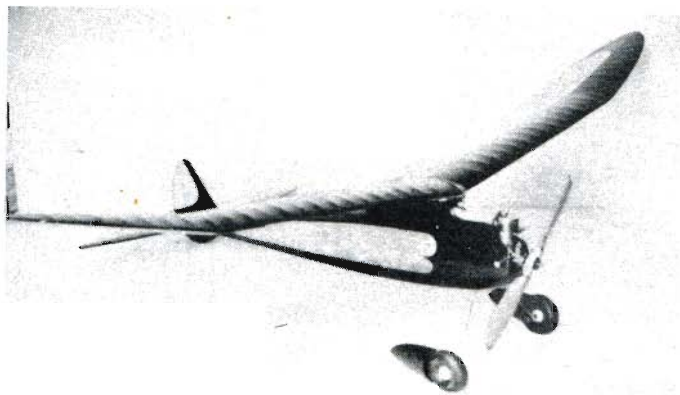
Tremendous power and soaring ability characterize this remarkable plane

A High-Climbing Soaring Gas Model That Has Placed Among the Winners in Every Contest Entered

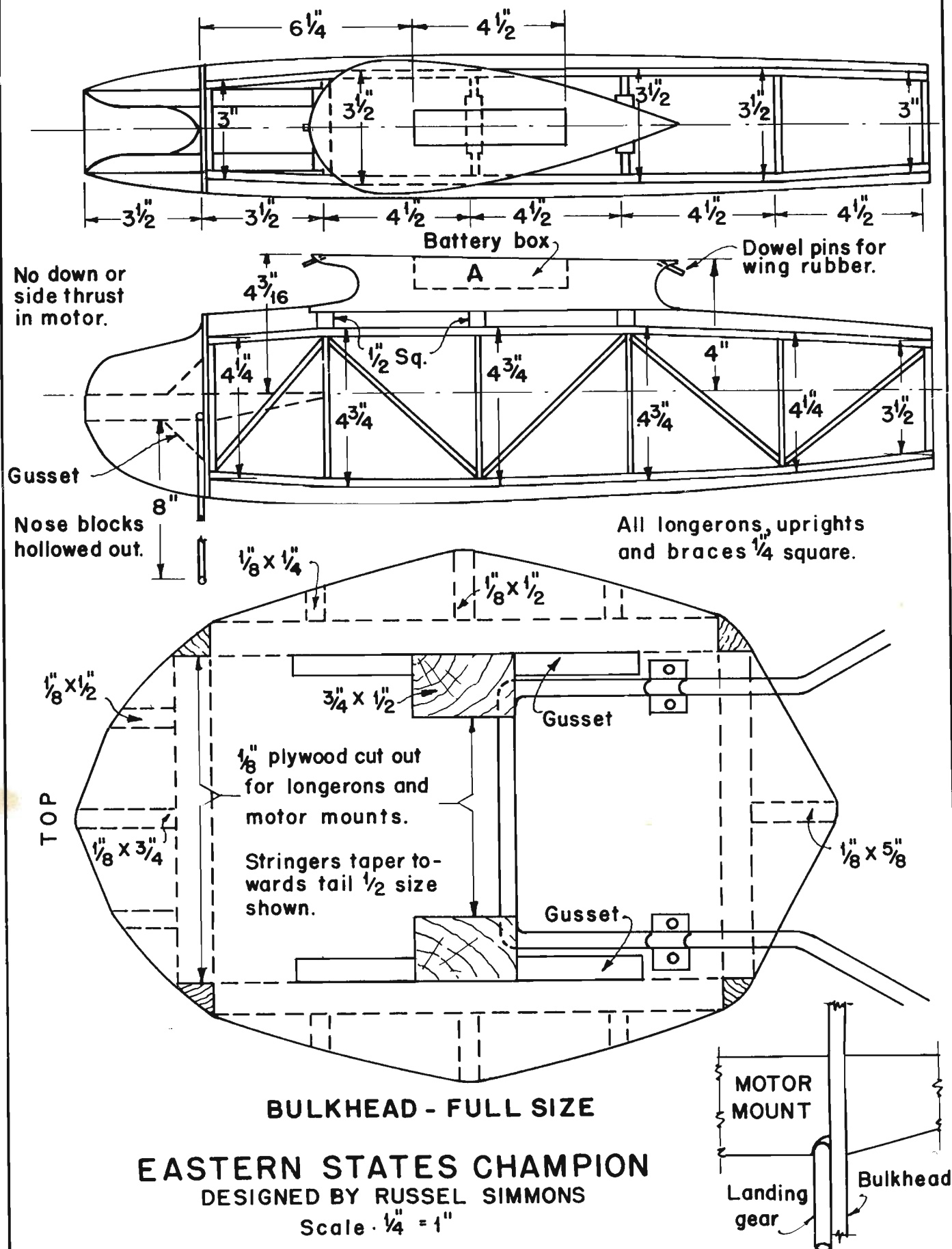
The plane gets up and stays up



The author and plane with some trophies won



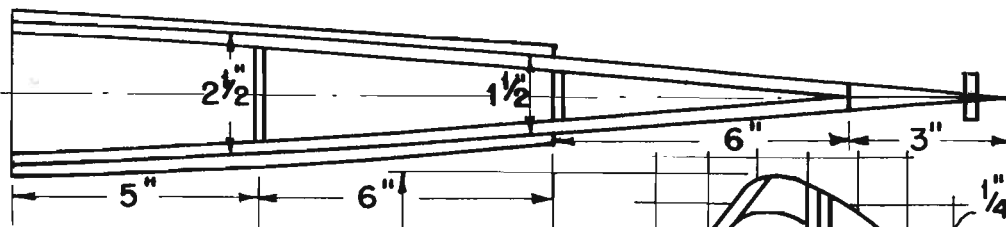
Beautifully streamlined, with folding prop to reduce drag. Note the streamlined wheels



EASTERN STATES CHAMPION

This hole to fit block
under stabilizer.

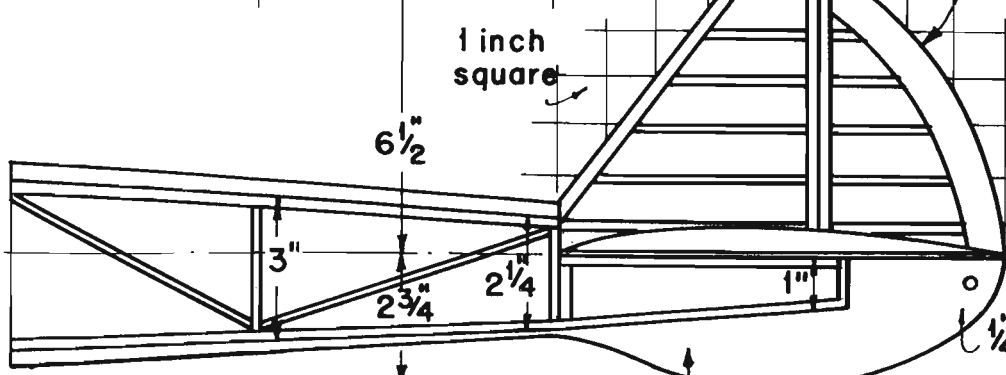
$\frac{1}{8}$ " sheet



RUDDER CONTROL

Rudder

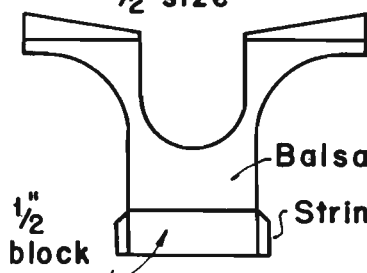
Stabilizer



BATTERY BOX CROSS SECTION AT "A"

$\frac{1}{2}$ size

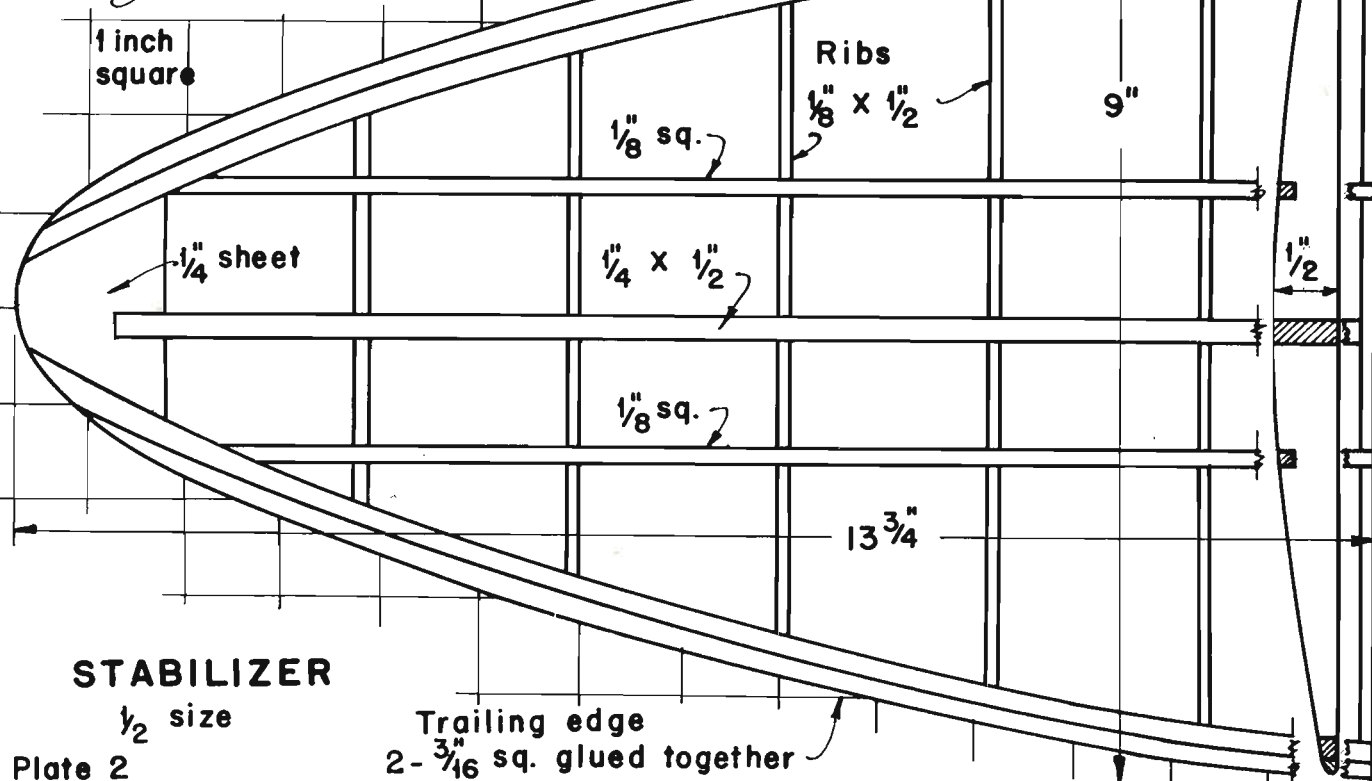
Long grain
Cross grain



Balsa block

Stringers

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

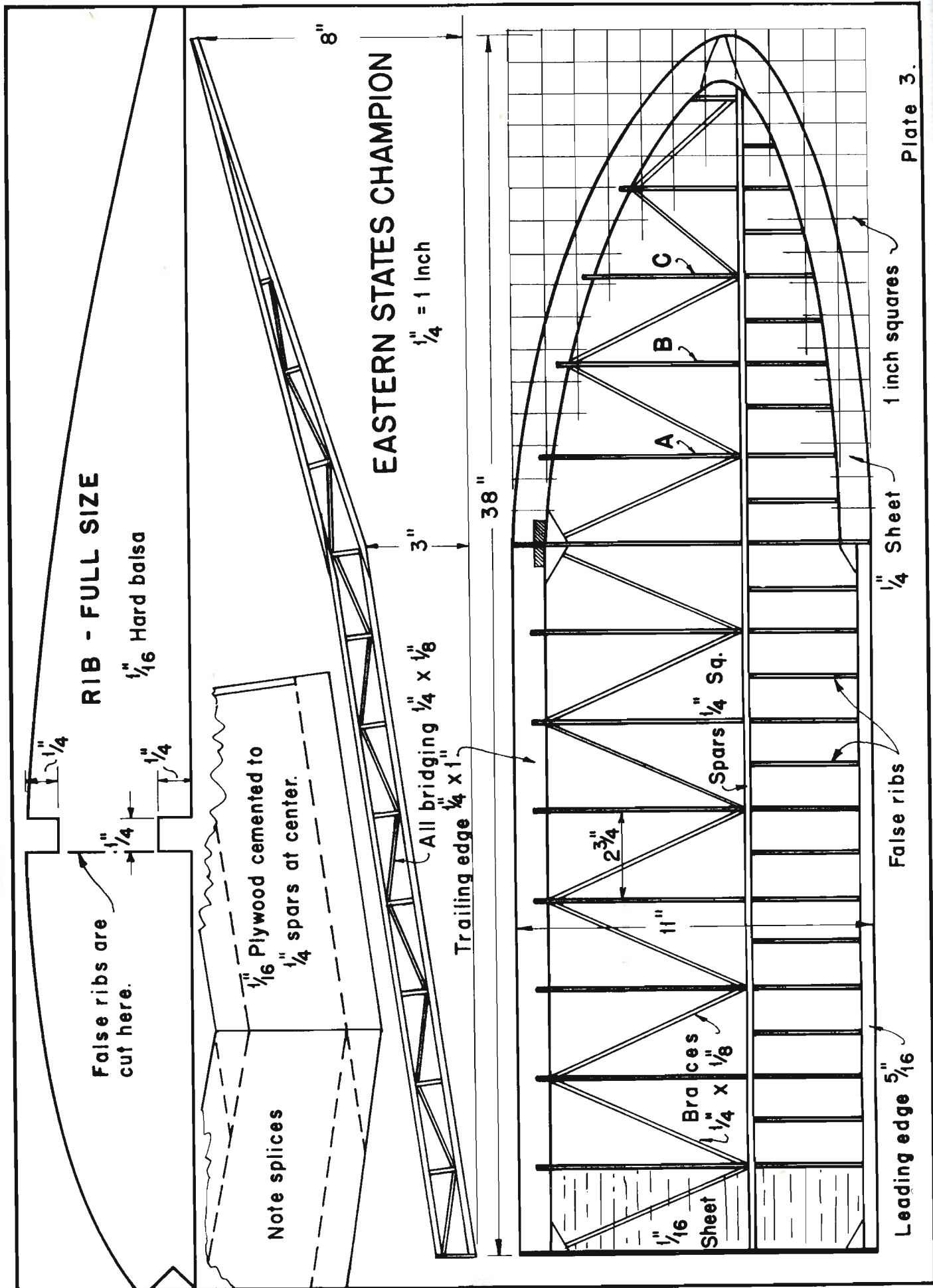


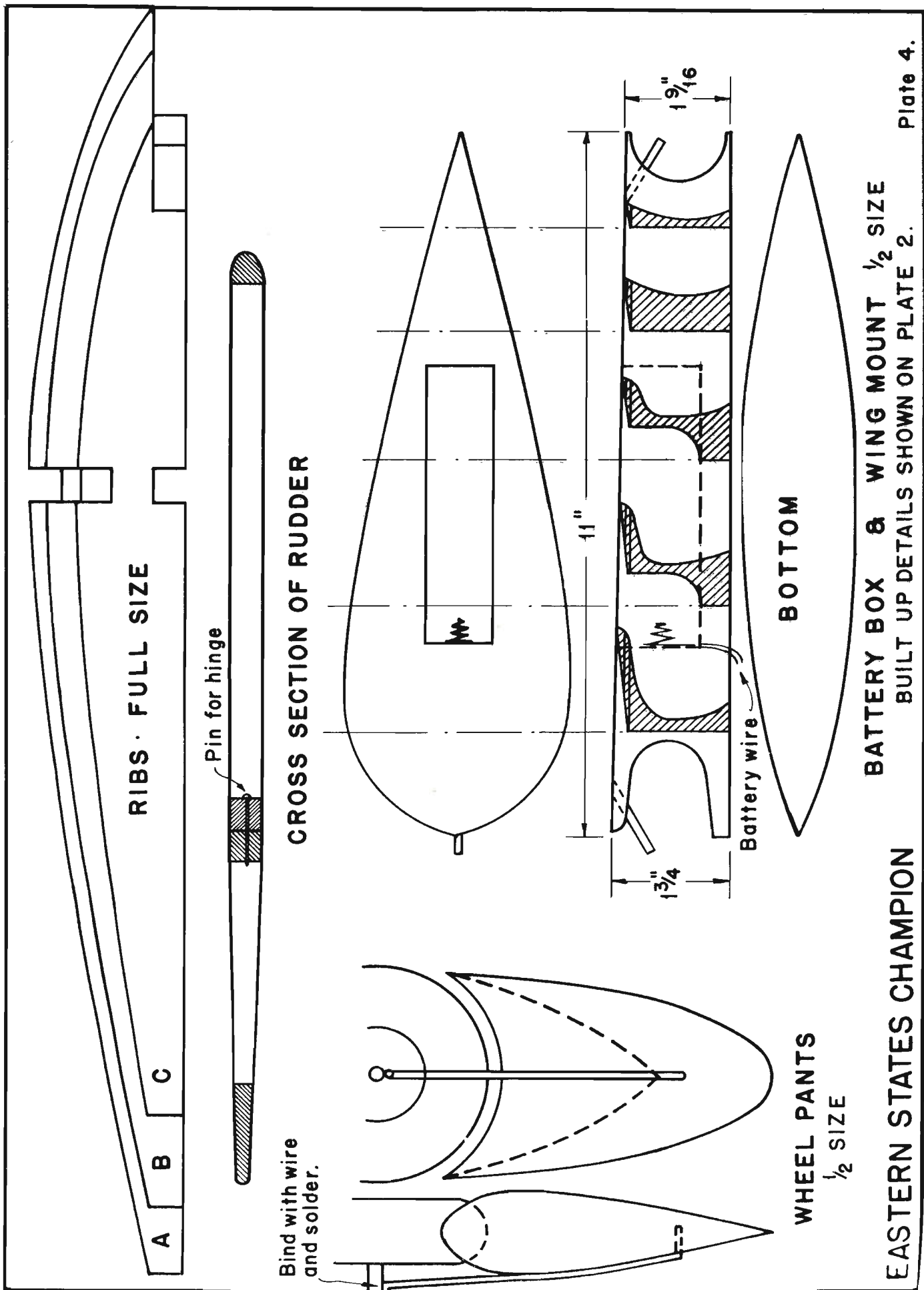
STABILIZER

$\frac{1}{2}$ size

Plate 2

Trailing edge
2 - $\frac{3}{16}$ " sq. glued together





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 dowels for the wing rubber bands 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 when covered with silk to 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 timer should be mounted behind the wing mount so you can easily get at it. Any good wiring diagram may be used, but 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 tip ribs 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 inner 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" gib 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 slight 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!



A FOUR FOOT WESTERNER

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 stowing 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.

Enlarge 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

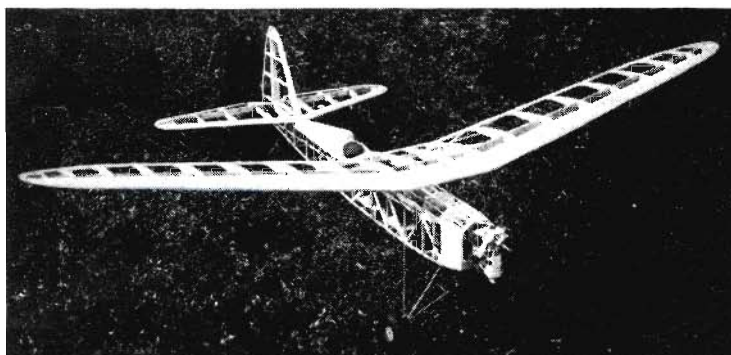
the work table. When all 1/8" square cross bracing is cemented in place, cut a piece of balsa size 3/8" x 9/16" x 1-7/16", which is the tailpost and which is installed next. All fuselage formers are of 1/16" sheet balsa except No. 1 and No. 9, which are 1/8" thick. Locate the positions for fuselage formers No. 8 to No. 12 inclusive, and cement each in place.

The top, forward, removable section of

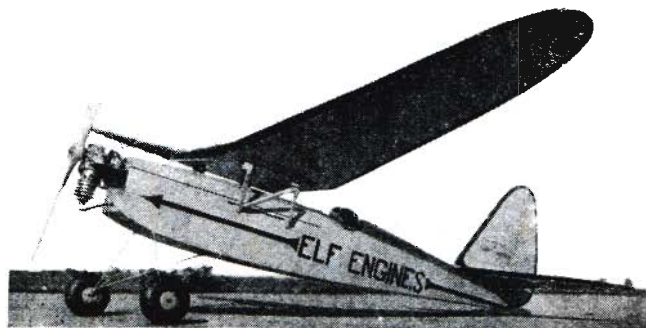


It gains altitude quickly with a steep climb

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 has the appearance of a full scale ship

By ELBERT J. WEATHERS

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.

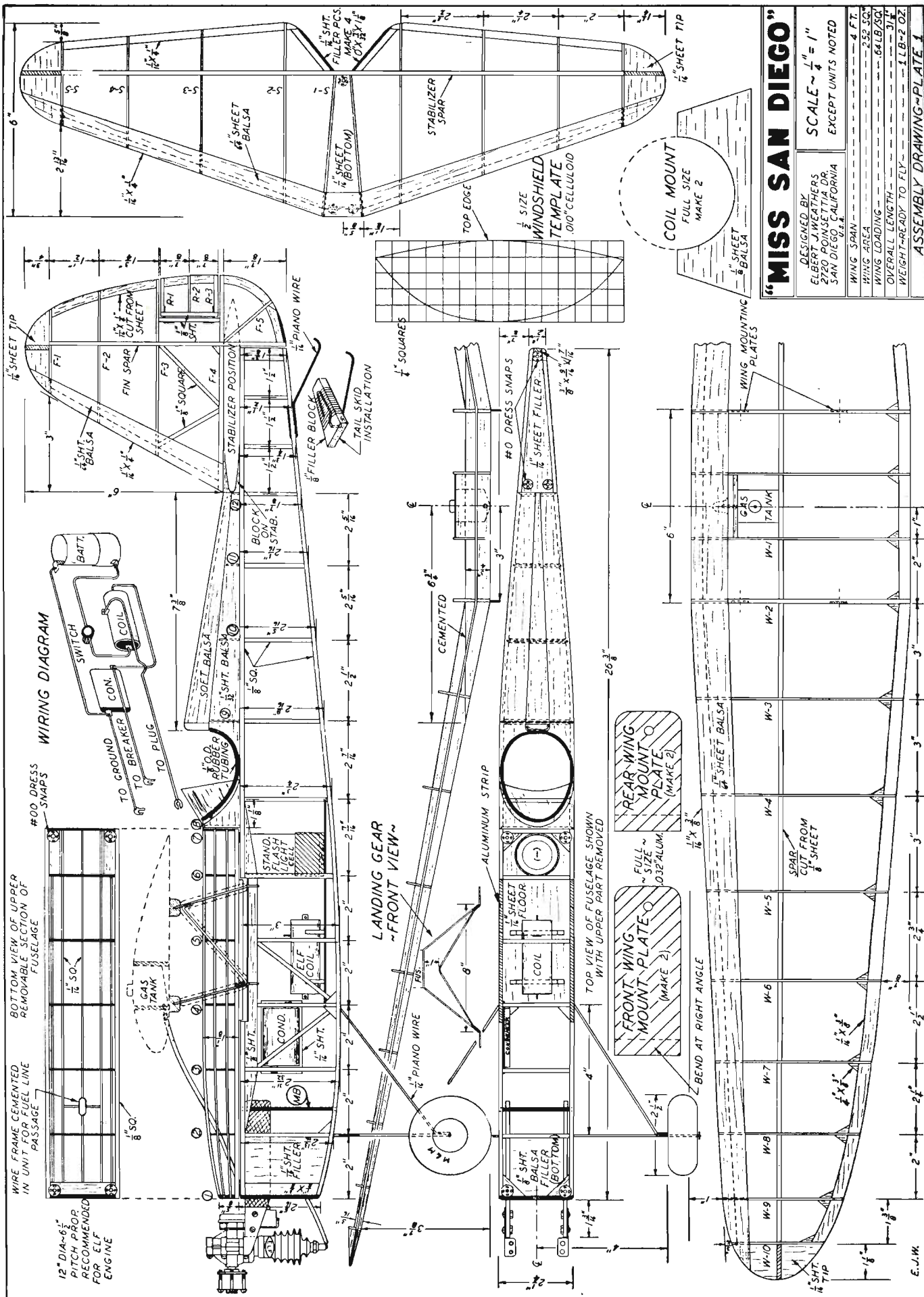
The 1/32" balsa sheet can now be applied from formers No. 8 to No. 12.

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 hollowed 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.

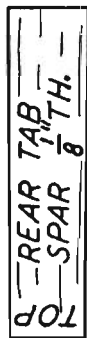
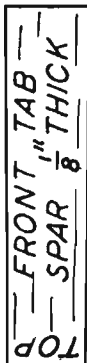
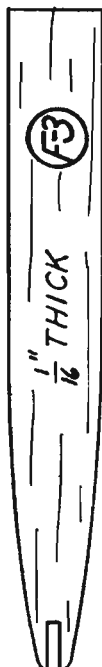
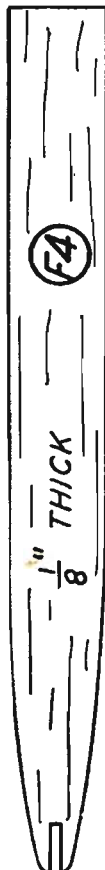
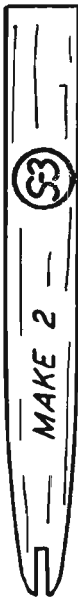
The landing gear is formed from 1/16" piano wire. First make the front side frame, followed by the rear side frame and the center shock strut. Cement two cross braces on the fuselage bottom, each size 1/8" x 1/2" hard balsa, to receive the landing gear. Use ample cement to bind each

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.





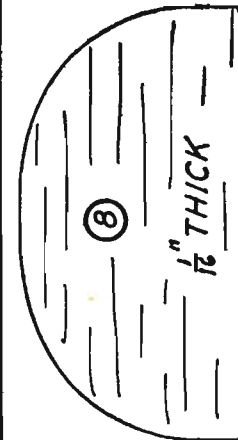
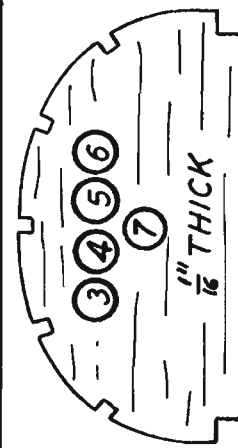
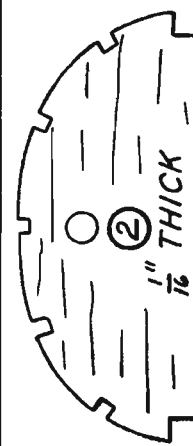
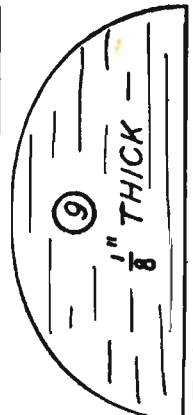
STABILIZER RIBS



FIN RIBS

1/2 OF STABILIZER SPAR (CUT FROM 1/8" SHEET BALSA)

FIN SPAR (CUT FROM 1/8" SHEET BALSA)



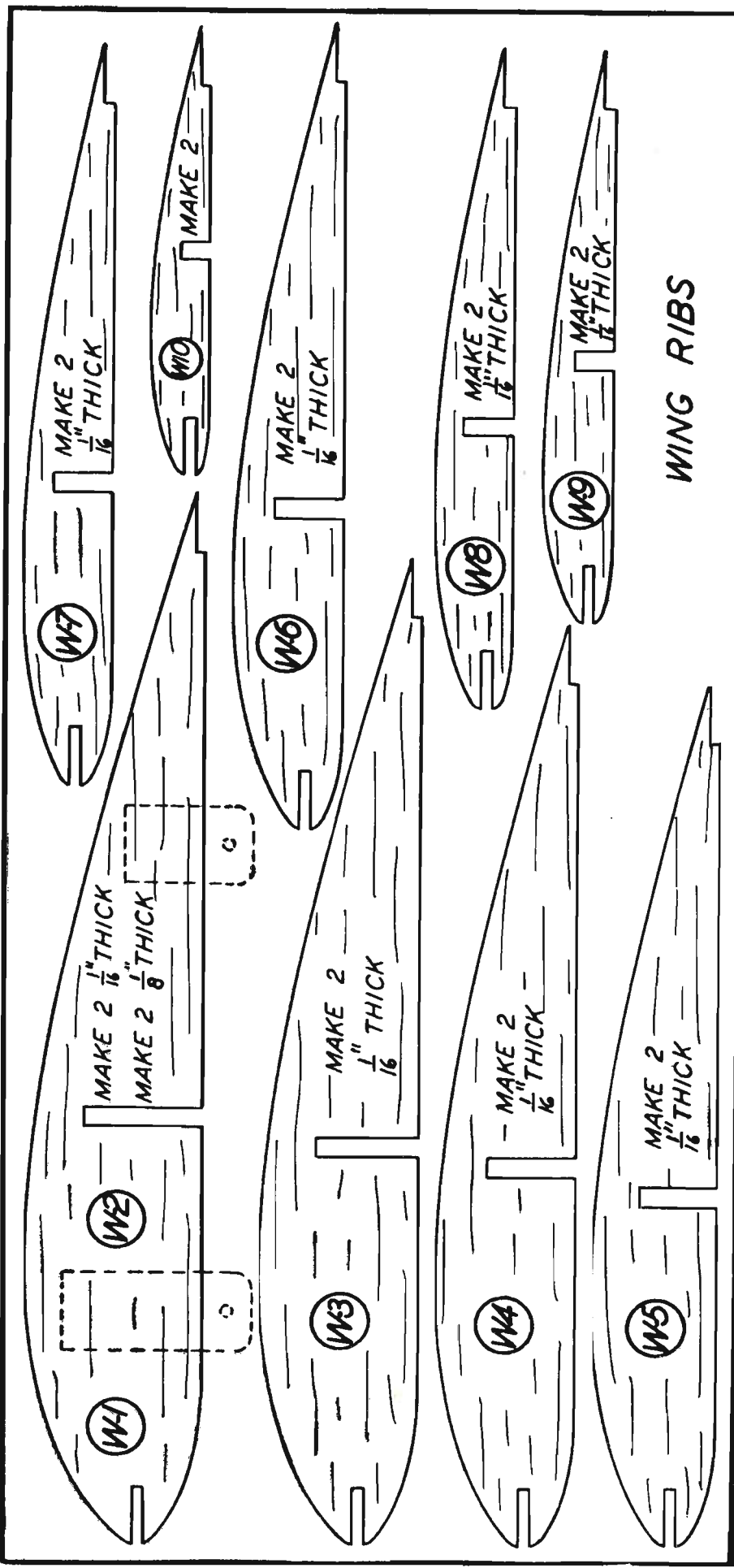
E.J.W.

FUSELAGE FORMERS

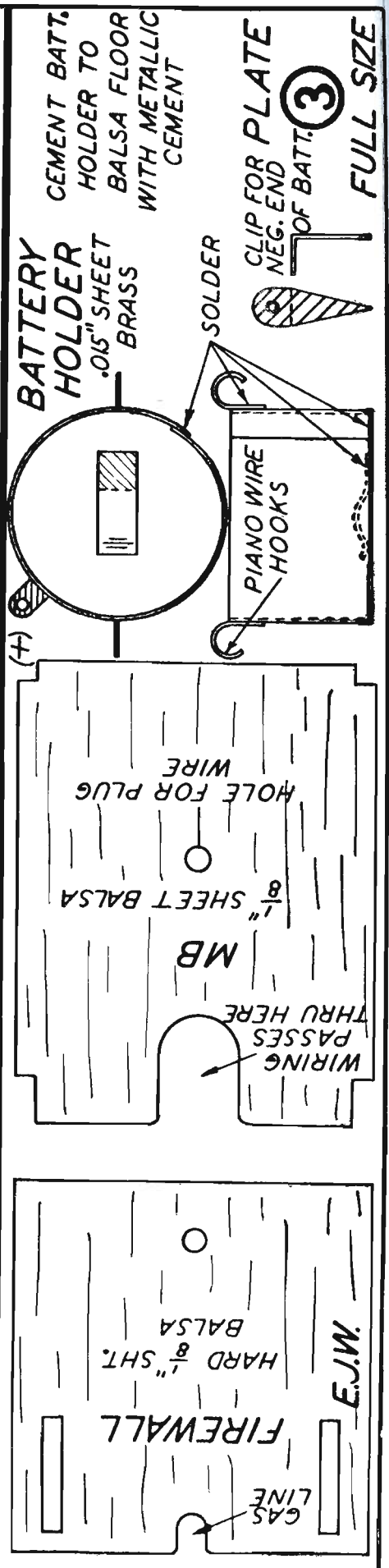
FULL SIZE

2

PLATE



WING RIBS



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.

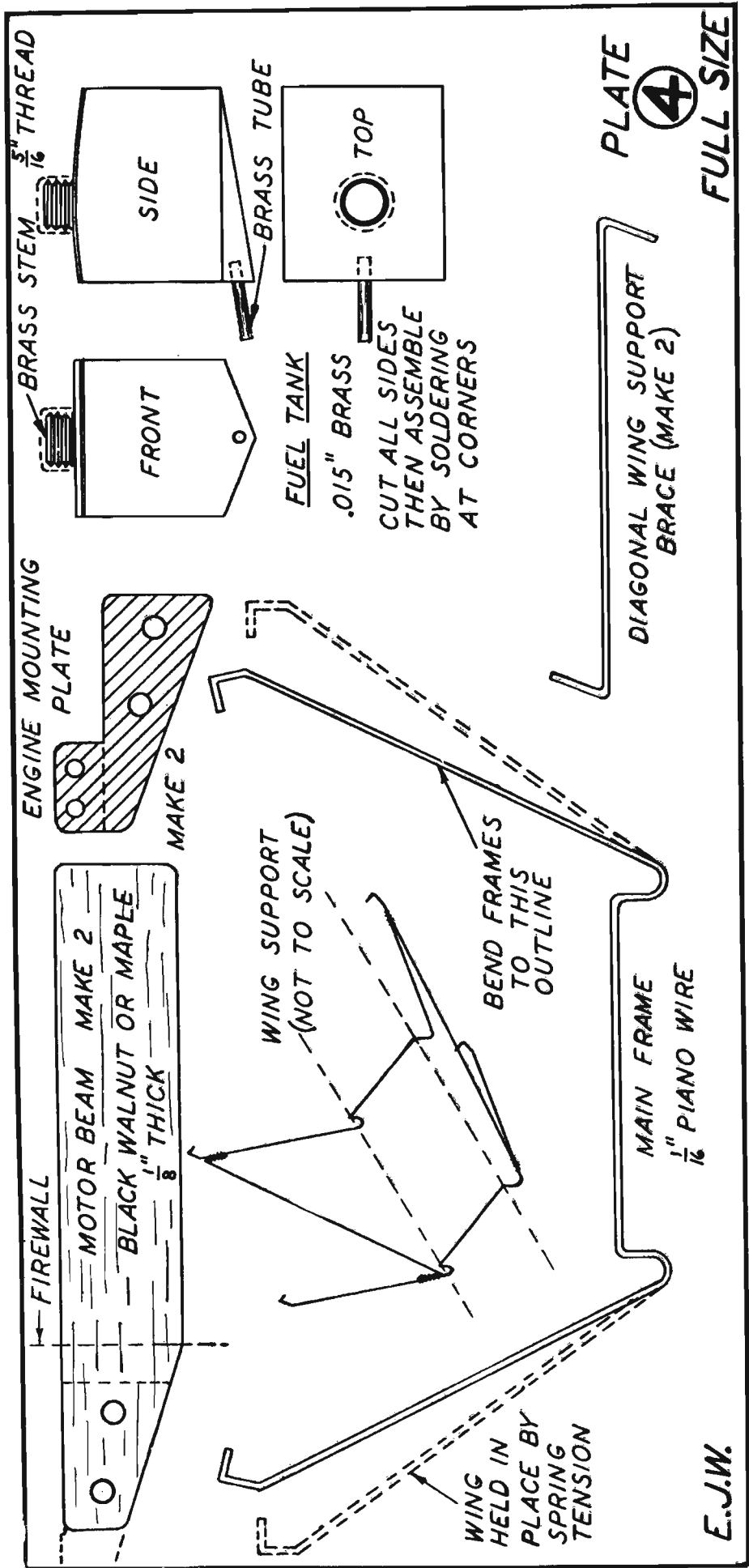
The wing strut unit, or cradle, which supports the wing, should be constructed next. It is formed from the same wire as used for the landing gear. Begin by forming two end frames, as shown. It will be noticed that each are to be bent with a narrower spread at the tip ends than that of the fittings on 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, before 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

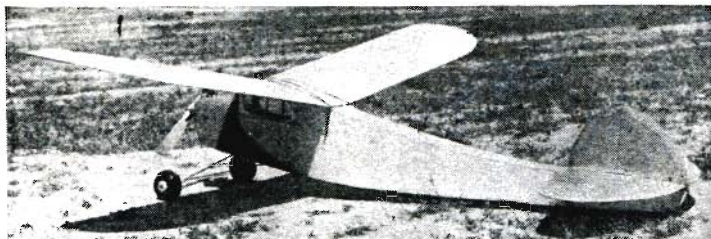
The ribs are all of 1/16" sheet balsa, except ribs W-2, which are of 1/8" sheet balsa. Both the leading and trailing edges are cut from 1/16" sheet balsa, and are of 3/8" width. Each consists of three parts, as the center section of the wing is constructed first, although the wing is a one-piece unit 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.

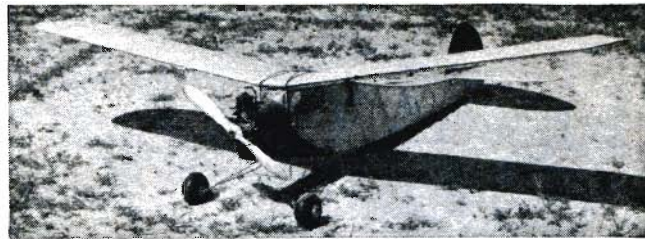
When dry, remove the wing center section construction from the work table and lay down the spar on either side to proceed with the right or left wing panel. Pin the leading and trailing edges in position and after raising the leading edge 5/16" at the inner end and 3/32"



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It is properly designed for stability and high performance



It is powerful, sturdy and of simple construction

A High Powered Contest Model That Climbs Straight Up—Equipped With Pontoons It Won the First Official Seaplane Contest

BUILDING THE "POWERHOUSE"

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 Haaren 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, Dennyrites, 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 trans-

port. 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 sensationally.

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

(Continued on page 98)

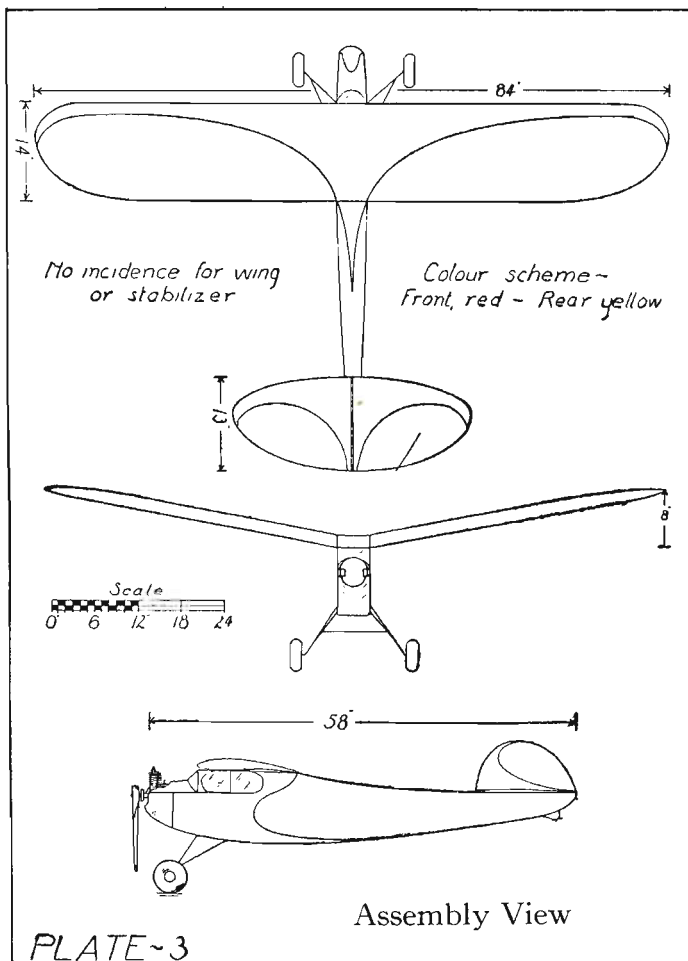
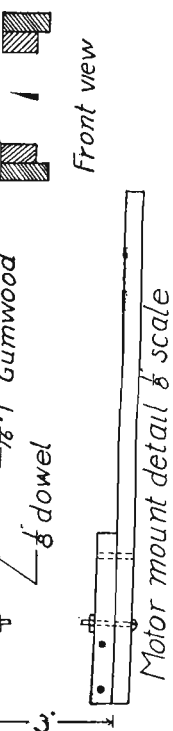
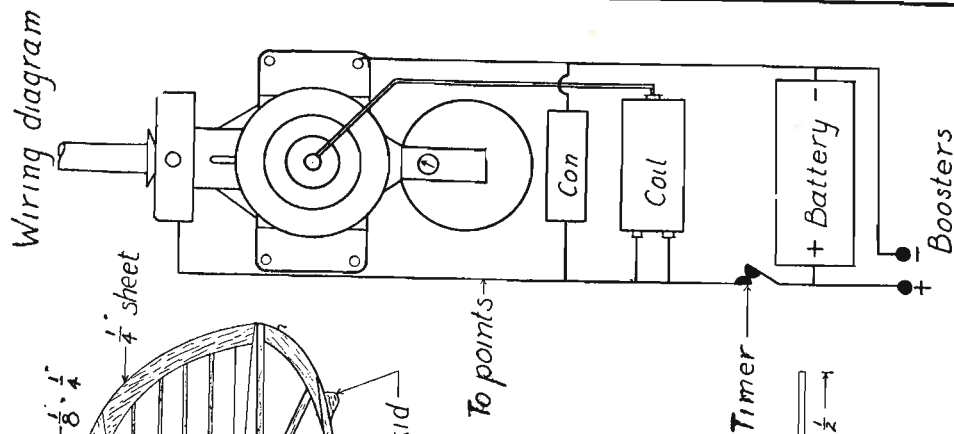
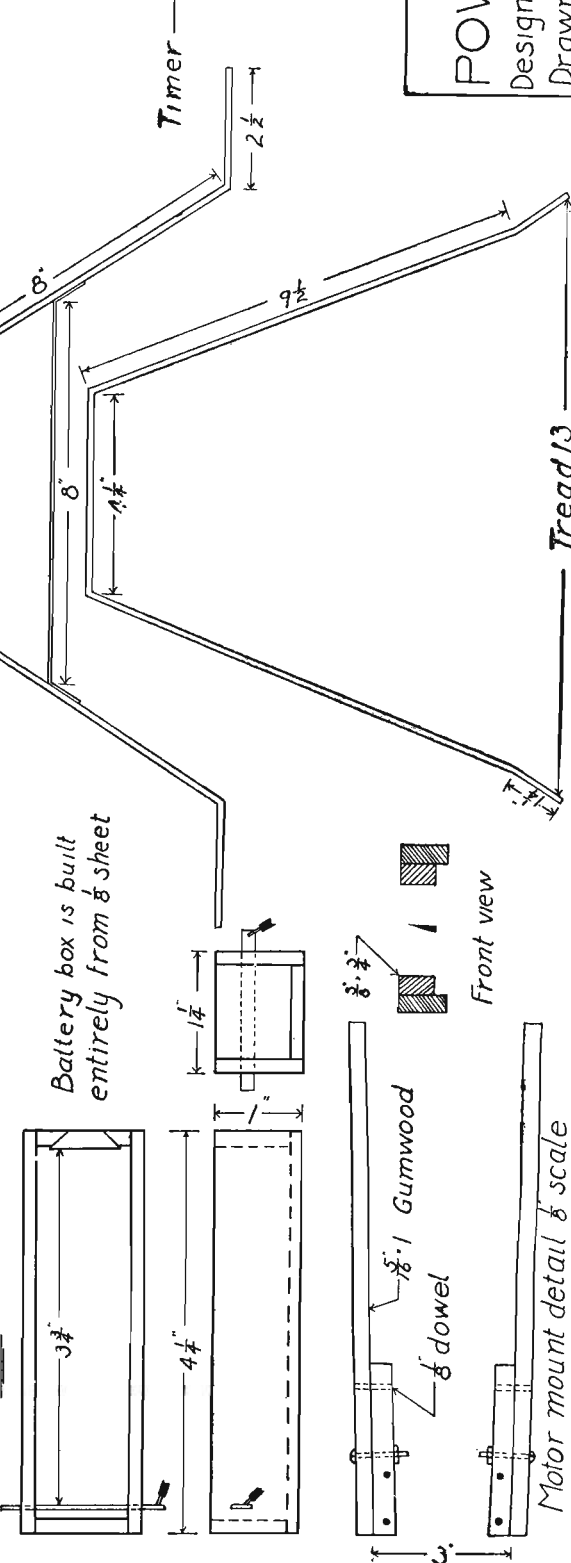
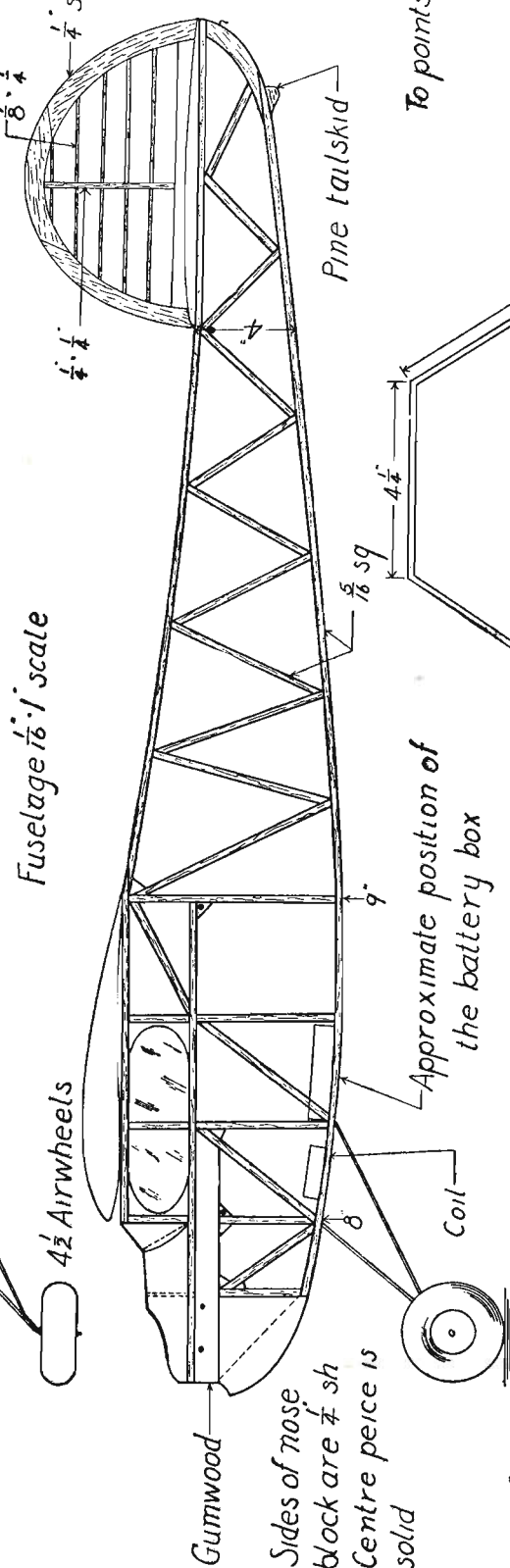
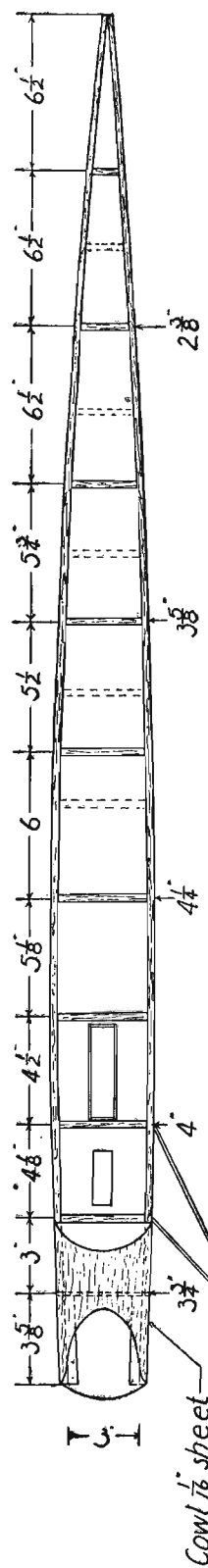


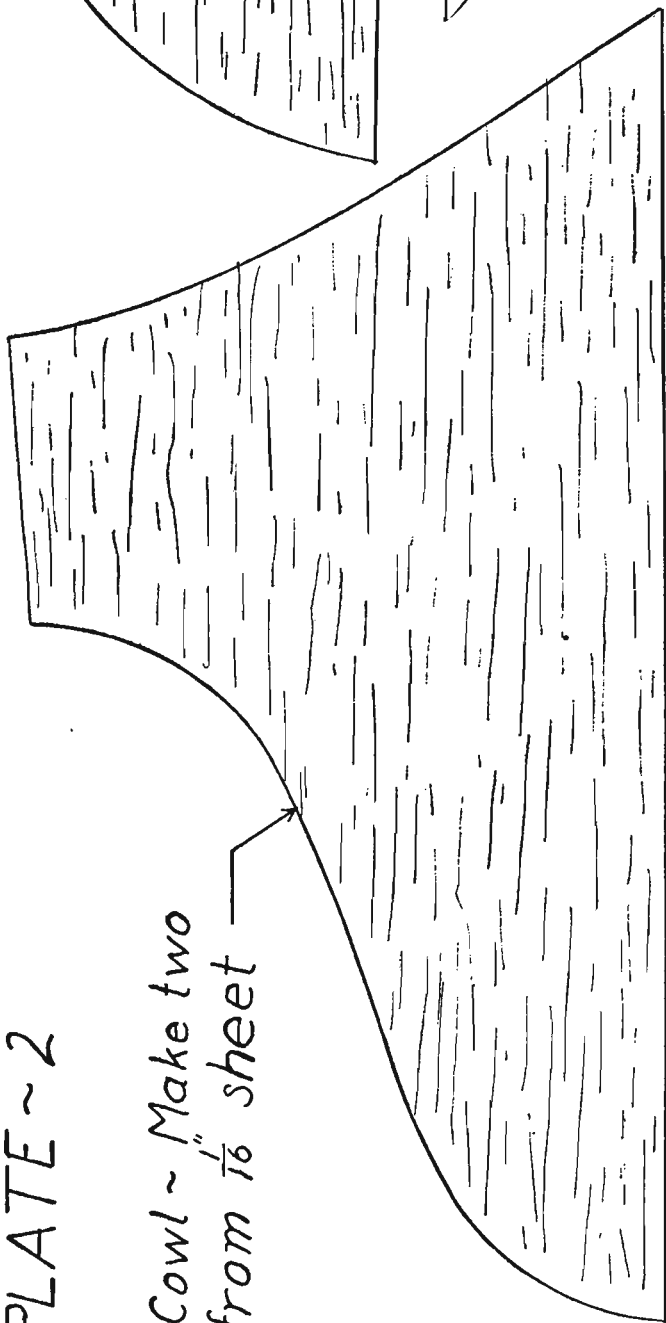
PLATE ~1



THE
POWERHOUSE
Designed by ~ Sal Taibi
Drawn by ~ Gordon Murray

PLATE ~ 2

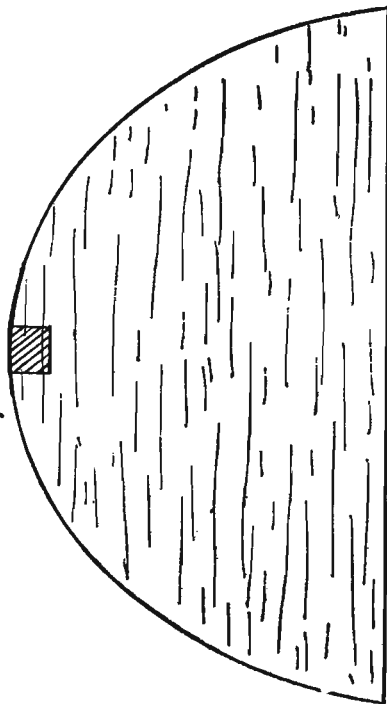
Cowl ~ Make two
from $\frac{1}{16}$ sheet



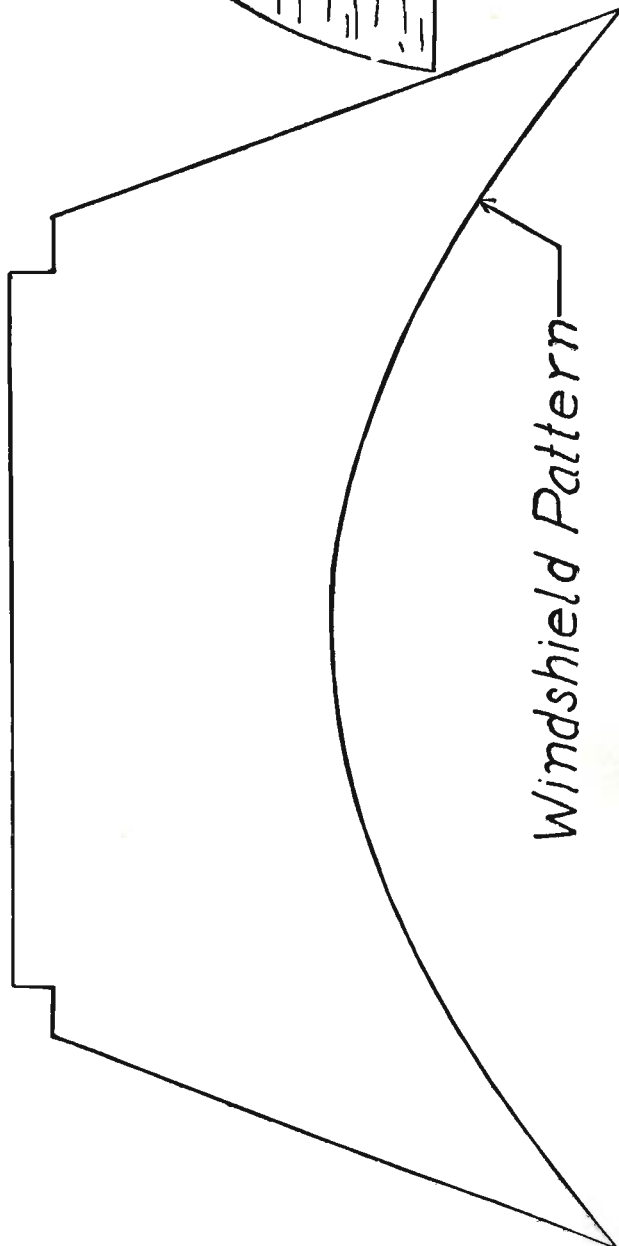
Front former



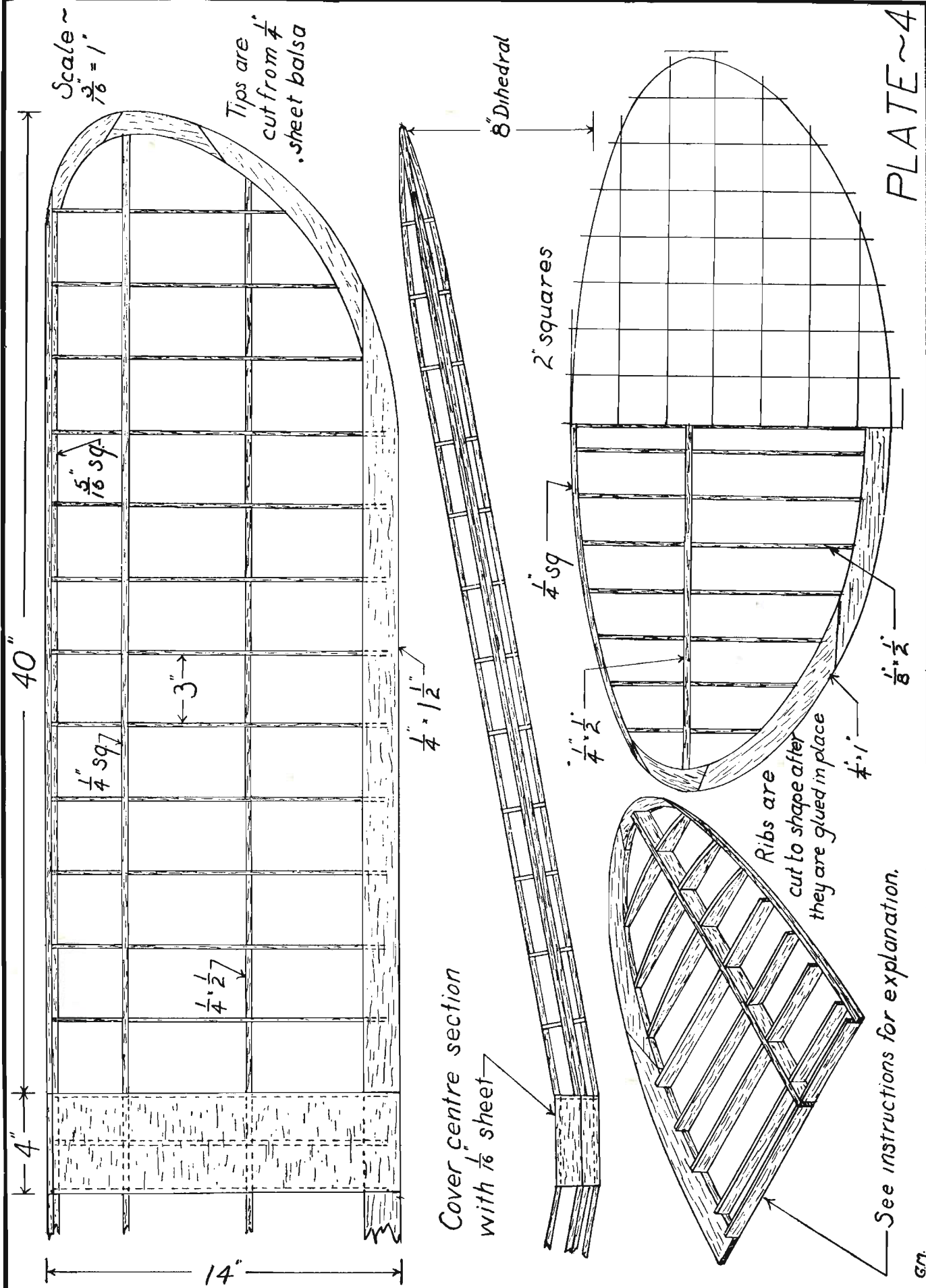
Tailskid is carved
from pine $\frac{1}{4}$ thick



Rear former ~ both
formers are $\frac{1}{8}$ thick



Windshield Pattern



Cut all ribs from
 $\frac{1}{8}$ sheet balsa.

Main rib ~ Make 25

Tip rib ~ Make 2

L.E.

5 $\frac{3}{8}$ "

3 $\frac{1}{2}$ "

$\frac{1}{2}$ "

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 bearers are 5/16" by 7/8" hard gum or bass wood, preferably the former. Get the red gumwood 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 cowling 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.

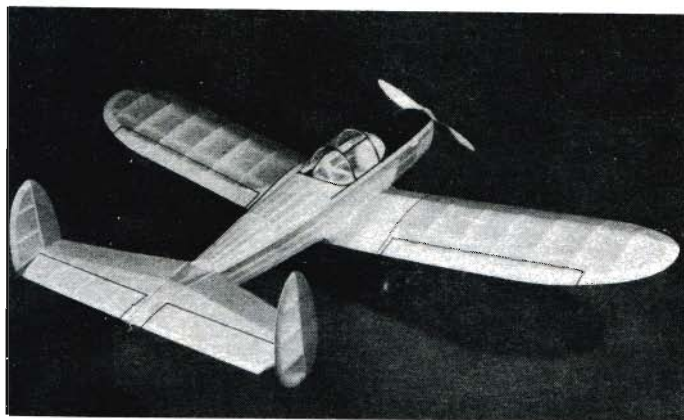
If the ship shows no spiral tendencies, due to warps, etc., more power may be used until finally you are using the maximum power available. It is advisable to decrease the motor run as you add power for the ship has decided "out-of-sight" tendencies.

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 ERCOUE FROM LILLIPUT

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

JUST prior to the United States' entry into this second World War the light-plane activities in this country was on a terrific upswing. Second-hand planes sold as cheaply as autos and plane manufacturers were offering flight instructions with every new ship purchased. Things were boomin'. Then along came the war and with it all the necessary restrictions and regulations needed for our defense. Aircraft manufacturing turned its full attention to getting the best equipment out to get this war over as soon as possible. And that is as it should be.

All this adds up to the stalemating of lightplane activities for the duration, but with the promise of great advancement after the war.

One of the newest and finest lightplanes to be produced is the Ercoupe. The Ercoupe is a two place airplane ideally suited for transportation or training. Of the \$2,000 class, the Ercoupe looks more like a snappy military pursuit job than a sportplane. Unusual points of interest in the ship is the tricycle landing gear, twin rudders and practically all metal construction.

Perhaps the most important feature of

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.

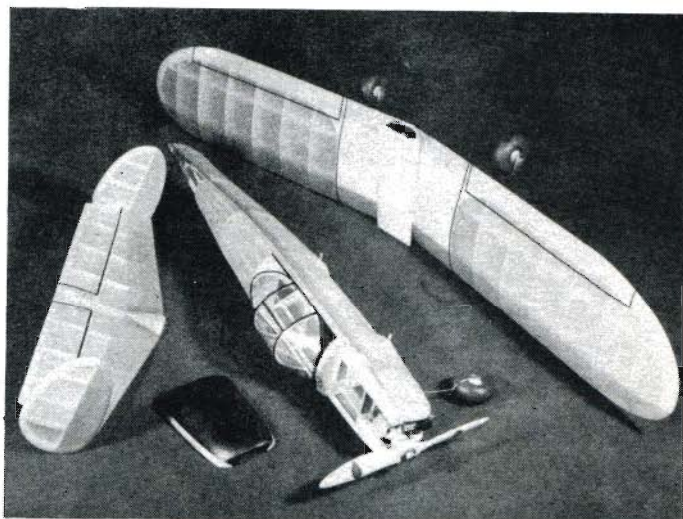
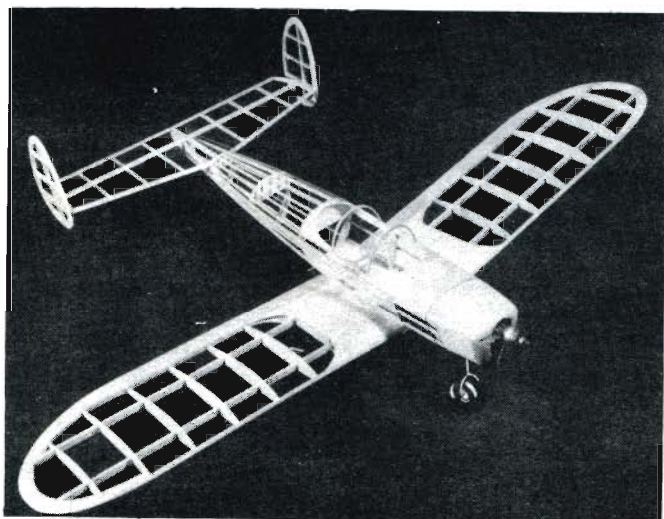
The Ercoupe's structure is all metal, as is the covering of all but the outer wing panels. The use of corrosion-resistant aluminum alloys in structure and covering brings to the lightplane pilot the dependability and freedom from maintenance of the large transport planes.

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)

Top Top views of the finished plane showing trim lines, realistic appearance and large stabilizer that gives steady flight. *Below left* The uncovered frame shows simple construction. *Below right* Units are quickly dissembled for transportation.



**STEPS OF PROCEDURE IN THE CONSTRUCTION
OF THE FUSELAGE.**

FUSELAGE VIEWS NOT TO SCALE.

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

1/8" X 1/4" STRIPS OF HARD Balsa.

1/4" X 3/8" HARDWOOD MOTOR MOUNTS.

SOFT 1/4" SHEET FILL-IN.

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

NOW BUILD THE LOWER FRAMEWORK AND ADD REMAINDER OF BULKHEADS AND STRINGERS.

THE FUSELAGE IS NOW COVERED WITH HEAVY SILKSPAN.

MAKE A LIGHT FRAMEWORK OF CABIN AND COVER WITH CELLULOID.

FRONT LANDING GEAR STRUT

NOTE:
TOP VIEW OF FUSELAGE IS SHOWN ABOVE 6.
FUSELAGE CRUTCH IS SHOWN BELOW 6.

1/4" SHEET FILL-IN

COWLING DETAIL

CARVE TO SHAPE FROM A SOFT Balsa BLOCK.

HOLLOW TO THICKNESS SHOWN IN DOTTED LINE IN SIDE VIEW

FRONT VIEW
1/2 SCALE SHOWN

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

SHAPE COCKPIT FROM 1/16" SHEET

STRIPS OF BLACK PAPER

THIN CELLULOID

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.

1/16" MUSIC WIRE.

2" DIA. SINGLE WHEEL

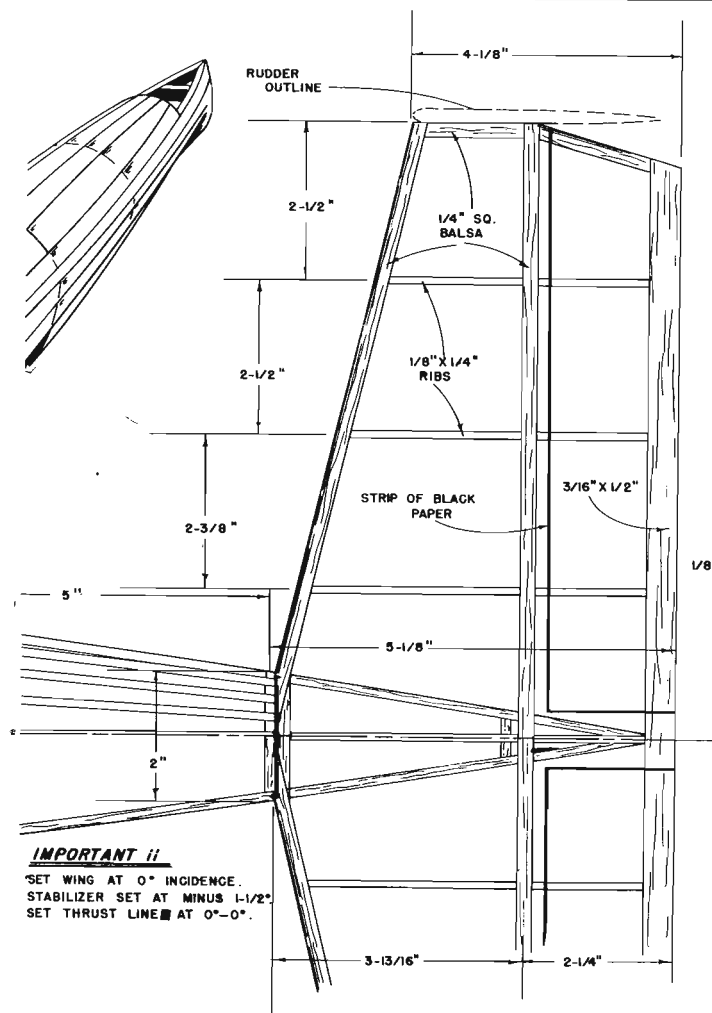
REAR LANDING GEAR DETAIL.

BASS L.G. BLOCK

1/16" MUSIC WIRE

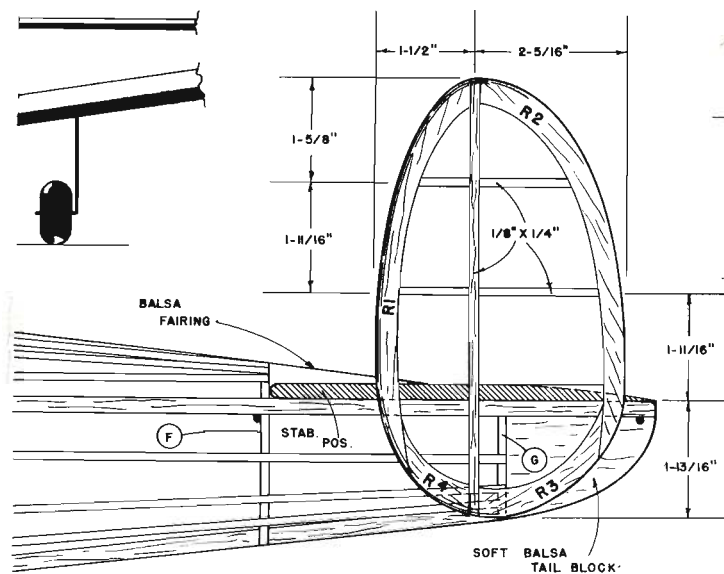
BIND AND CEMENT TO FRONT WING SPAR.

2-1/2" DIA. WHEEL



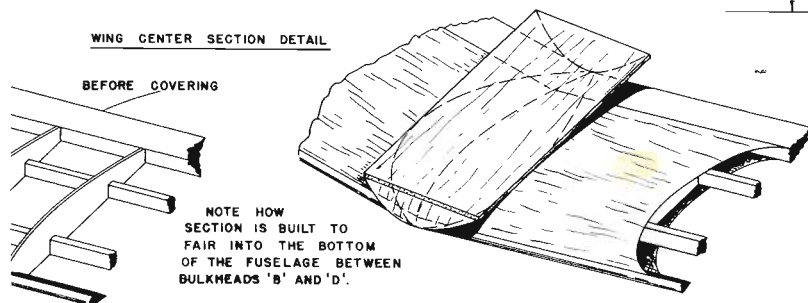
IMPORTANT !!

SET WING AT 0° INCIDENCE.
STABILIZER SET AT MINUS 1-1/2°
SET THRUST LINE AT 0°-0°.

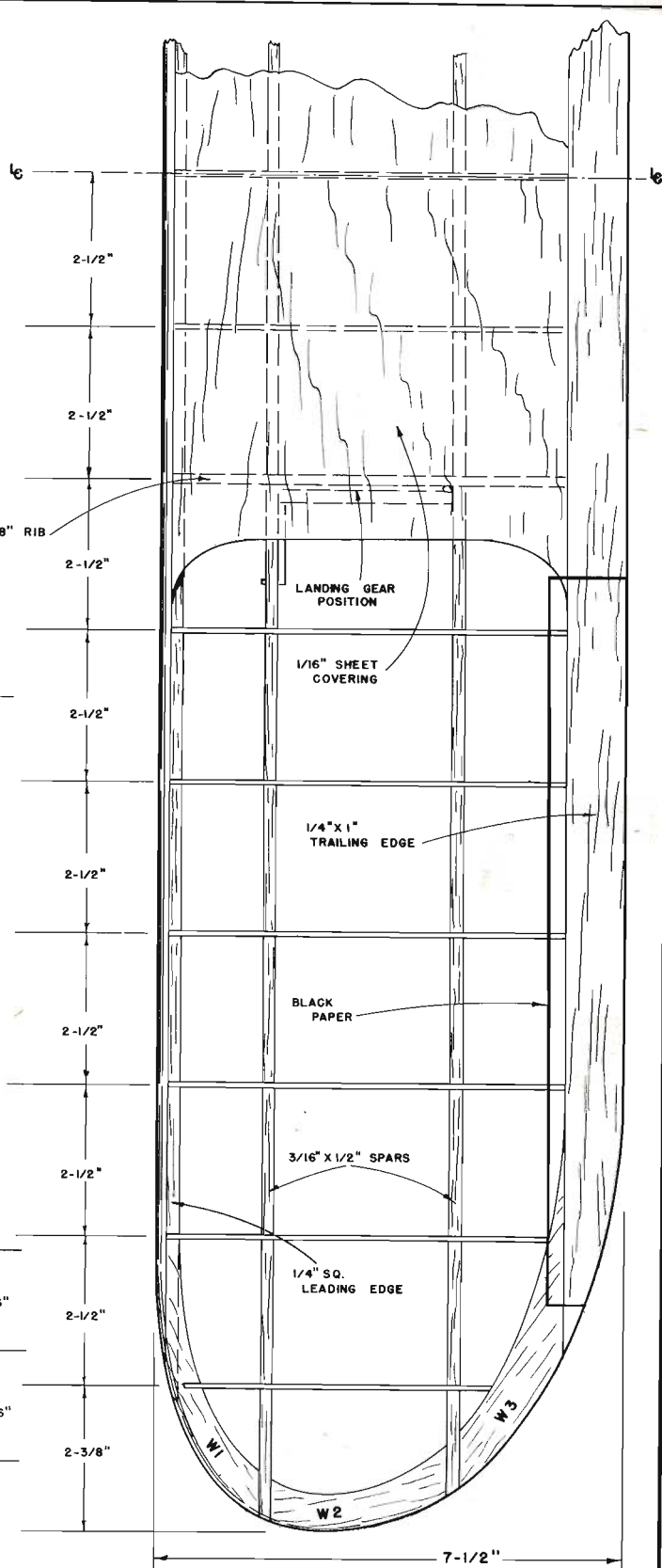


WING CENTER SECTION DETAIL

BEFORE COVERING



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



"ERCOUPE SPORTPLANE"

BY SYDNEY R. STRUHL

WING SPAN	44-1/2"
FUSELAGE LENGTH	30"
MOTOR POWER	CLASS A. OR B.
SCALE: PLATES 1. & 2.	1/3" = 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 RQ'D.

R1

W1

R2

R4

R3

W3

W2

TIP RIB

2 OF 1/16"

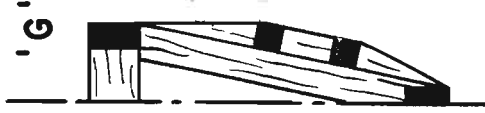
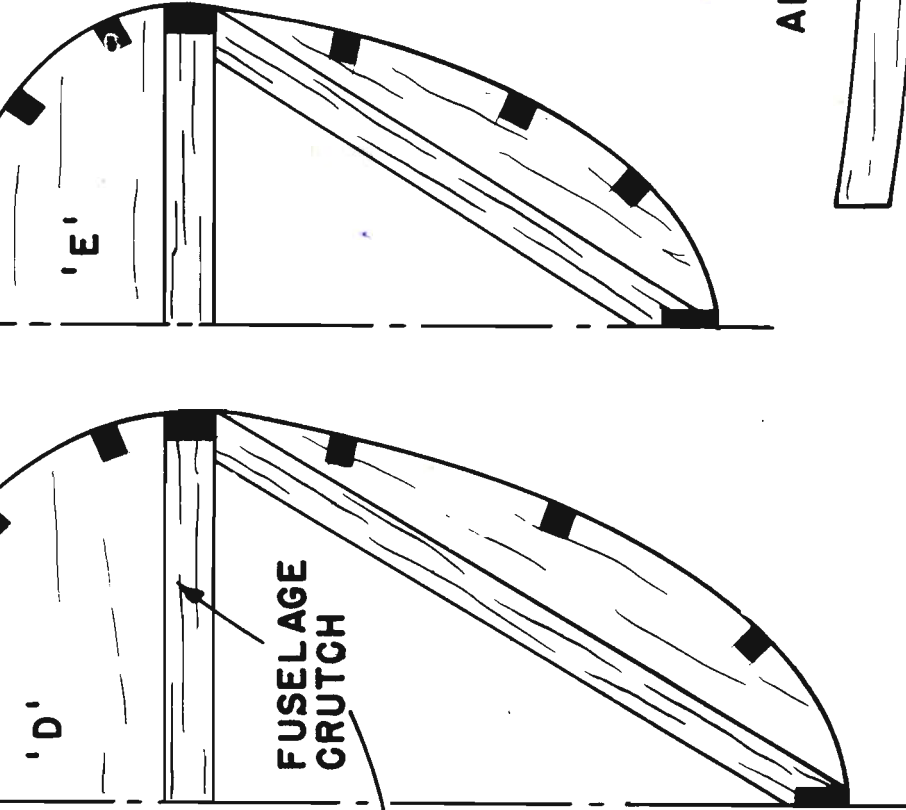
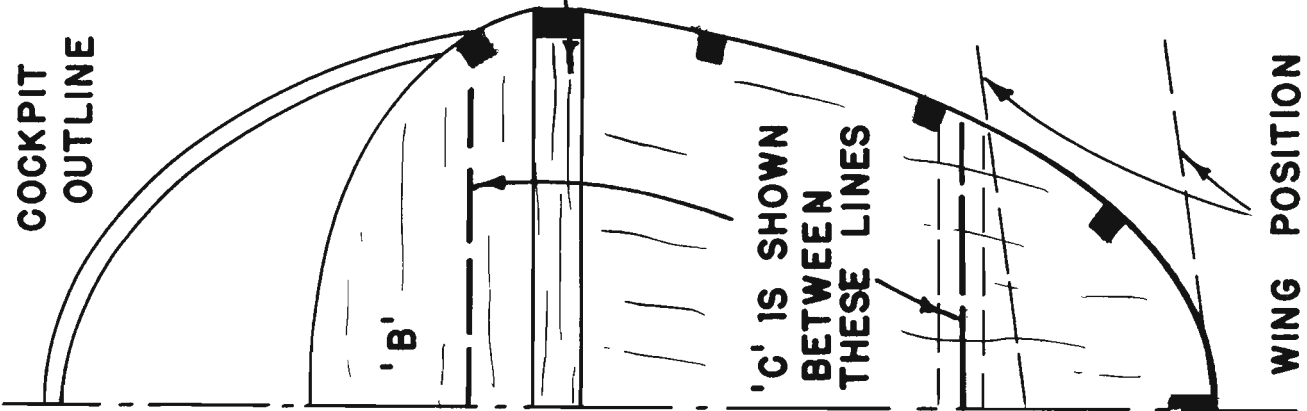
MAIN RIB

2 OF 1/8"
13 OF 1/16"

PLATE 3.

SYDNEY R. STRUHL

COCKPIT
OUTLINE



ALL BULKHEADS ARE 1/8" SHEET



ALL PARTS SHOWN ON PLATES 3. AND 4.
ARE FULL SIZE.

PLATE 4.



A three wheel landing gear provides fine takeoffs and landings

plane you can't alter them at all, however you must be sure to keep the wing set at 0° and stabilizer set at $1\frac{1}{2} 0^\circ$ minus. The thrust line is kept at $0^\circ-0^\circ$; 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 $1/8" \times 1/4"$ strips in place on the drawing of the crutch and cement cross members in their proper locations. Basswood motor mounts $3/8" \times 1/2"$ 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 $1/8" \times 1/4"$ balsa strips between bulkheads D and G. The lower portions of bulkheads D, E, F and G are now cemented against the $1/8" \times 1/4"$ 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 $3/16" \times 1/2"$ trailing edge. Cut the ribs from $1/8" \times 1/4"$ 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 $1/8" \times 1/4"$ spar and ribs and cement each joint firmly. Trim and sandpaper rudders to a streamlined cross-section. 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 $1/4" \times 1"$ trailing edge to shape and pin in place. Pin the two $3/16" \times 1/2"$ 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 $3\frac{1}{2}"$ 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

It is a consistent and amazing flier



snugly into the box formed between bulkheads B and D.

COVERING—It is advisable to use colored Silkspan for covering rather than color-doping the model. Of course color is optional. Use heavy clear dope as an adhesive. Sand the frameworks lightly to remove any flaws and ridges that might mar a neat covering job. If any warps have developed they should be removed before covering.

Cover the fuselage first, using several pieces of Silkspan to fit the curves of the turtle-back and sides. The cowling and similar wood parts, such as the landing gear struts, are tissue covered, too.

Use a separate piece of paper for 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 lines or designs, control surfaces outlines, etc., are made from colored paper. Outline the windows with strips of black paper doped to the celluloid cabin.

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.

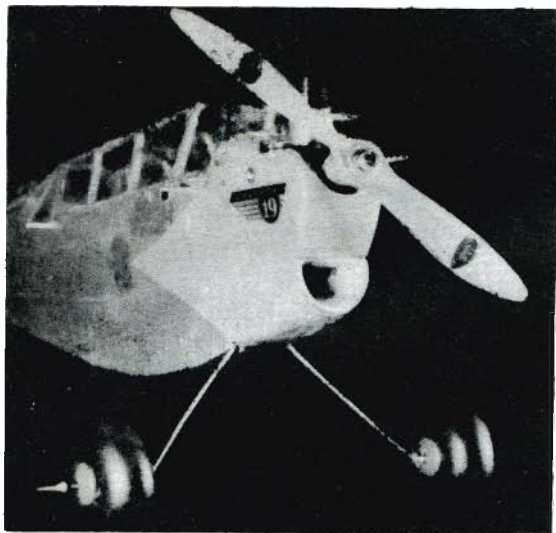
Set the timer for 15 seconds for the first flight and use very low power. Under power the model should climb slowly in 200 foot circles to the right. When the motor cuts it should go into larger circles in a very slow glide. If the ship reacts well on the first flight, fly it again with

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 satisfactory 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 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



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 weight 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

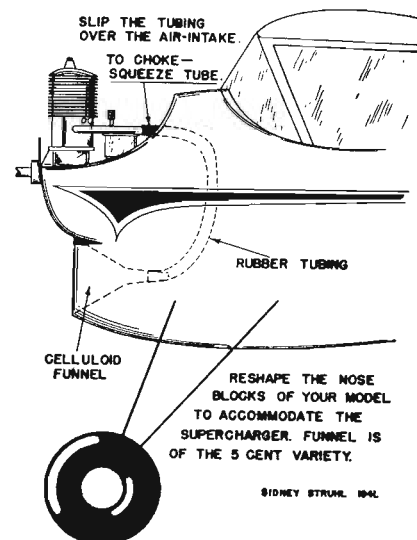
STEPPING UP YOUR POWER

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

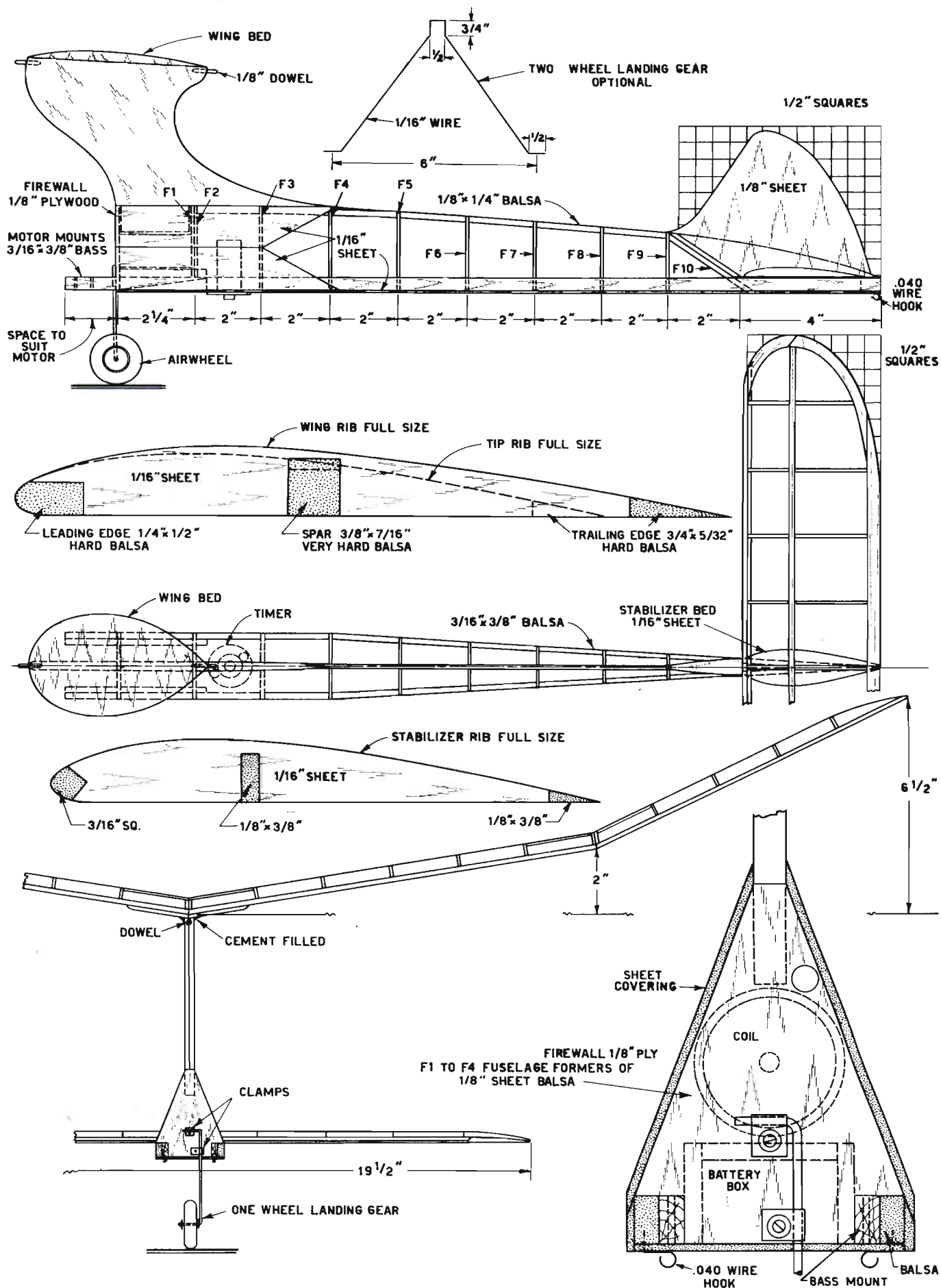
By **SIDNEY STRUHL** and **CHESTER GREENBERG**

that would force air into the motor like a full size supercharger and yet it had to be light, simple and 100% foolproof. You can see that our little supercharger meets all

(Continued on page 121)



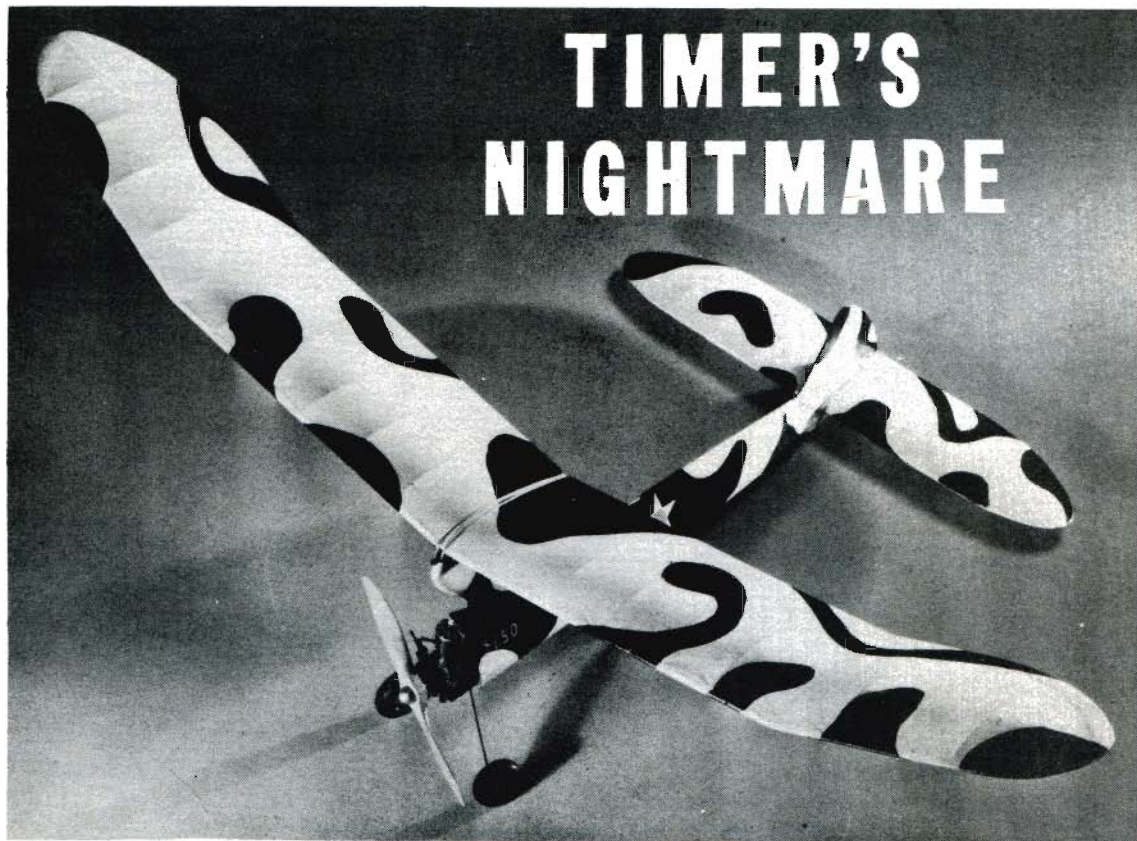
SIDNEY STRUHL, 1944



**A reliable
easily-built
class A
gas model
designed to
give highest
performance**

by
**FRANK
EHLING**

TIMER'S NIGHTMARE



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 stopwatch 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 flier as well as one capable of high time.

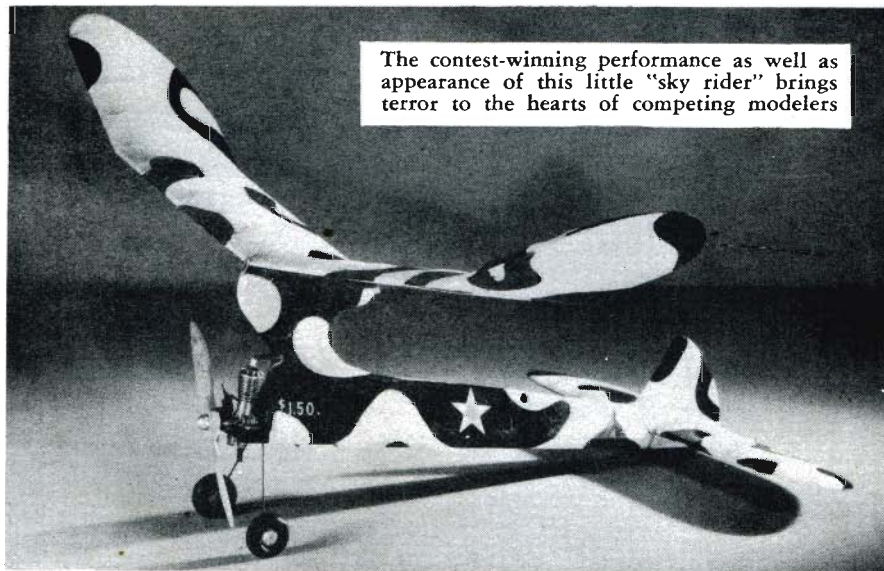
It was designed especially for the new rules. The fuselage shape used gives the least drag for the amount of space required to house the coil, condenser, battery box and timer; also it blends well into the pylon which was used to get the wing high and well forward. This is the best way to spell "stability." 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.

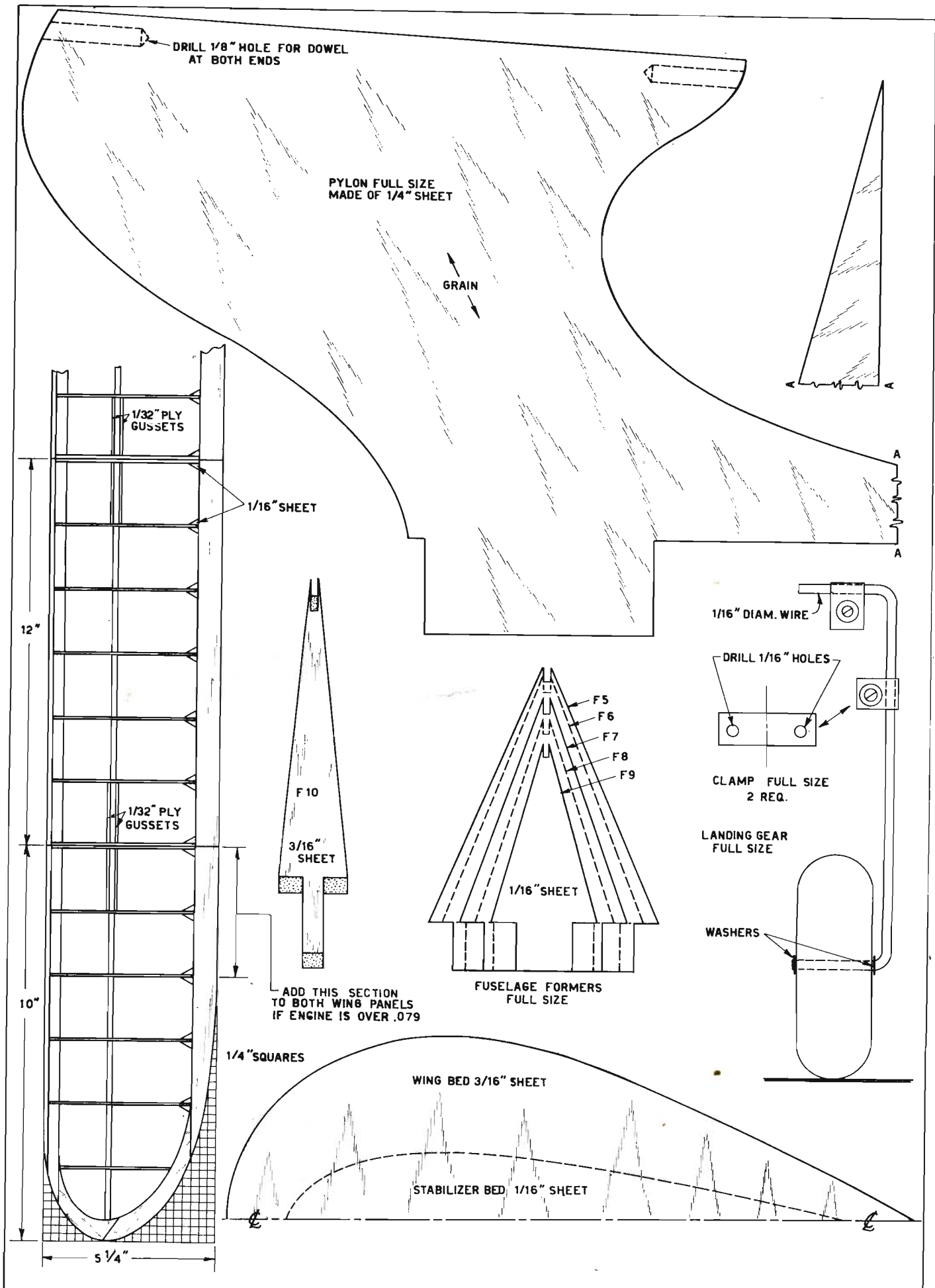
Enough talk, a "slip of the lip" won't build this ship; so clear the work table and to work. The plans are one-quarter size, so enlarge the plan of the crutch, wing, stabilizer and rudder four times the size shown on the plan. Start by cementing the motor bearers to the crutch and then assemble. The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

The contest-winning performance as well as appearance of this little "sky rider" brings terror to the hearts of competing modelers



(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 in the wing. Add the wing tips 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 Silkspar 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 rudder is then cut out of sheet and sanded to a streamlined section, after which it is cemented to the stabilizer. A former similar to the one that is at the rear of the fuselage is cemented to the front of the rudder. When this is dry the rudder is covered; include this former in the job as that is how the rudder fillet is formed, thus forming the rear section of the fuselage.

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 fine 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 are much less subject to troubles traceable to initial 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 plug points 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.

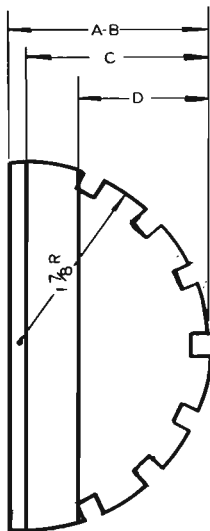
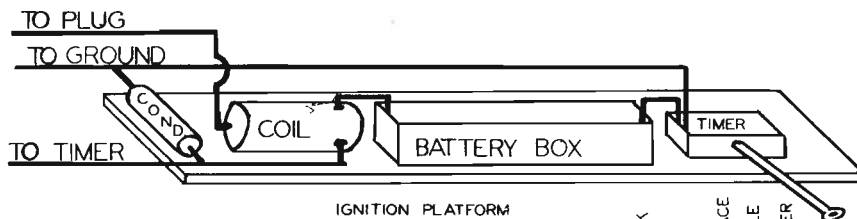
Any method of increasing the running time of each burst will considerably shorten the troublesome break-in period. Since the length of these bursts is determined by the motor temperature, it will be advisable to maintain the cylinder at a low temperature for as long as possible. This can be easily accomplished 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 precaution will result in higher peak power and longer life after the motor is thoroughly broken in.

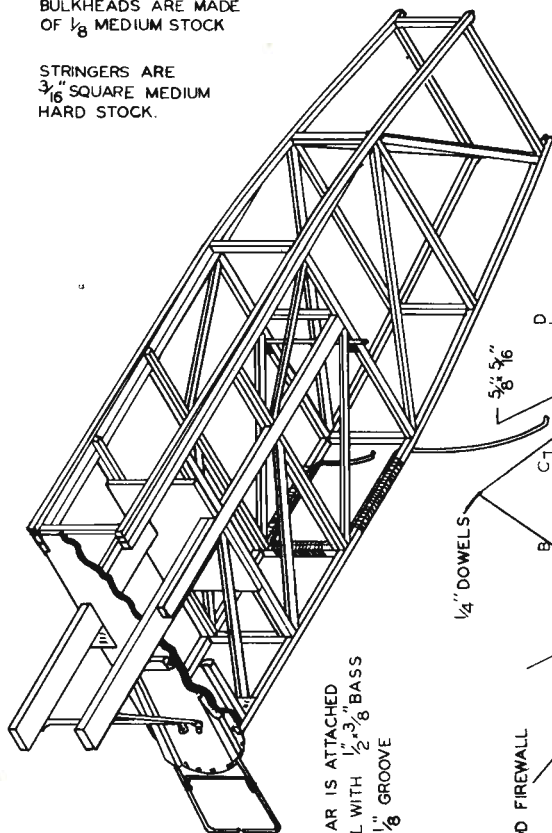
Since so much oil is used during the break-in period, the motor will cover everything in its vicinity with a heavy oil film. It is therefore advisable not to break in the motor while it is mounted in a shiny new model plane. In addition to the dangerous carbon monoxide hazard, this furnishes another 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 drain 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 sweetly running motor and a ragged irregular run. The use of No. 14 wire is therefore 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 voltage 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 then measured as outlined above 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.



BULKHEADS ARE MADE OF 1/8" MEDIUM STOCK

STRINGERS ARE 3/16" SQUARE MEDIUM HARD STOCK



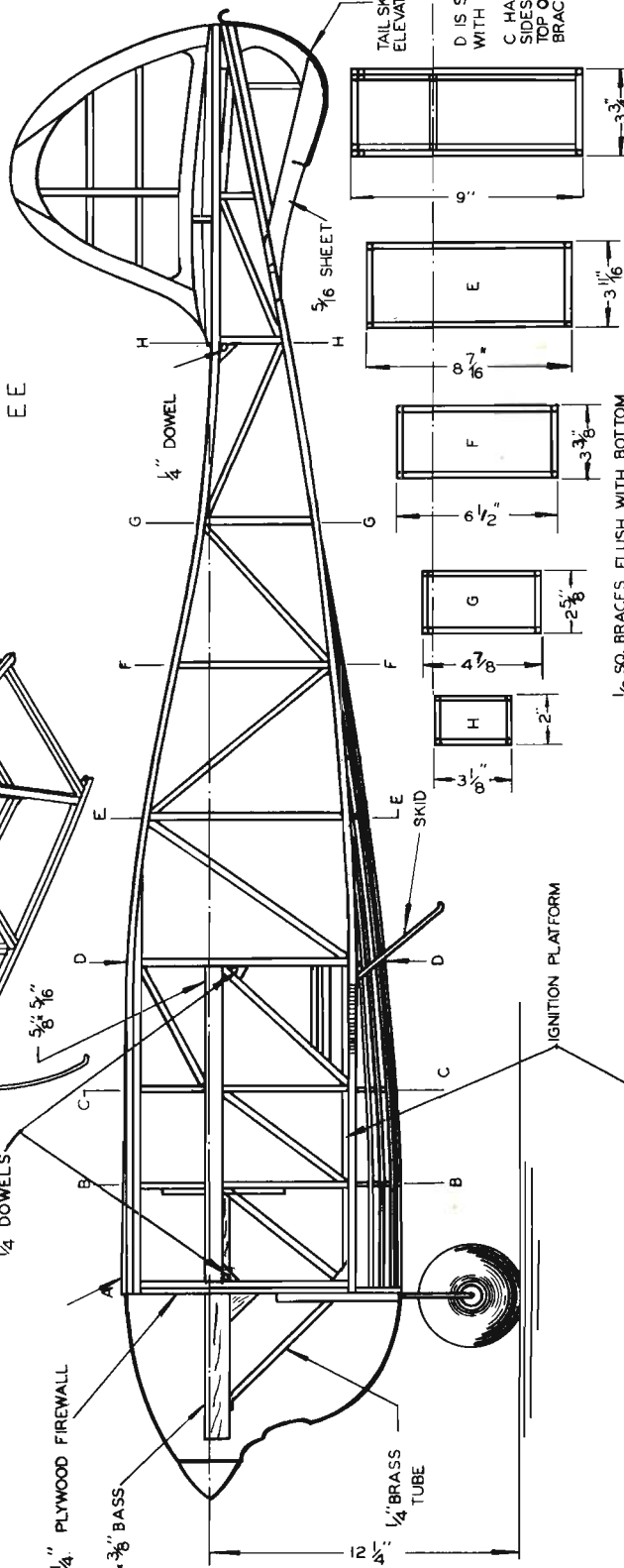
1/4" DOWELS

5/8" 5/16"

1/4" BASS

1/4" BRASS TUBE

2"



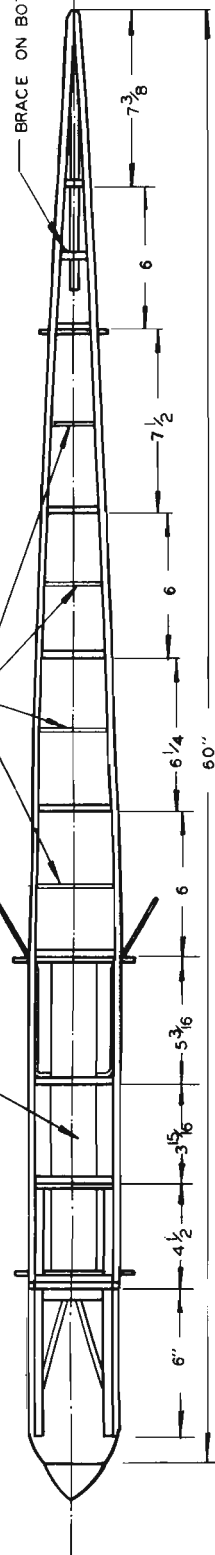
1/8" SQ. BRACES FLUSH WITH BOTTOM OF LONGERON - TOP SIDE ONLY

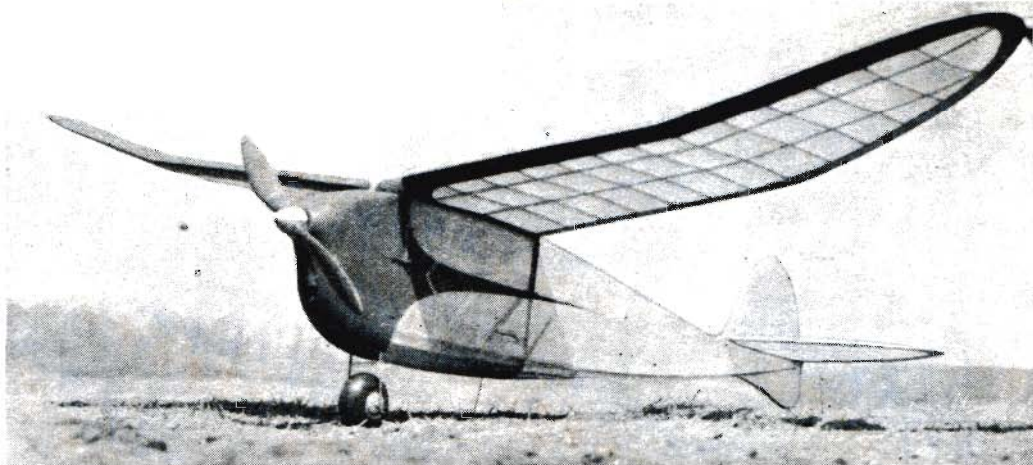
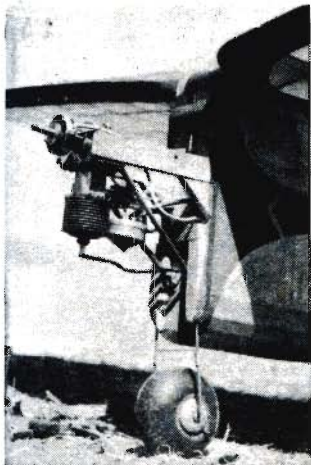
BRACE ON BOTTOM ONLY

PLATE ONE
THE HORNET

DESIGN BY: SAL TAIBI
DRAWN BY: LOU ORTOLANI

"SKY-SCRAPERS"





The 7'4" Hornet ready to fly. Skids keep it upright. A close-up of the motor is at the left

Building The Hornet

Complete Data to Build A Low-Drag High-Performance Gas Model That Gets Up Quickly and Stays There

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.

By **SAL TAIBI**

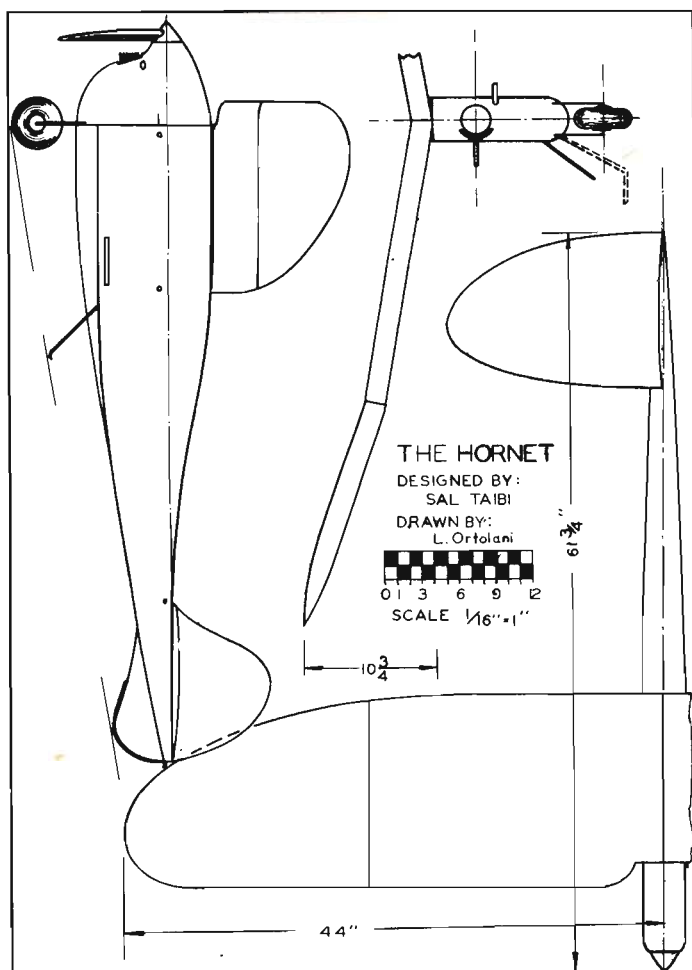
From a standing start, with absolutely no hand-guidance, the ship amazed all witnesses by consistently doing 1:40 on a TEN SECOND MOTOR RUN.

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

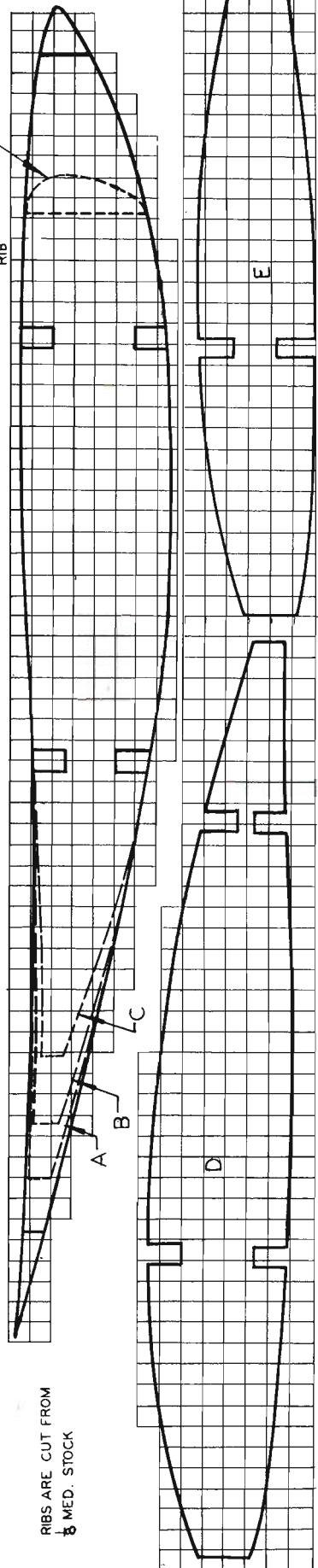
The first step in building the Hornet is to "scale up" the plans to full size. Ordinary bond paper may be used for this process, which may be obtained at any stationery store for about a dime a roll. In scaling up a plan the builder will learn more about the construction of the model than he can in any 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 . . .

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.



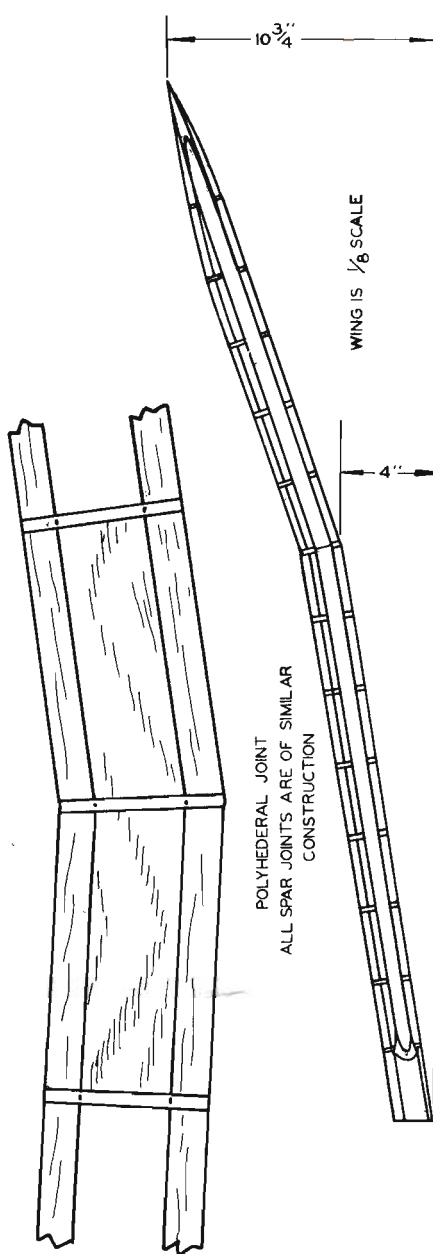
The large span and clean streamlines provide fine floating qualities. Here it is gliding in to a landing

CENTER SECTION
RIB



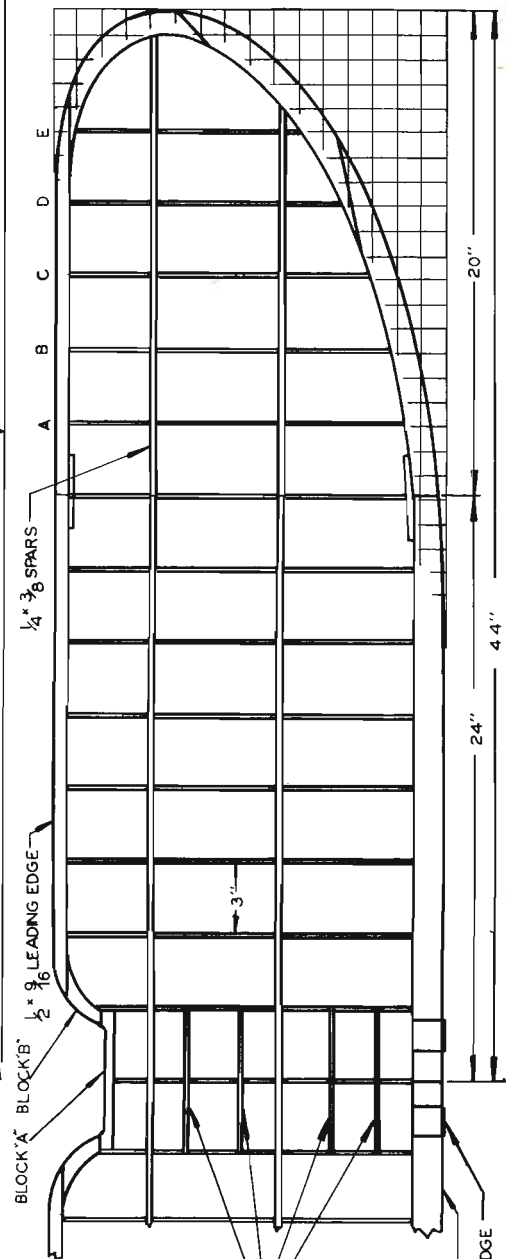
RIBS ARE CUT FROM
 $\frac{1}{8}$ MED. STOCK

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



POLYFEDERAL JOINT
ALL SPAR JOINTS ARE OF SIMILAR
CONSTRUCTION

WING IS $\frac{1}{8}$ SCALE



TO OBTAIN THE CORRECT WING TIP
PLOT ONE INCH SQUARES TO CORRESPOND
TO THE SQUARES ON THE DRAWING

COVER CENTER SECTION
WITH $\frac{1}{16}$ SHEET BALSA

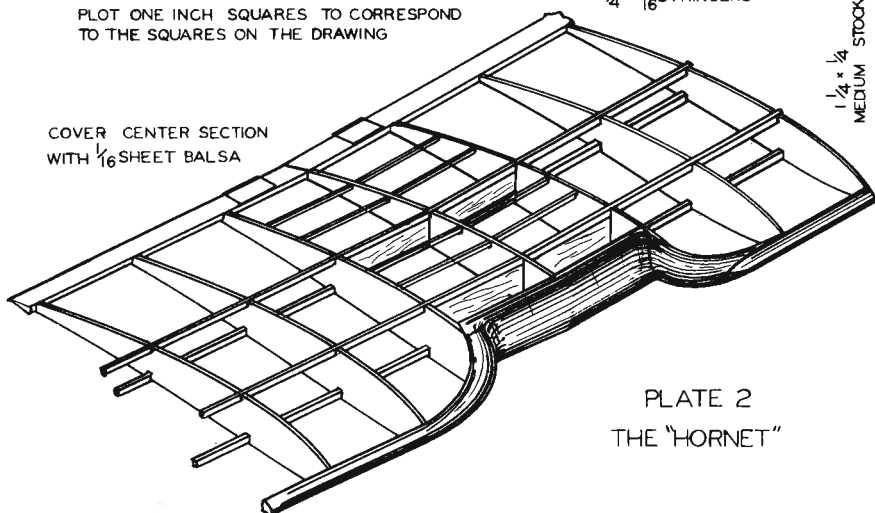
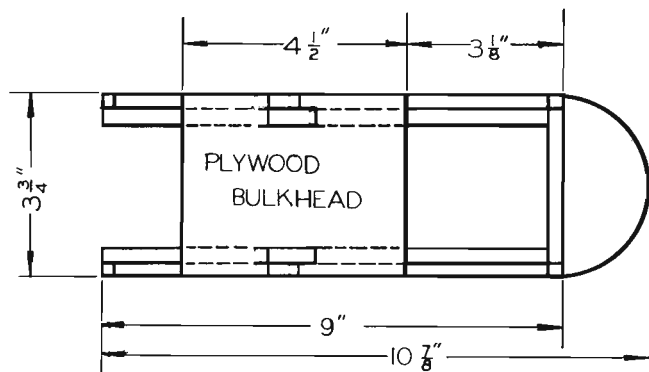
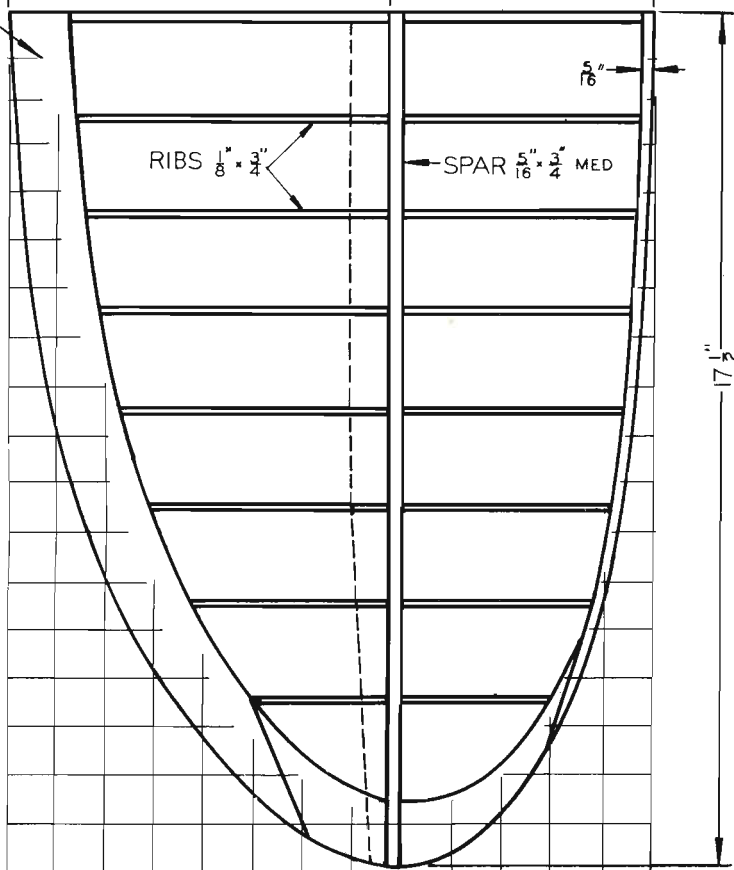
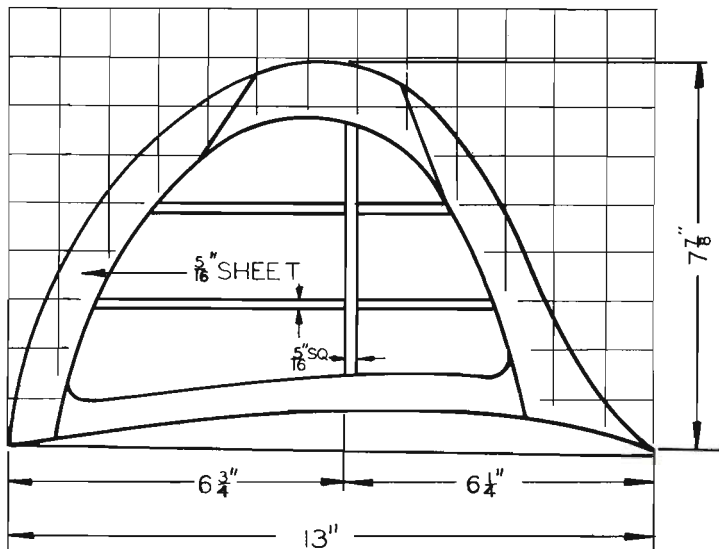


PLATE 2
THE "HORNET"

L. Ortolani



$1\frac{1}{2}" \times \frac{5}{16}"$ TRAILING EDGE, MED



1 INCH SQUARES

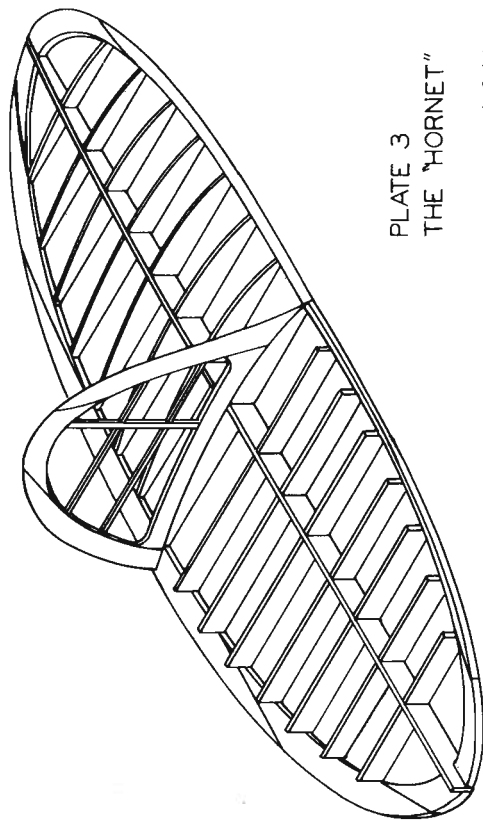
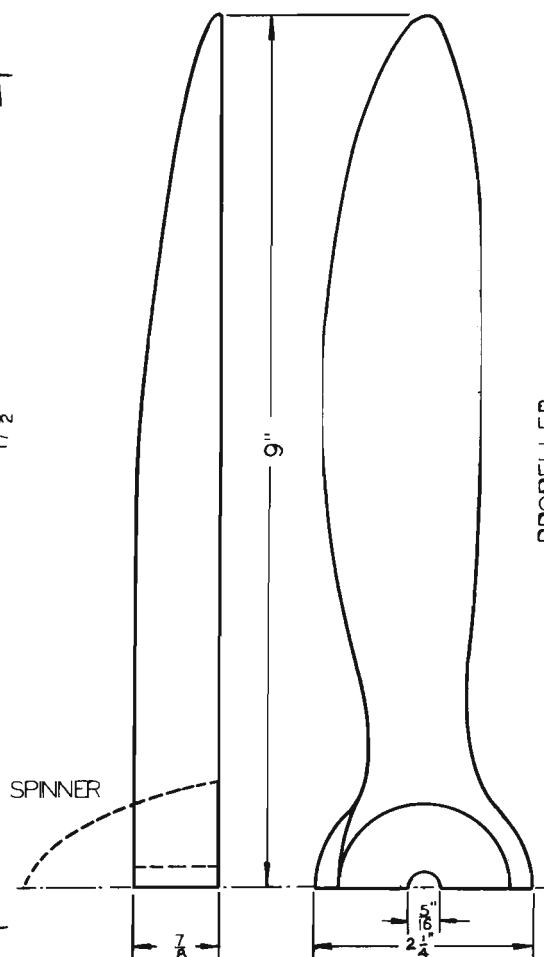
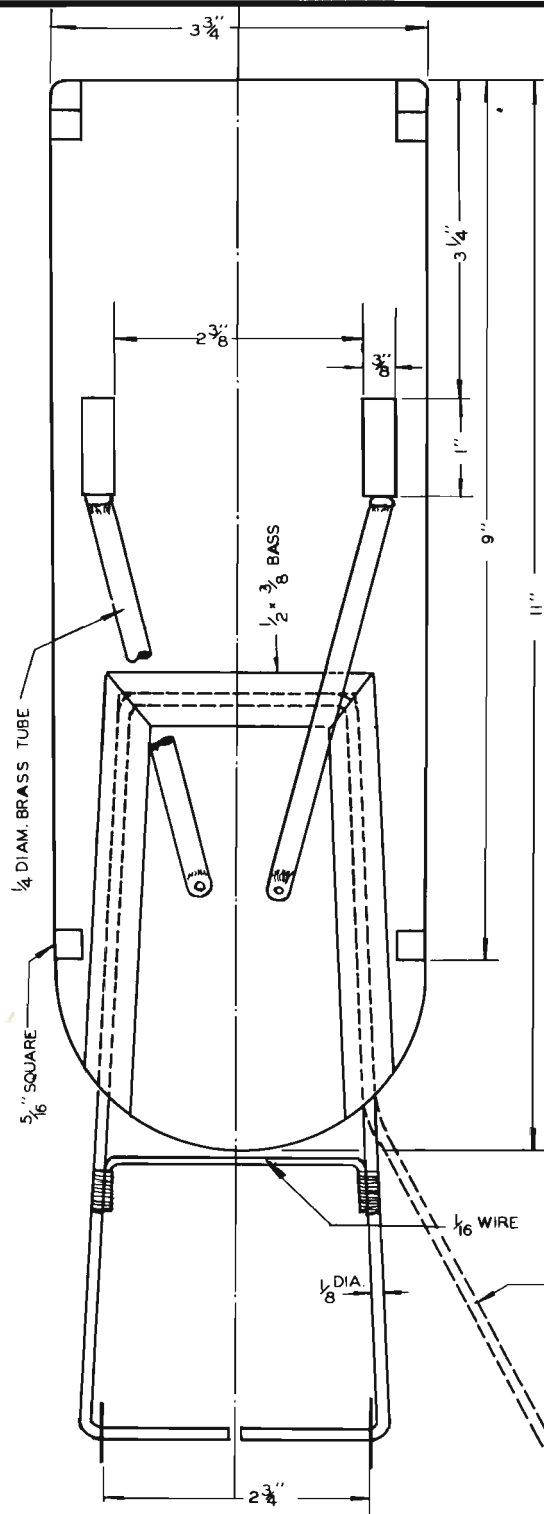


PLATE 3
THE "HORNET"

L. Ortolano.



PROPELLER



$\frac{1}{4}$ DIAM. BRASS TUBE

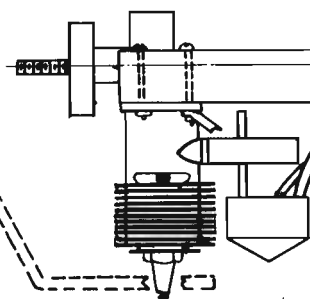
$\frac{5}{16}$ SQUARE

$\frac{1}{2} + \frac{3}{8}$ BASS

$\frac{1}{16}$ WIRE

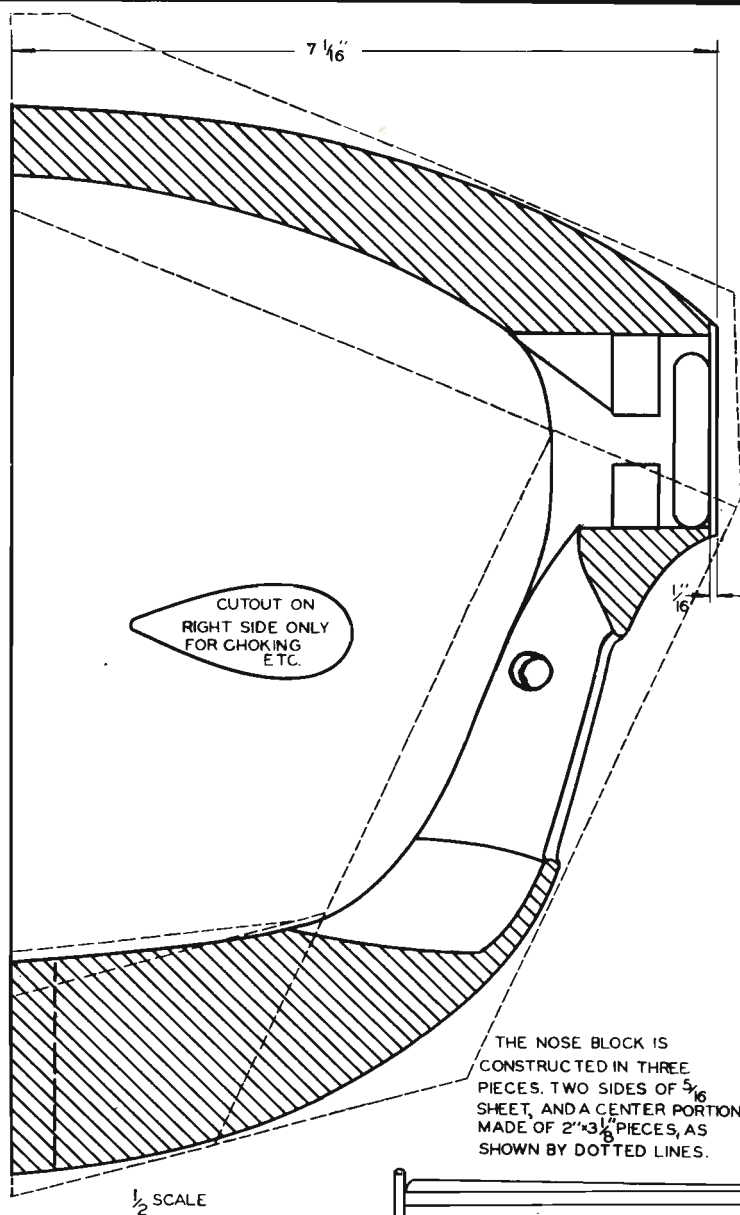
$\frac{1}{8}$ DIA.

OPTIONAL LANDING GEAR



ENGINE DETAIL

$\frac{1}{4}$ SCALE



CUTOUT ON
RIGHT SIDE ONLY
FOR CHOKING
ETC.

THE NOSE BLOCK IS
CONSTRUCTED IN THREE
PIECES. TWO SIDES OF $\frac{5}{16}$
SHEET, AND A CENTER PORTION,
MADE OF $2 \times 3\frac{1}{8}$ PIECES, AS
SHOWN BY DOTTED LINES.

$\frac{1}{2}$ SCALE

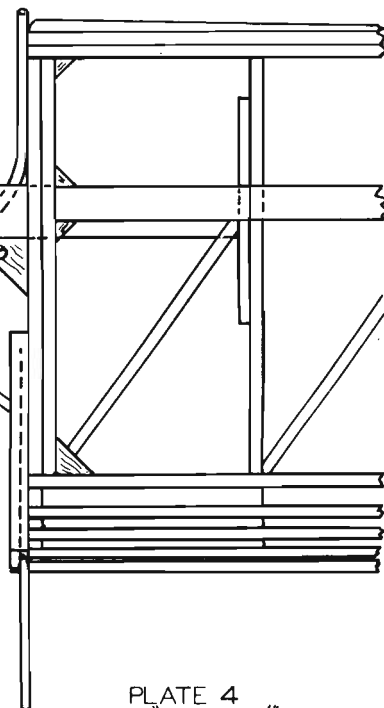
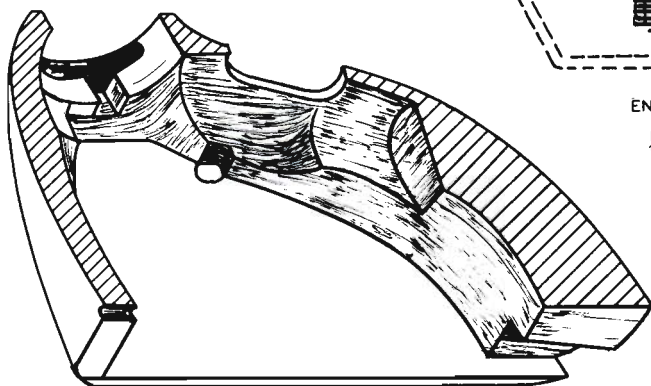
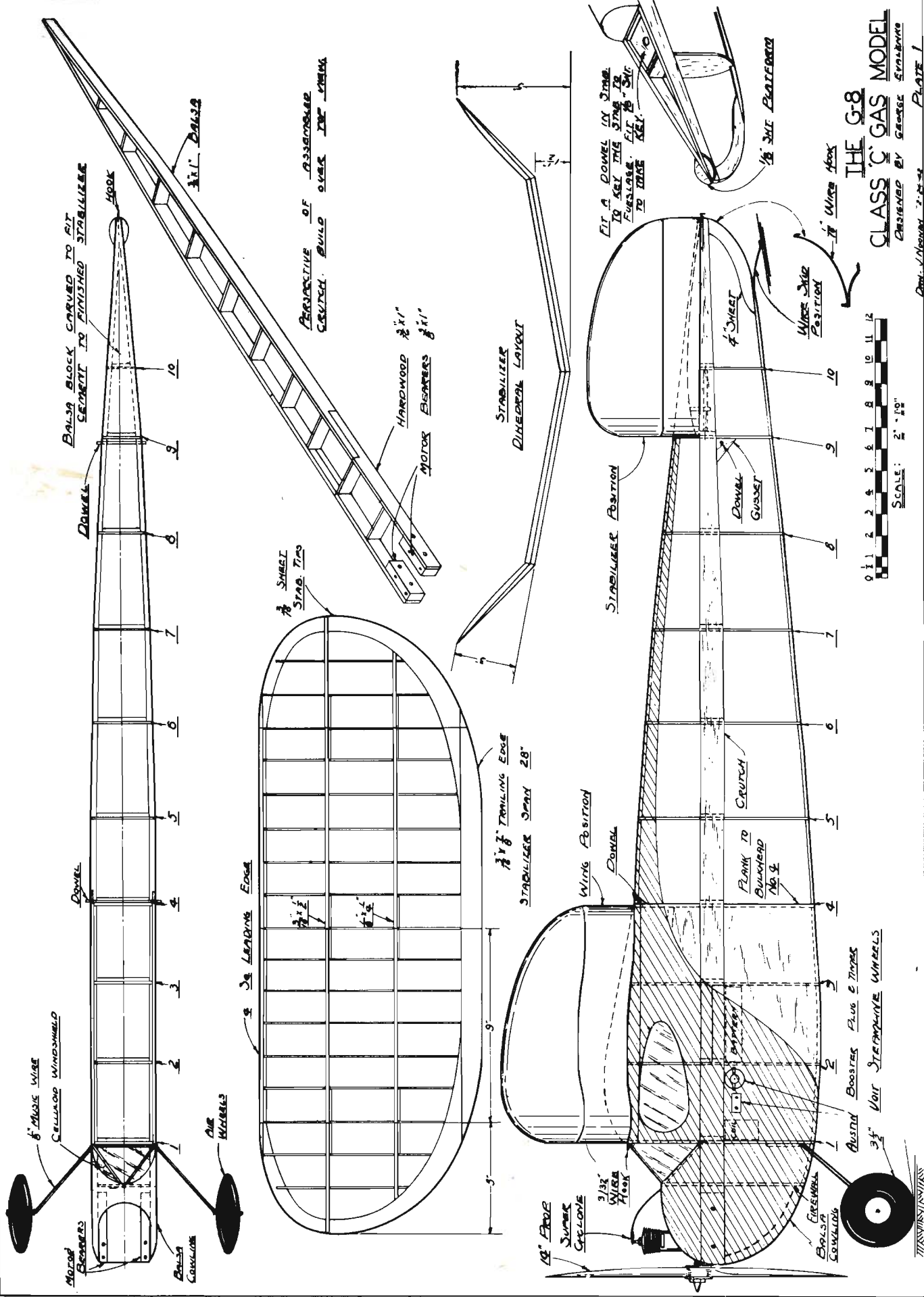


PLATE 4
THE "HORNET"

L. Ortolani



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 airfoil 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 acrobatics, 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 awasting, 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 cowl and nose blocks in place. Reglue all joints and check alignment of 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, in-

stall 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.

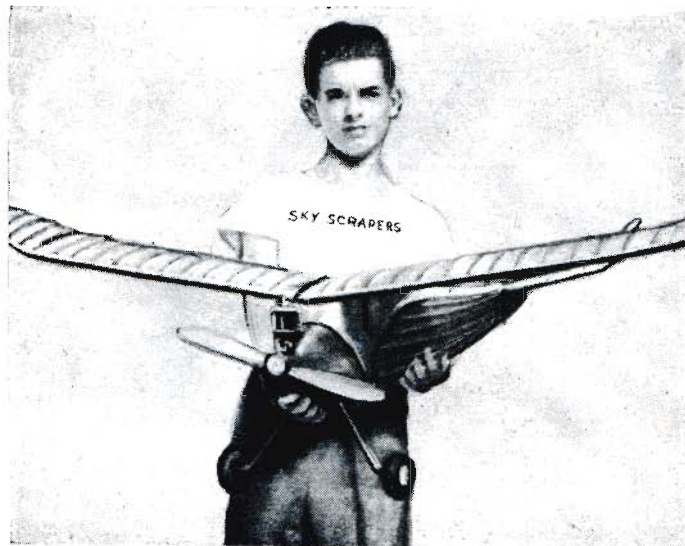
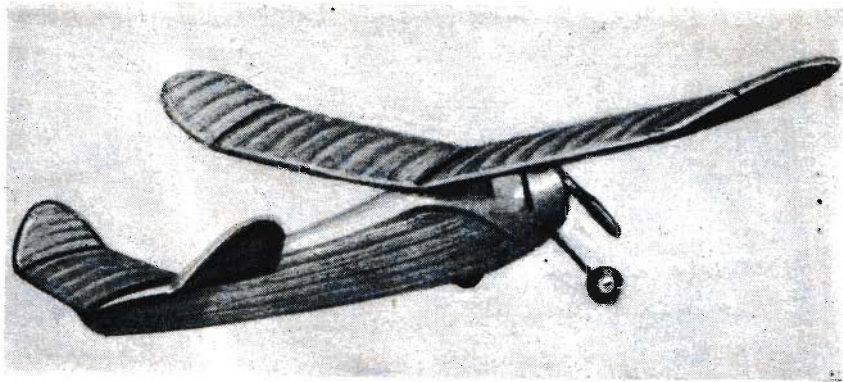
The battery box is mounted on a piece of 1/8" plywood, with a slot cut the length of it, by means of a bolt. Thus it is movable, and will aid greatly in balancing the model. Wires are connected to the box by clips so that the box is easily removable when it is necessary to change the medium size batteries. An unexpected advantage of this method is its shock-proof nature. 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. Plank the portion of the fuselage below the crutch 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.

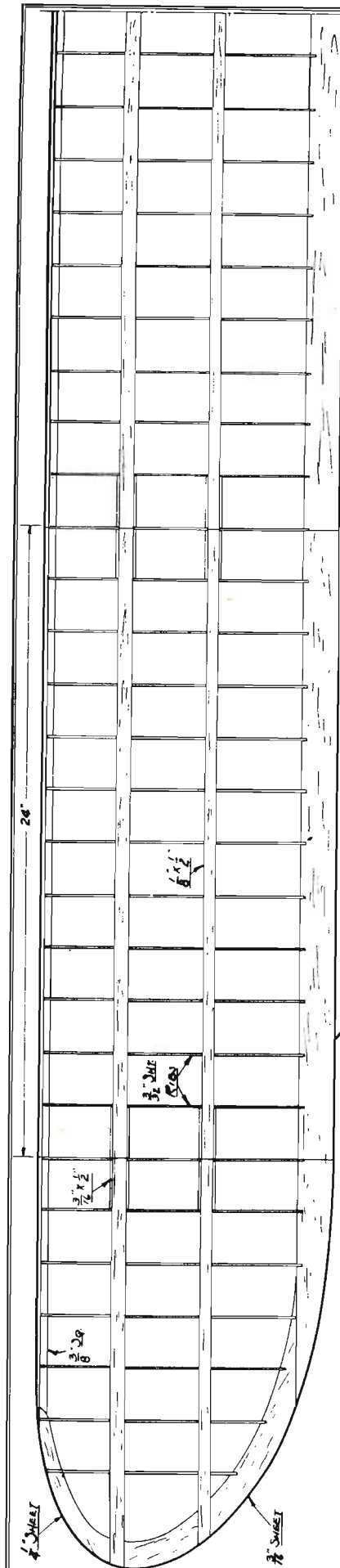
Now add stringers spaced as your judgment dictates. Shape the cowl and nose blocks roughly. Reglue the entire fuselage; when dry, sand thoroughly first with fairly rough sandpaper, and then with a finer variety. Attach windshield braces and cut out windows from medium thick celluloid. Make a template of front windshield, from stiff writing paper, and, using it as a pattern, cut out celluloid windshield. 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)



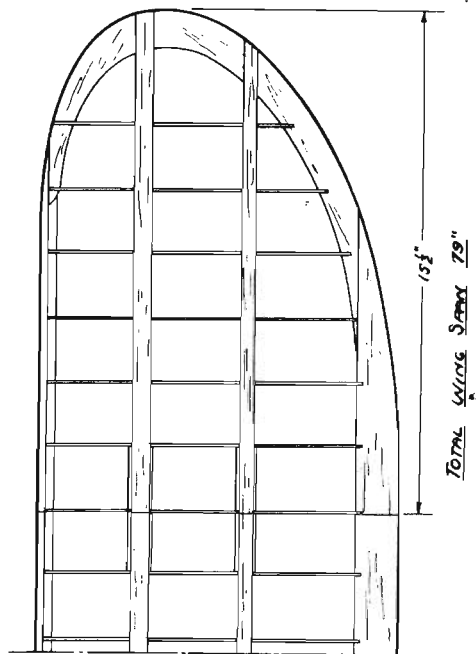
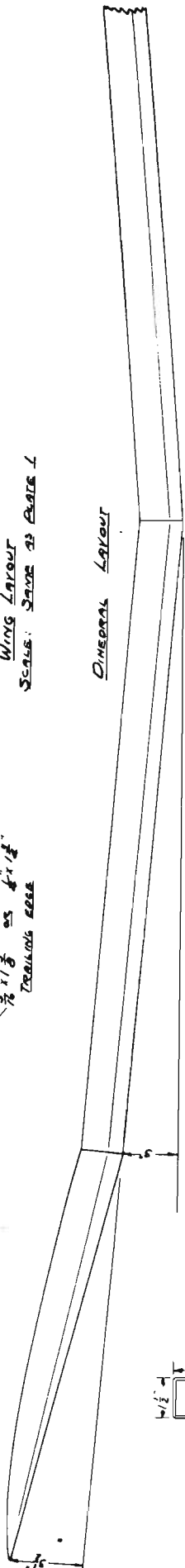
Above This unique model with its bird wing section soars on the slightest up-current of air. Note the combination fin-stabilizer tail plane. *Left* The author with his G-8 bird wing plane before the flight on which it disappeared



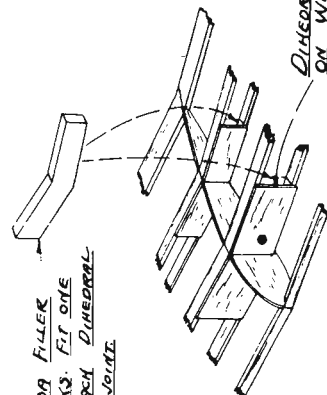
Wing Layout
Scale: Same as Page 1

$\frac{3}{8} \times \frac{1}{8}$ or $\frac{1}{4} \times \frac{1}{8}$
TRAILING EDGE

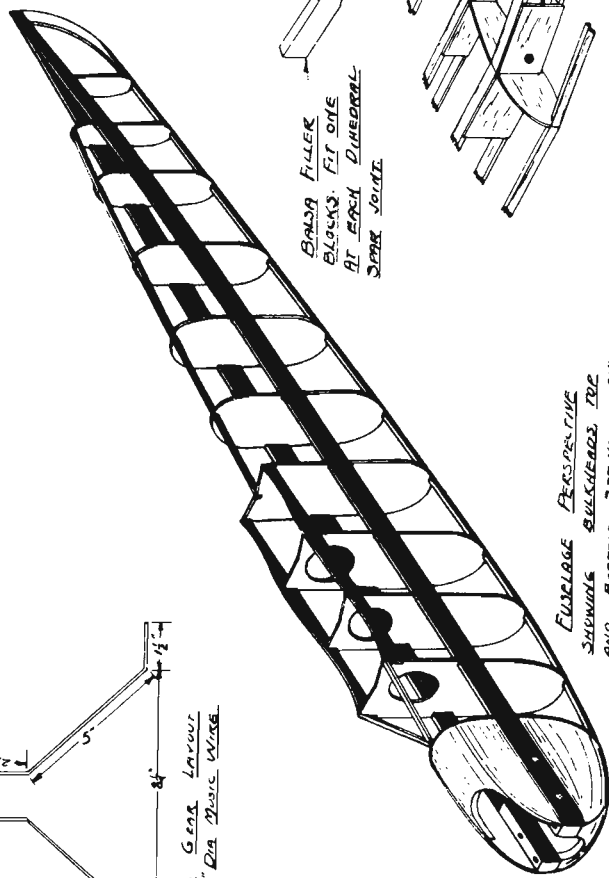
Dihedral Layout



Total Wing Span 19"

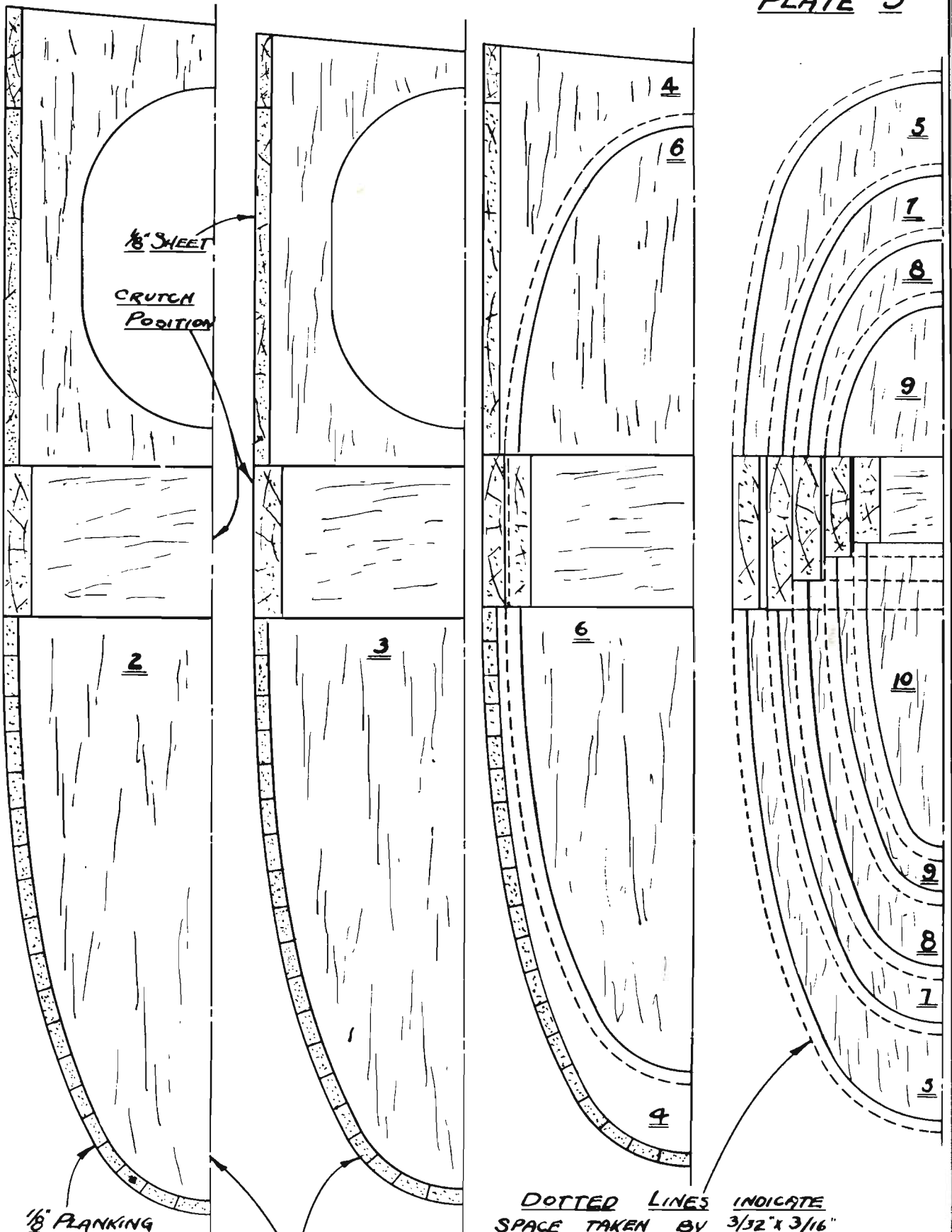


Dihedral Reinforcement
ON WING & STRINGERS
 $\frac{1}{16}$ OR $\frac{3}{32}$ BIRCHWOOD



FUSelage PERSPECTIVE
SHOWING BULKHEADS, TOP
AND BOTTOM STRINGERS AND
CONICAL BLOCKS IN PLACE.

THE G-8 CLASS "C" GAS MODEL DESIGN BY GEORGE BUNNICK



1/8" PLANKING

BULKHEADS ARE 1/8" SHEET
EXCEPT WHERE NOTED

DOTTED LINES INDICATE
SPACE TAKEN BY 3/32" x 3/16"
STRINGERS. NUMBER OF STRINGERS
IS LEFT TO THE INDIVIDUAL BUILDER.

J.M.

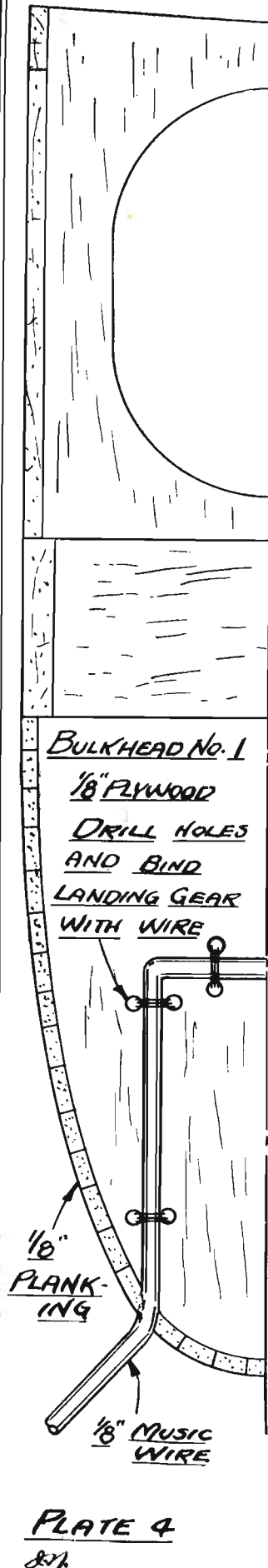


PLATE 4

871

WING PLATFORM
HARD 1/4\" SHEET

FIRE WALL
1/8\" PLYWOOD

MOTOR
BEARERS
3/8 x 1

CRUTCH

NOTE: SPACE MOTOR BEARERS
TO FIT YOUR PARTICULAR MOTOR

READ INSTRUCTIONS
CAREFULLY BEFORE BE-
GINNING WORK ON THE
MODEL.

ALL PARTS ON PLATES
3 AND 4 ARE FULL
SIZE.

A FULL SIZE METAL
TEMPLATE OF THE
RIBS WILL MAKE THE
JOB EASIER.

STAB. RIB
PATTERN

3/16 x 1/8
TR. EDGE

3/16 x 1/2

1/4 SQ. L.E.

3/16 x 1/8

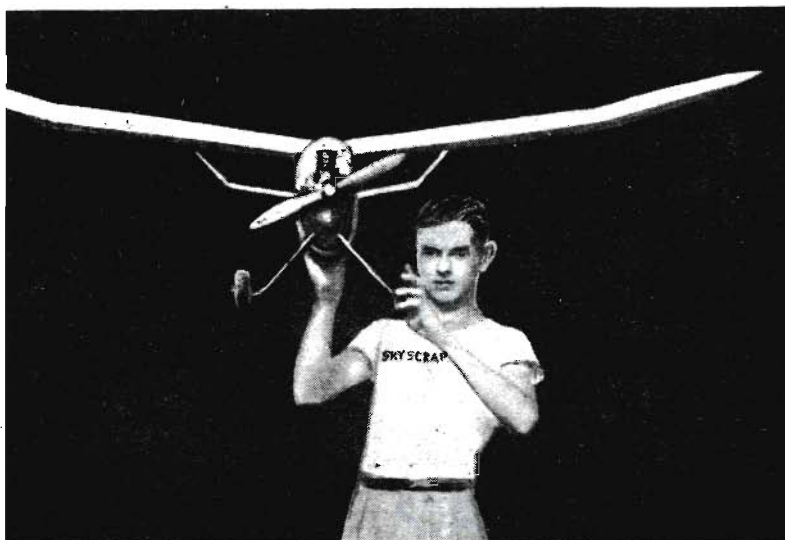
GRANT G-8 AIRFOIL

1/8 x 1/2
SPARS

3/16 x 1/2
SPARS

3/8 SQ LEADING
EDGE

1/8 x 1/2 SPAR



A front view showing the "V" tail and thick wing

Bird Wing Gas Model

(Continued from page 117)

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, and tips. 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 proportionate 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)

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.

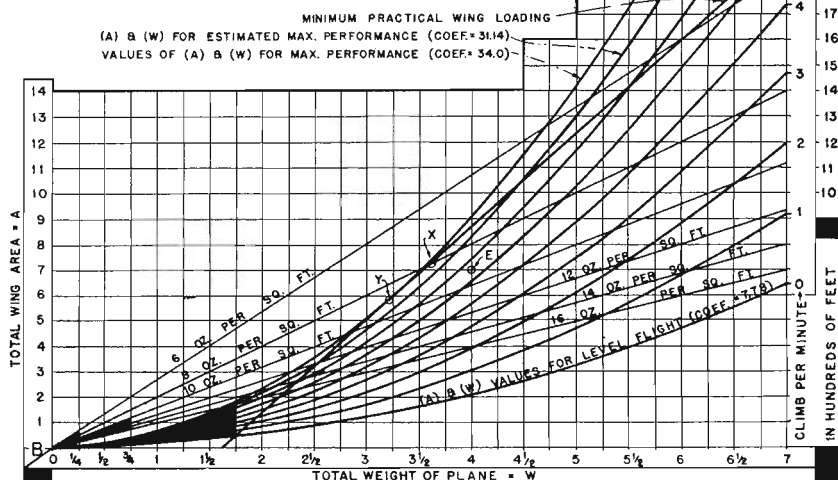
WARNING: You can use this supercharger for only short motor-run periods. It is not advisable to use it for runs of over a minute or a minute-and-a-half, because the motor speed is increased to such an extent that longer periods may cause damage by overheating. These periods are adequate enough for the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

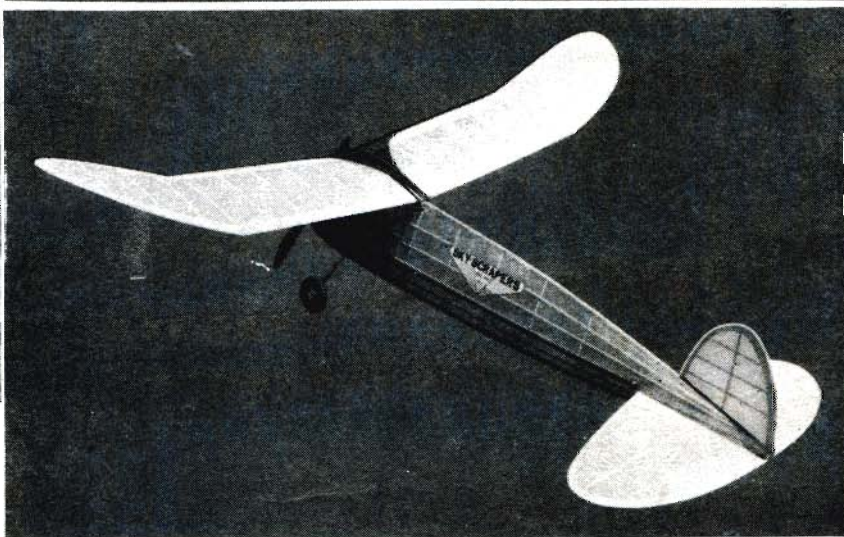
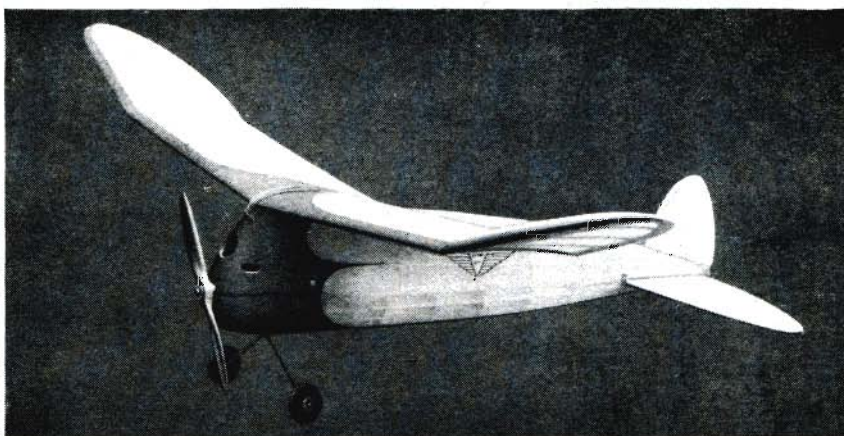
Try it and see for yourself!

GAS MODEL PERFORMANCE CHART
FOR 1/2 H. P. ENGINES





Though of simple construction it is a fine performer because of clean lines and excellent design



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 outsoar 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 exceptional 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 562 square inches, the model has to weigh 31.4 ounces; it is simple, rugged in construction and flies easily.

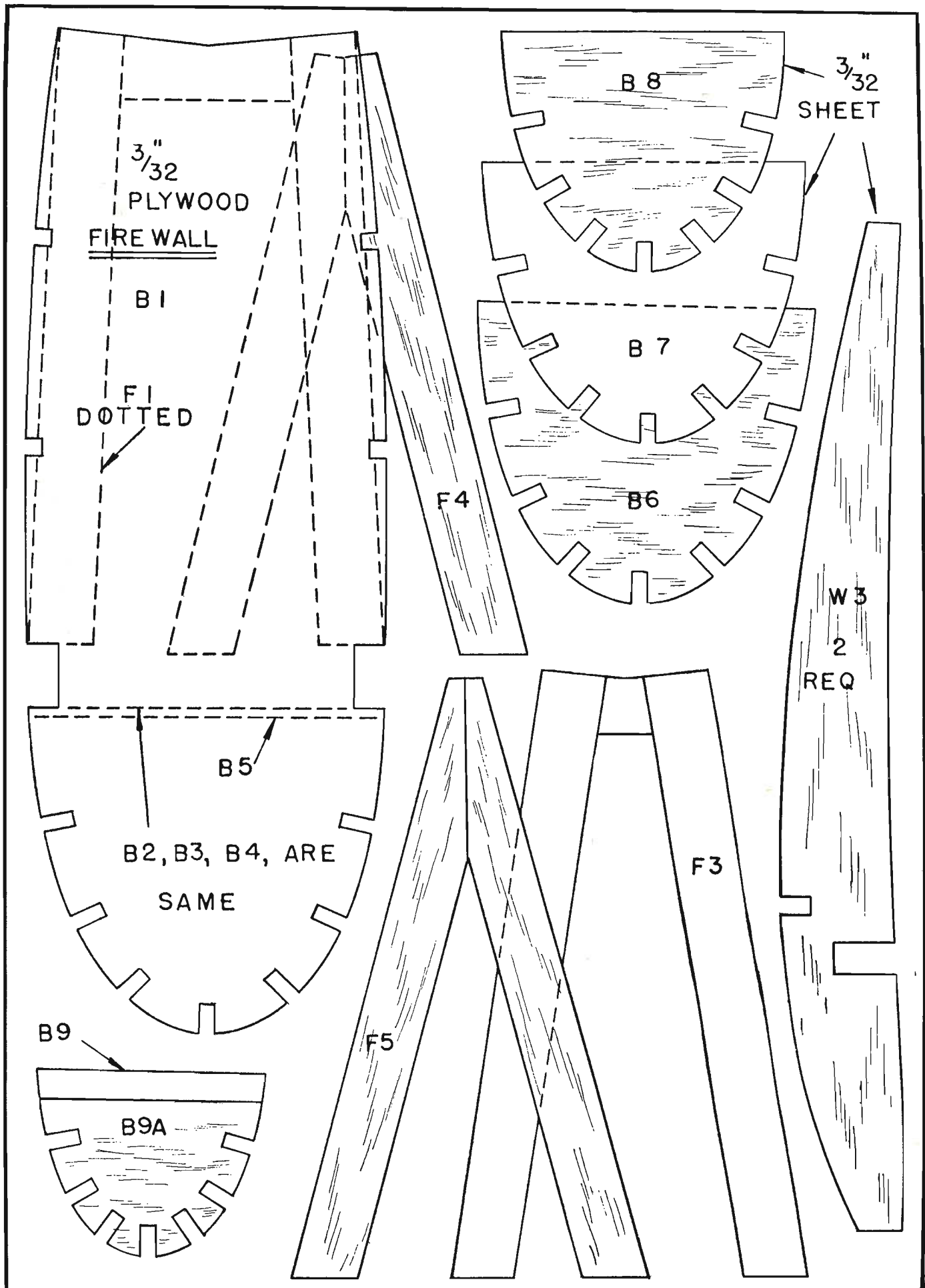
Fuselage

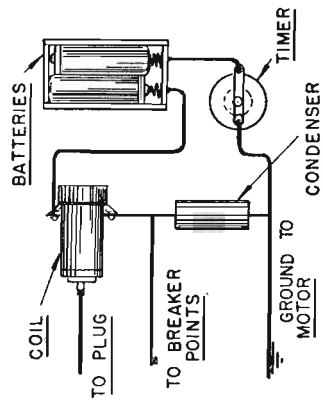
The first step in building the fuselage is to draw the top view full size. An elaborate

drawing is unnecessary; a center line with the width markings suffices. The formers and bulkheads are drawn full size on the plans and can be traced directly to balsa with carbon paper, or can, like the formers, be built on the plan.

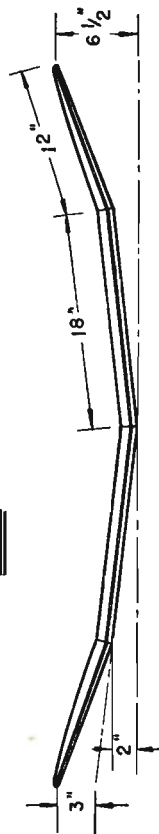
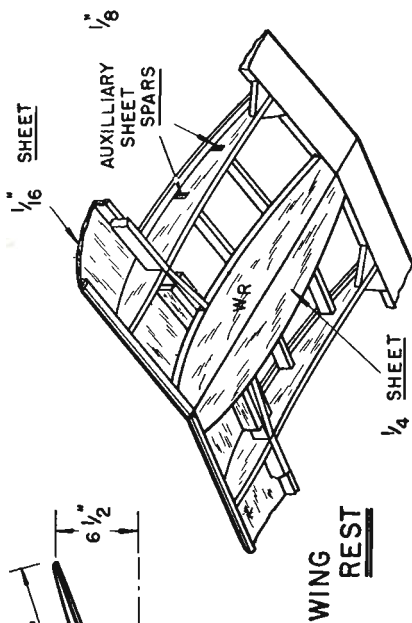
1/4" x 1/2" gumwood is spliced to the two longerons before starting to build the "crutch." Former 1 is built of 3/16" x 1/2" balsa; 2, 3, 4 & 5, of 1/8" x 1/2" balsa; 6 & 7 of 1/8" x 3/8" balsa; 8 & 9 of 1/8" x 1/4" balsa; and 10 & 11 are cut from 1/8" sheet balsa. The bottom bulkheads are cut from 3/32" sheet balsa. While the crutch is drying, cut out the fire wall 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 prevent 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 cemented between the crutch longerons. This tubing is the pivot about which the rudder turns. A piece of 0.16 aluminum 7/16" x

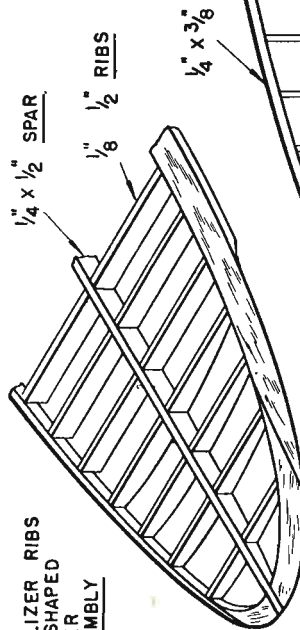




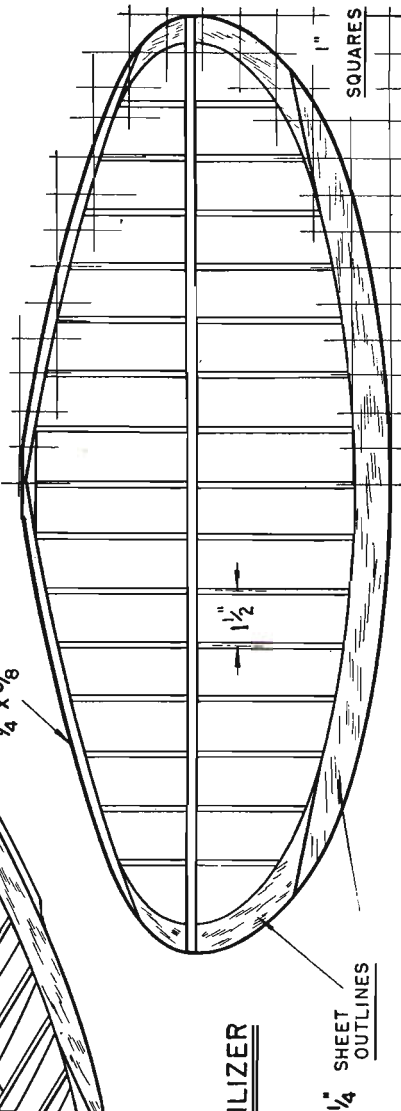
WIRING DIAGRAM



WING POLYHEDRAL



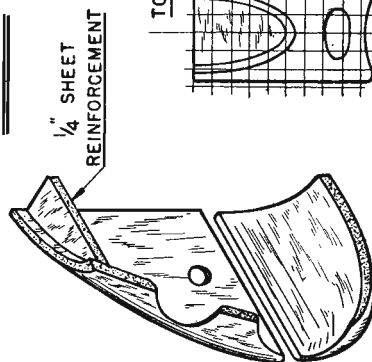
STABILIZER RIBS
ARE SHAPED
AFTER
ASSEMBLY



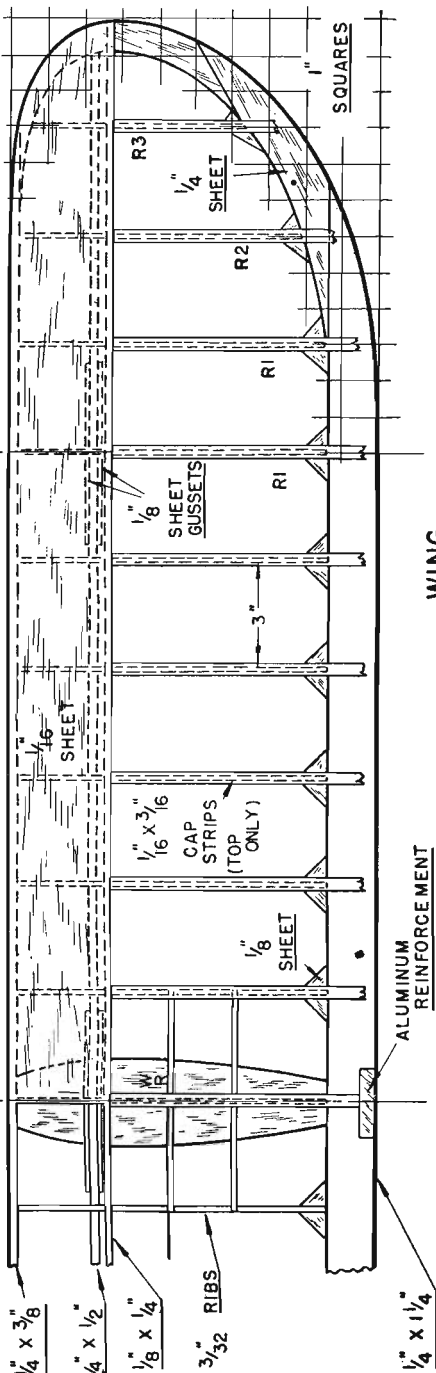
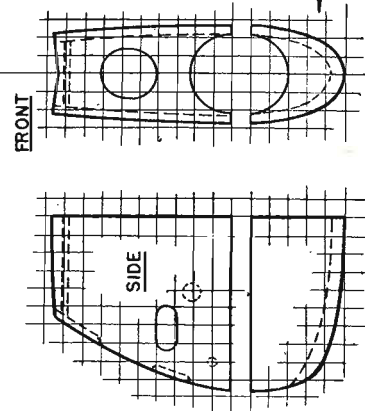
STABILIZER

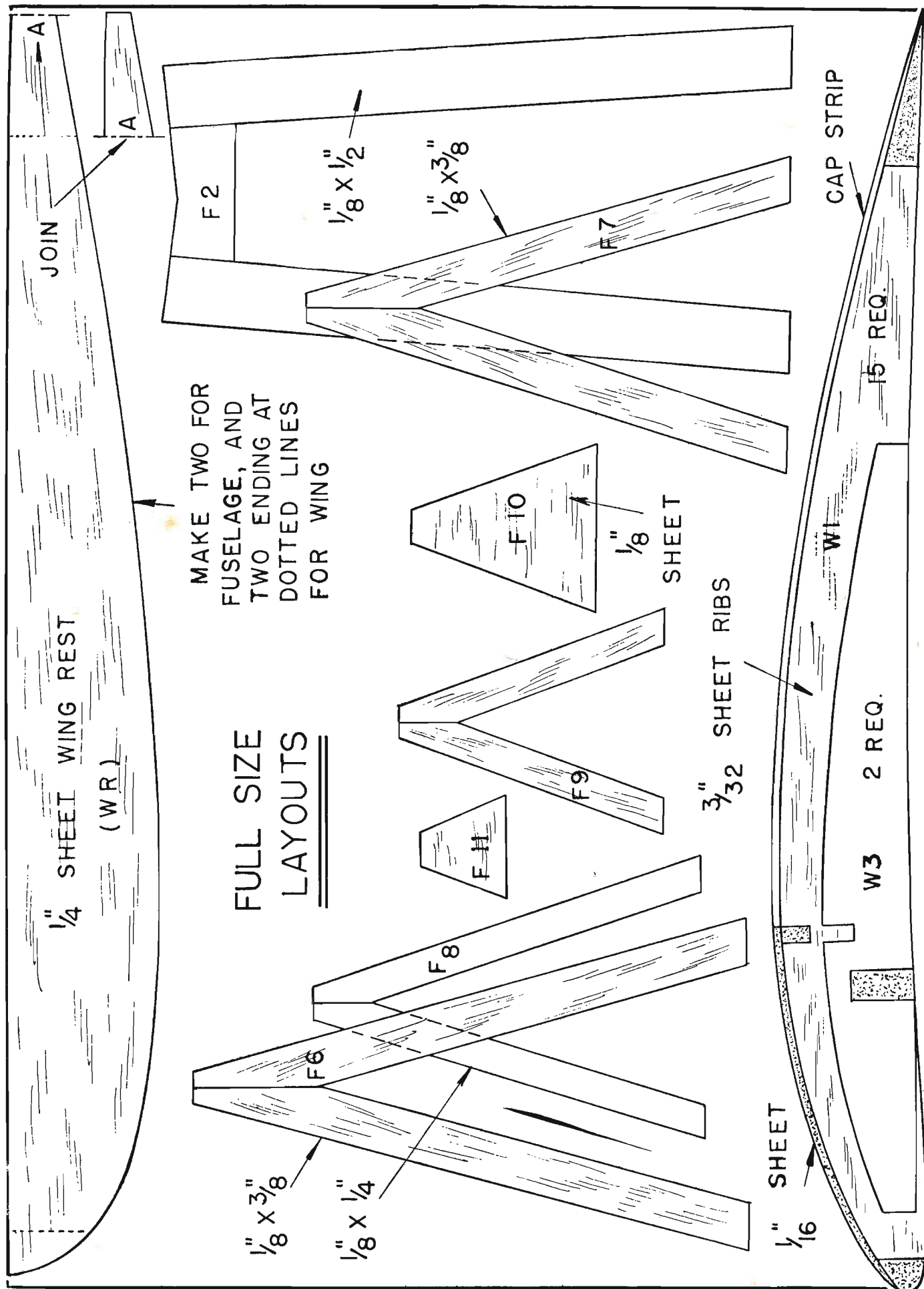
COWLING ATTACHED
TO FUSLAGE
WITH RUBBER
BANDS ON
HOOKS

COWLING



CROSS SECTION





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 crutch. 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 cowl 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 in number to the smaller squares of the cowl 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 cowl. Fit the block into the fuselage and cement lightly. After several hours of drying the cowl is ready to carve. After shaping and sanding the outside to shape remove the cowl and cut out the inside. Carve the cowl to approximately 5/16" thickness all around. The bottom block is made similarly except that it is cemented permanently in place.

Motor mounts are made of basswood and are bolted to the gumwood longerons. Mount the motor on the basswood mounts as shown. The coil is enclosed in a 1/8" sheet box and cemented in the bottom of the cowl. 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 cowl is on. Don't forget the reinforcement piece across the top of the cowl. 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 cowl 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 cowl 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.

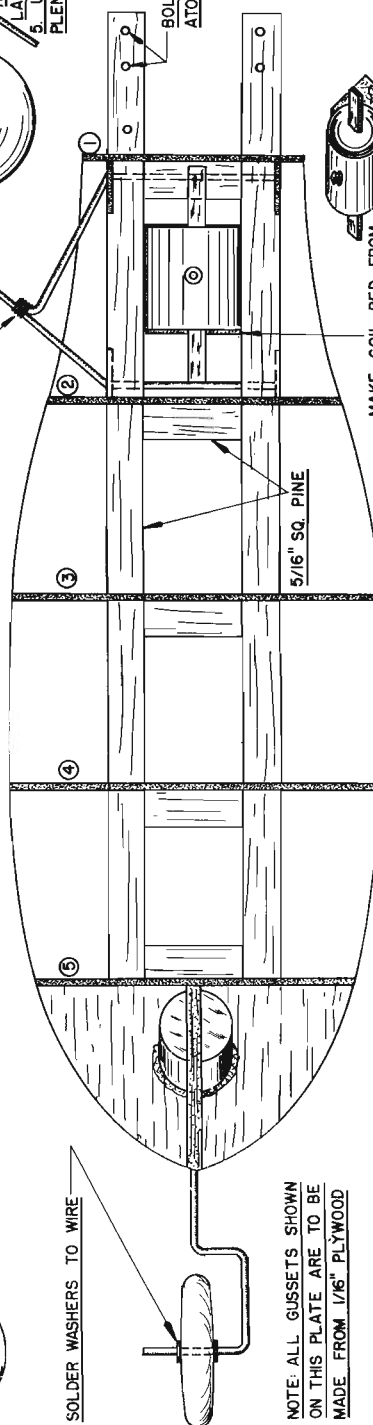
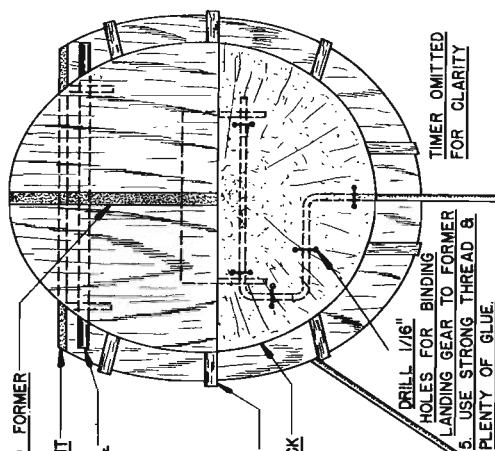
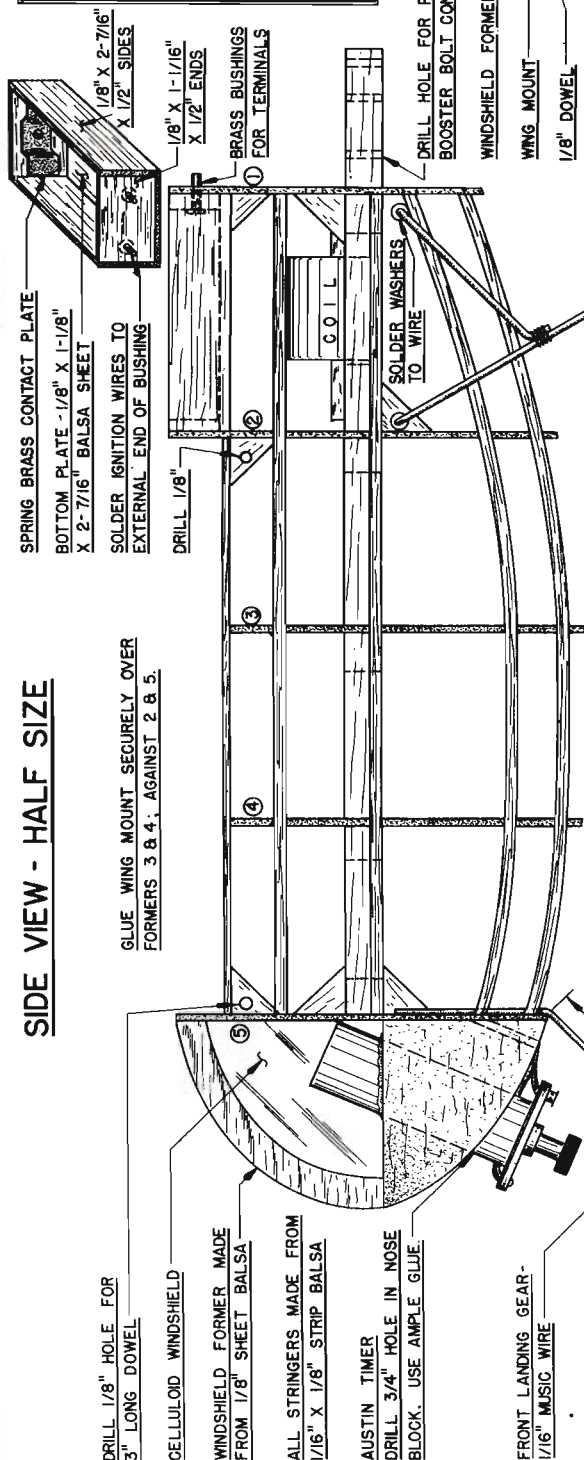
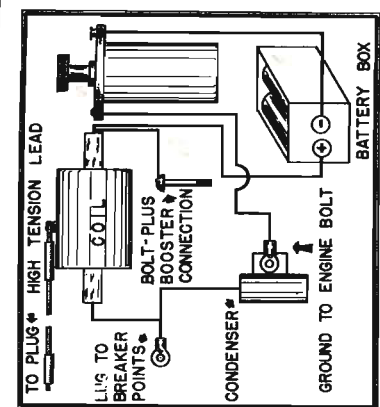
Flying

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



THE SAMBA

DESIGNED BY F. P. CONANT

WING SPAN — 42"

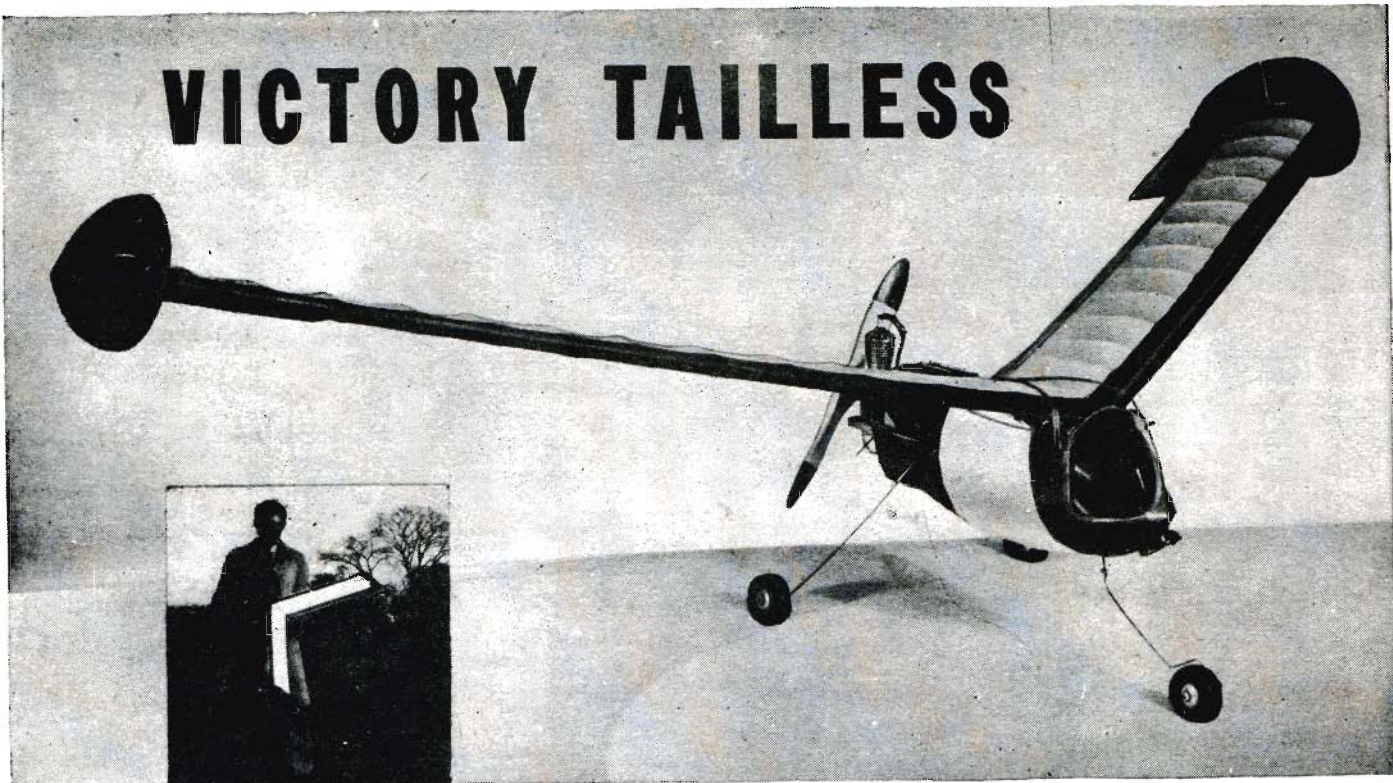
CHORD — 5-1/2"

AIRFOIL — RAF 32

ENGINE — ATOM

D.A.A.

VICTORY TAILLESS



The Samba—outstanding flying-wing gas model

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 dove 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

by **FRANCIS P. CONANT**

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.

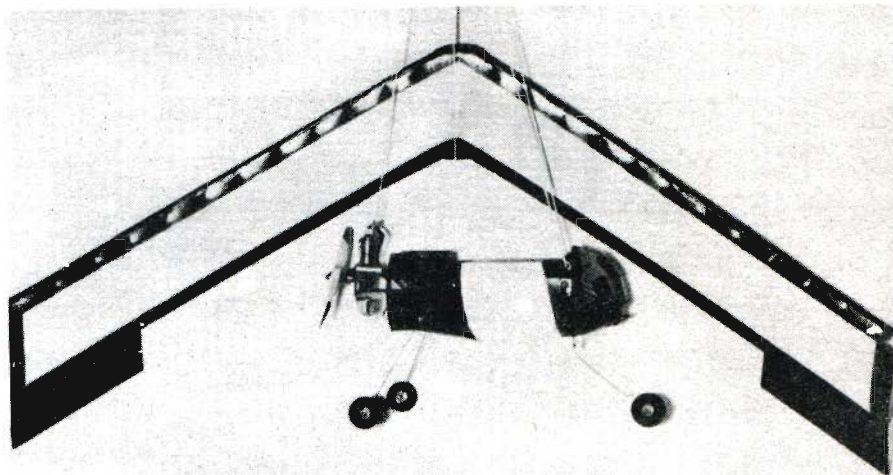
Make the battery box and solder the ignition wires to it; be sure to use enough wire to reach the timer and other parts of the ignition system. Now mount the coil as shown on the side and top views. Use

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 then 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-

Top The model ready to fly (*Inset*) Mr. Conant with his Samba. *Below* View showing body and detached wing



WING PLAN - 1/2 SIZE

Balsa fairing blocks glued to L.E.
& shaped to match former 5.

1/4" X 3/8" LEADING EDGE - SOFT BALSA

SPAR - 1/4" X 1/2"
ROCK HARD BALSA

COVER TOP & BOTTOM WITH 1/16"
BALSA AFTER JOINING PANELS

DIHEDRAL BRACE IS
MADE FROM BALSA
CUT TO MATCH
ANGLE OF SPARS

GUSSETS ARE
1/8" BALSA

PLATE WITH 1/32"
SHEET BALSA

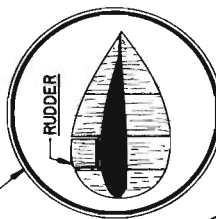
JOIN SECTIONS OF WING
PLAN ON THIS LINE

FAIR TE AND F2
WITH 1/16" BALSA

FORMER 2

1/8" X 1/2" TRAILING EDGE - STRIP BALSA

DETAIL



1/32" SHEET BALSA
TOP & BOTTOM

HINGES

RUDDER

DO NOT TAPER TE
FROM HERE TO TIP

ALUMINUM HINGES

ELEVATOR - MAKE ONE FOR EACH WING FROM 1/8" SHEET
TAPER FROM LEADING TO TRAILING EDGE

SIDE VIEW

(LANDING GEAR OMITTED)

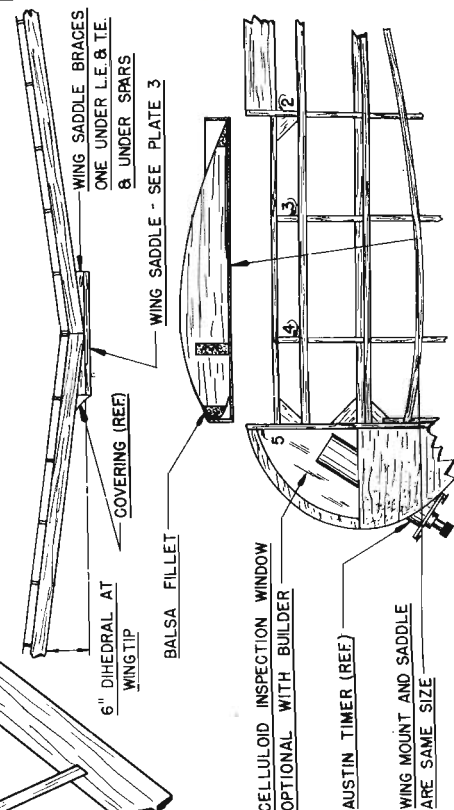
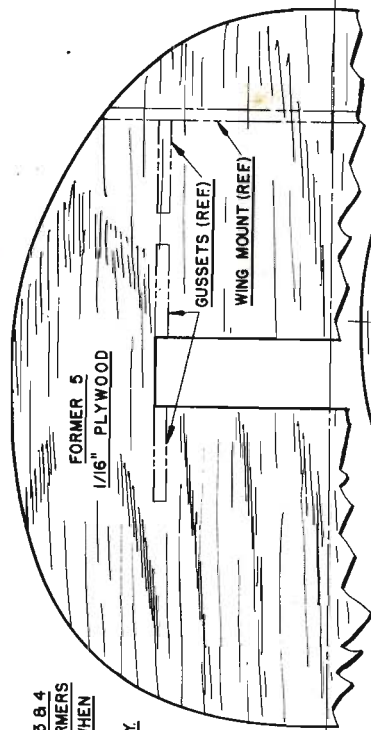
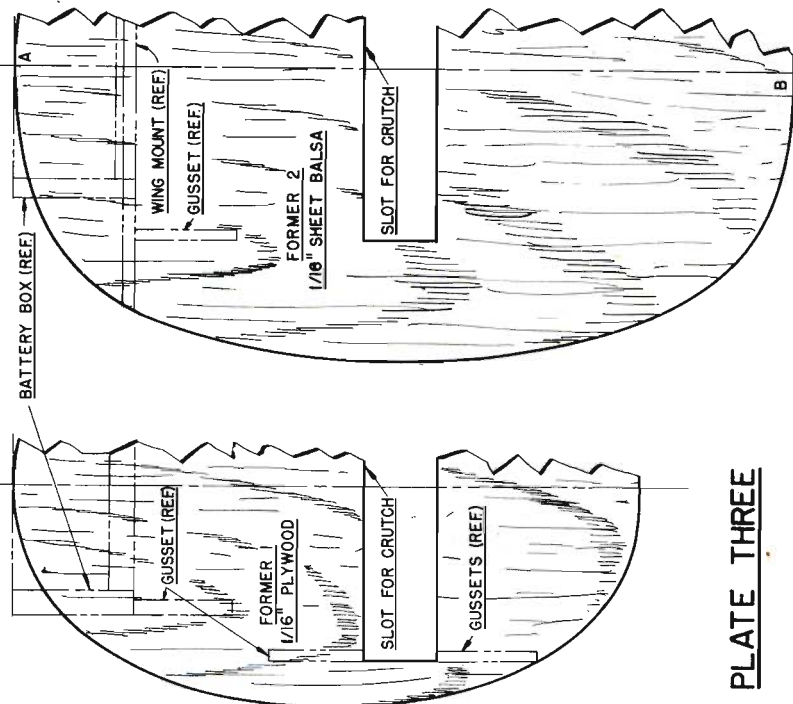
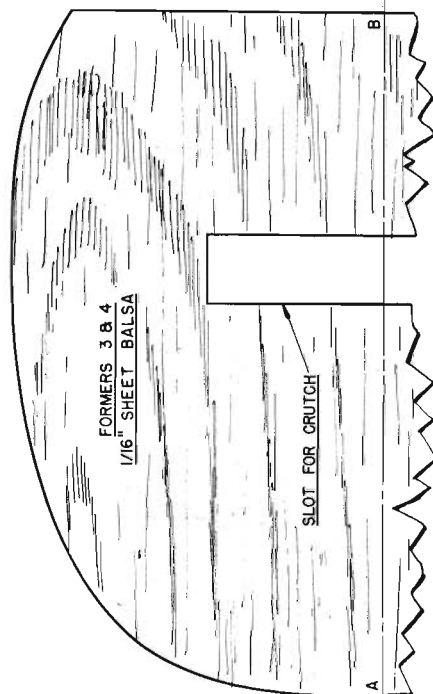


PLATE TWO

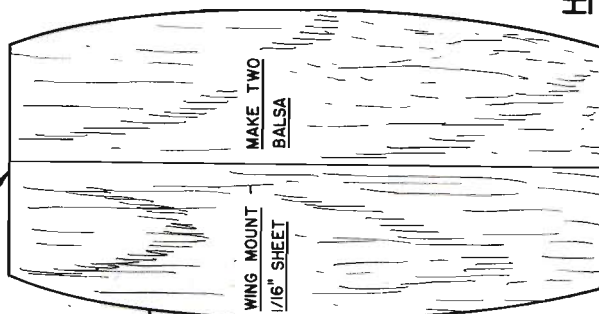
DAVID ANDERTON

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.

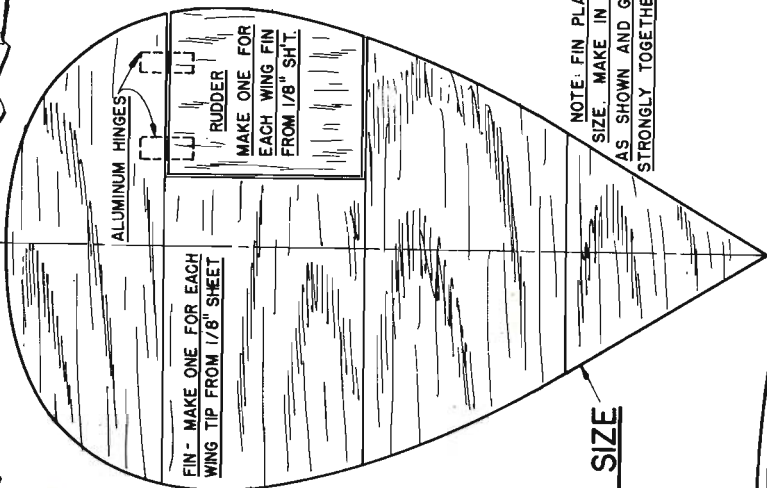
ALL FORMERS ARE FULL SIZE EXCEPT AS NOTED.



GLUE THIS END AGAINST FORMER 5.



HALF - SIZE



HALF SIZE

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

GLUE THIS END AGAINST FORMER 2 - SEE PLATE 1

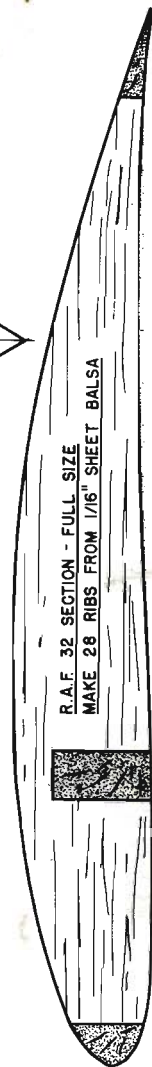


PLATE THREE

derneath 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 your guide. Now shape 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 both parts of the landing gear and solder them to the wires to they are 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 rather wait until the fuselage has been completely finished before attaching the wheels permanently.

Do not glue the 1/16" x 1/8" stringers in place before the ignition system and landing gears are completely finished and installed. Stringers are glued to the top of the formers—they are not notched. This prevents the covering from sticking 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 solder the high tension lead clip to 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 fuselage 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. Carve the trailing edge only up to the elevators, so 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. Elevators are made from one piece of balsa, if possible. If this 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 shave off the protruding parts. This will also have to be done to the spar. Now bring the panels together and jack up the tips 6". Coat the middle ribs of each panel with glue and then clamp together, thus firmly joining two wing halves. Allow to dry thoroughly. Now watch the two united middle ribs just behind the spar to permit the dihedral brace to be glued 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 centersection 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 adhesive 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 dope has dried 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 underneath 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 and keep a watchful eye to see 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 had a white band around the middle and a wide blue band at either side, with all three bands separated by a red stripe.

If your model is color-doped the interior beneath the windshield should be a dark color: the author used blue. The windshield former should also be painted before the windshield itself is mounted. Actual fitting of the windshield 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 "pusher 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 it as a testing ground; if not, the model must be launched for the first 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 gradually 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-

expectedly favorable. For those who wish to experiment, the author has found small, wooden blocks, placed under the engine, a convenient means of varying the thrust line.

If the builder gets as much fun out of building and flying the Samba as did the author, he will be well rewarded.

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.

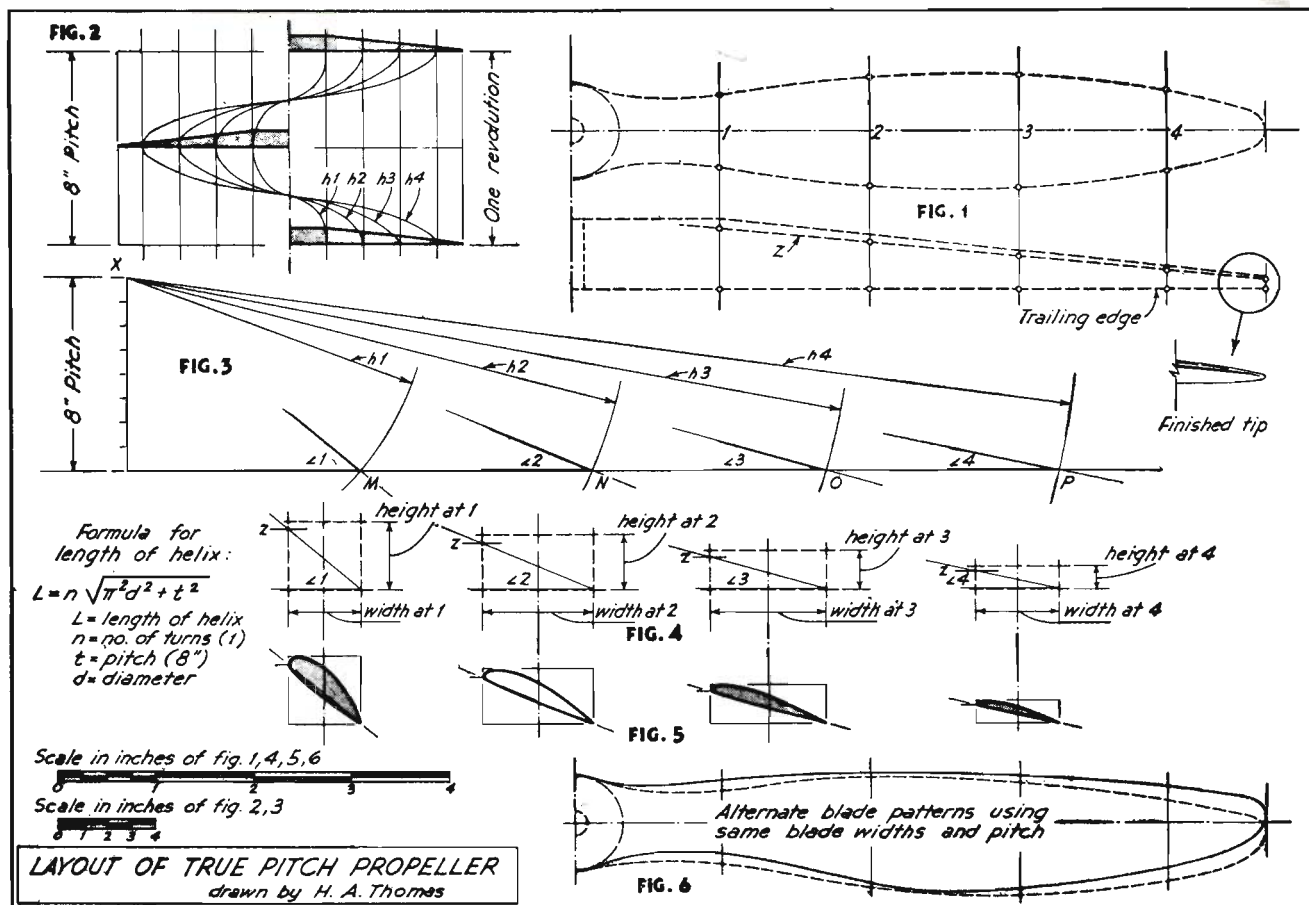
"True pitch" is a phrase that is freely used regarding propellers, many of which

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

A Practical Method of Creating Gas Model Propellers That Will Operate With Greatest Efficiency

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 - 14" DIA., 8" PITCH

Full size

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 these 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 $\angle 1$, $\angle 2$, $\angle 3$ and $\angle 4$.

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 tips 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.

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 those 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"

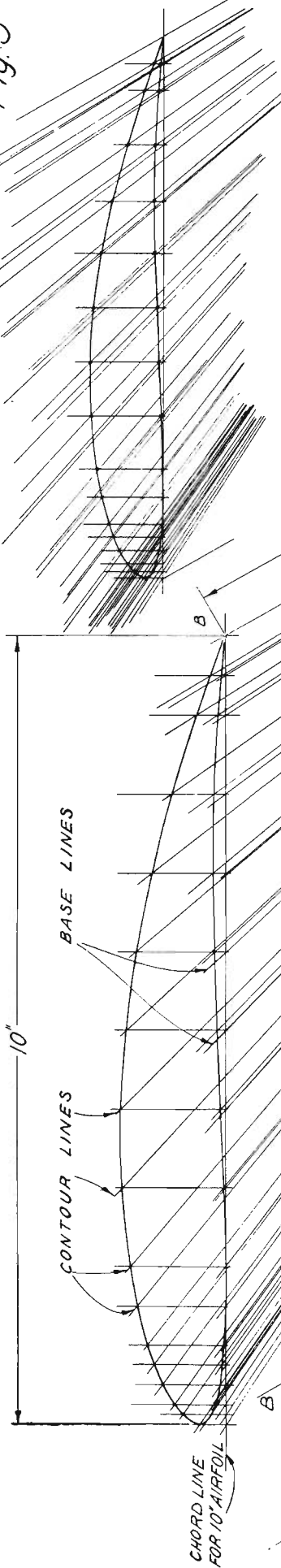
airfoil. Call these *base lines*. Then draw lines from A to the points of the airfoil itself. Call these *contour lines*. Also draw a horizontal line through A. That's all there is to the chart and it is ready to use.

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.

Fig. 3



%	UPR.	LWR
0	3.42	3.42
12.5	5.56	1.96
25	6.52	1.50
50	7.84	0.88
75	8.83	0.50
100	9.72	0.30
15	11.02	0.08
20	11.92	0.00
30	12.98	0.30
40	13.10	0.70
50	12.46	1.10
60	11.06	1.46
70	9.10	1.60
80	6.56	1.46
90	3.60	0.92
95	1.98	0.52
100	0.12	0.00

RAF. 32

ABOUT 12°

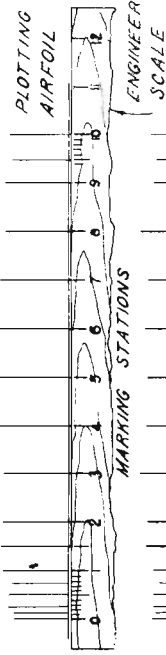
0% BASE LINE

CHART
Fig. 1

6 1/2"

0000

HOW TO DRAW LINE
PARALLEL TO AB



FOR 10" AIRFOIL
1% = 1/10
10% = 1"

PLOTING PTS.

DRAWING CURVE

Fig. 2

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've built lots of models that way ourselves; yet we're sort of glad that there are getting to be more and more Johnnies 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.

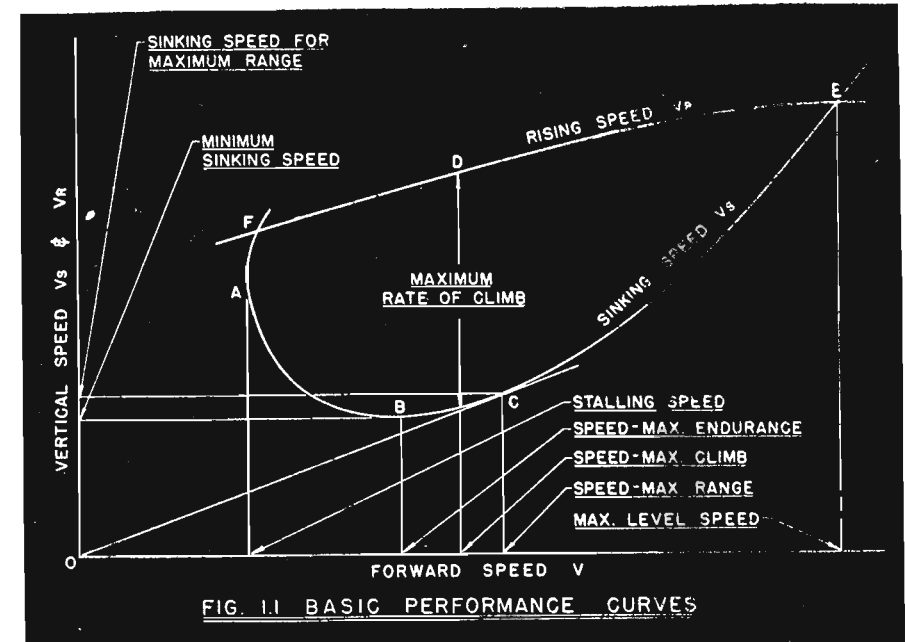
Bill isn't going to be much interested in our present series of articles, but if you're like Johnny you should get a big kick out of them for we're going to apply everything that modern aerodynamics has to offer in a big attempt to improve model design. Fortunately, it's possible to use easy-to-read 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 present 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 places¹ 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 source² 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 McBride² 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 Boston³ and at the same time the writer supervised tests on wings of various sizes, aspect ratio and airfoils⁴ 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 wrongly, 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 test!

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 writer⁵, only to find 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 filled reams of paper with an investigation (unpublished) of our fundamental problem—that is, the variation of flying 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.⁶ Unhappily, the Oswald and latter methods developed by Rockefeller and White and Martin⁶ (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 the 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 aerodynamic 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: Off-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 (V_s) 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 B 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 we locate 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 C also tells us the *maximum lift to drag ratio* itself which may be obtained by dividing the forward speed at point C 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 alti-

tude with any known rising air current by the simple equation:

$$1.1) \text{ maximum gliding endurance} = \frac{\text{altitude}}{\text{min. } V_s - \text{speed of rising air}}$$

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.

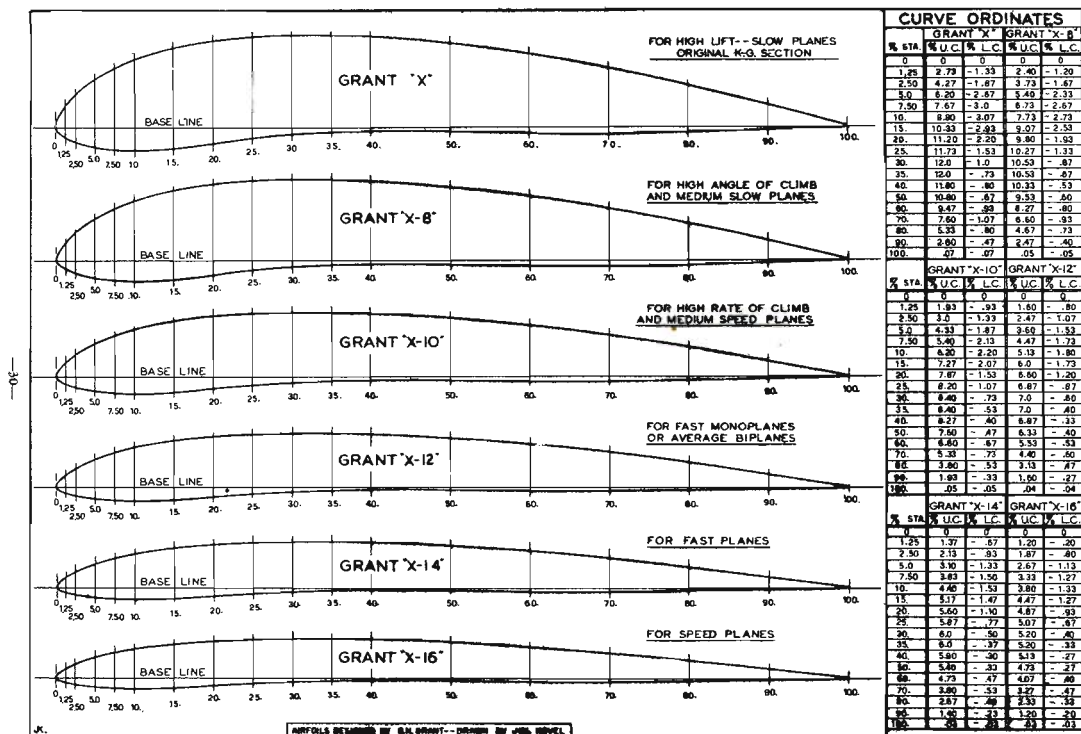
THE EFFECT OF ENGINE POWER ON A MODEL: Fortunately aeronautical engineers have invented a very clever dodge. Let's say, for example, that a particular engine puts out a certain amount of horsepower. By multiplying by a conversion factor (.550) we convert this horsepower to foot pounds of work per second. 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

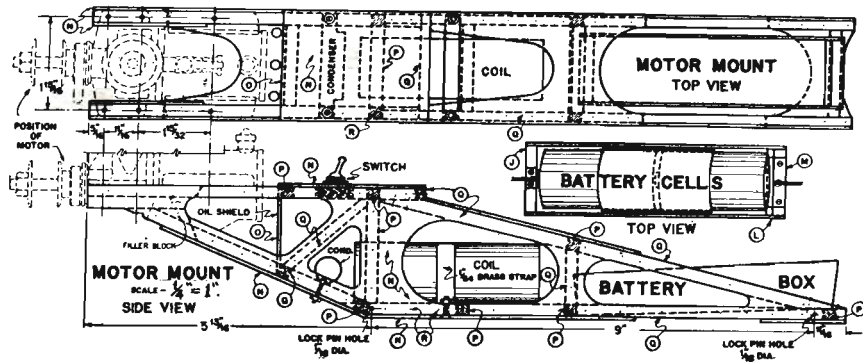
pounds per second output by the airplane's weight. With an actual airplane this is always somewhat optimistic as not all of the power can be used to raise the plane. In the first place, we must make allowance for power lost at the propeller, by introducing a *thrust horsepower* equal to the product of 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.,

$$\text{rising speed} = \frac{\text{engine HP} \times \text{Prop eff.} \times 550}{\text{weight in pounds}}$$

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:

Rate of climb—climbing speed (V_r)—sinking speed (V_s) 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* occurs 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 V_r is equal to V_s . 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

High Powered Ammunition

From an Expert That Will Enable You to "Shoot" Your Gas Motor Troubles

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.

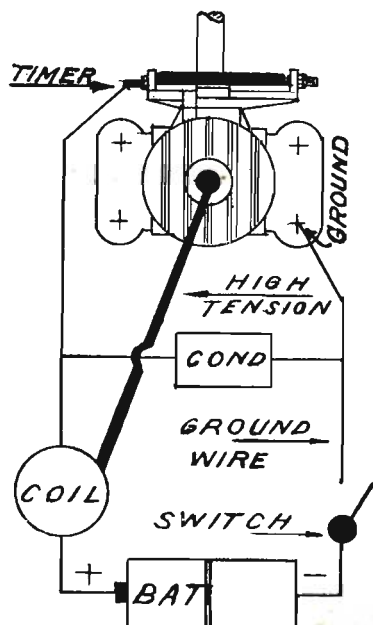
Now that that's off our chest, let's get down to business and do something about it. Let's make competition stiffer for each other so that there will be more scientific research going on than just guesswork.

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 leave 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



It takes a smooth running engine to give your plane altitude so it can glide like this one.

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 pressure 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



A balky motor on the take-off caused this. Look out, it may happen to your ship.

contributing to the successful operation of the two-cycle engine is probably the most neglected, and is most always left to the last minute. For instance **HOW MANY OF YOU BUILD BEAUTIFUL AIRPLANES, THEN GRAB ANYTHING THAT WILL SERVE AS WIRES?** Fellows then wonder why their motors will not function properly, but how can they if they use house fixture wire.

The first thing to do is to go to any radio supply store and purchase a few feet of stranded wire that is used for radio hook-ups, etc. This wire is ideally suited for our purpose. A good idea is to purchase wire of different colors. For instance, you can use red wire for the high tension wire which leads to the spark plug; yellow wire leading to the breaker points and green wire for the battery terminals and ground connections. In this way you can see with a glance the condition of the wiring without having to first untangle the wires to see what's what, and then you are not sure if everything is in its right place. For an added precaution radio spaghetti can be used for insulating your wire. This bit of added work is liable to save you plenty of trouble, so why not make it a feature in your wiring.

When you cut wires, cut them to correct lengths so that there will be no danger of tangling in case your model should have a rough landing, or when you turn over the model to empty the gasoline tank. In cutting your wires make sure that the ends do not become frayed. An easy way to prevent frayed ends is to sweat some solder over the ends, then get some shellac or dope and brush the insulation where it was cut. This will insure clean and tight connections. Avoid sharp kinks in the wires so that there will be no danger of broken wires. A switch should be provided between the ground wire so that you may be able to close the circuit when the plane is not being used. This little feature will save you plenty of trouble, in that it conserves your batteries, and most of all saves your coil from any possible break down.

Your spark plug should always be kept clean. A fouled plug will never give proper results so essential in the performance of your engine. A simple but efficient way for keeping your plugs clean is as follows: mix equal parts of ammonia and water. Let the spark plugs soak in the solution until the carbon flakes off. Never use sandpaper or other abrasive materials. They scratch the porcelain, thus making the spark plug easy 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.

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 quality 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. The author has found that a gasoline with an octane rating of about 79 will give the best results. If a higher octane gasoline is used in the motor, results will not be as good as you might expect. The faster burning gasoline will have a tendency to pre-ignite and your engine will have a noticeable pinging 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 so difficult to visualize what damage 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, whereas a good grade of SAE 60 or 70 oil with a paraffine base will not crack or burn under the high operating temperatures. It will also form a perfect lubricating film of oil on all the moving parts. Carbon deposits will be reduced to a minimum and the life of your engine will be increased tremendously.

The majority of the fellows follow the instructions which are given them by their engine manufacturers, but when they get on the contest field they become very careless with the gasoline. They either forget the instructions or become so excited thinking about the world's record that they may break, that the gasoline is just poured into the tank without care. When their engine refuses to run properly, they try to figure out what's wrong with it. This trouble could have been eliminated in the first place by straining the gas through a piece of cloth, or better yet they should have a little

funnel made with a piece of screen in the open end.

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 requirements that the engine 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 accumulation, then pour oil into the cylinder making 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 attacking 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, inspect 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 spill it over the engine wiping it dry. 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 starting, don't forget to put some oil in the cylinder, because when you put the pure gasoline 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 mount their engines and ignition system. 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 start. Some tie 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 put a clamp on all your future headaches? When you are ready to mount 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 a 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.

1. Weak batteries. (Test for amperage.)
2. Spark plug fouled. (Clean and adjust electrodes.)
3. Check contacts.
4. Check connections. Check if loose.

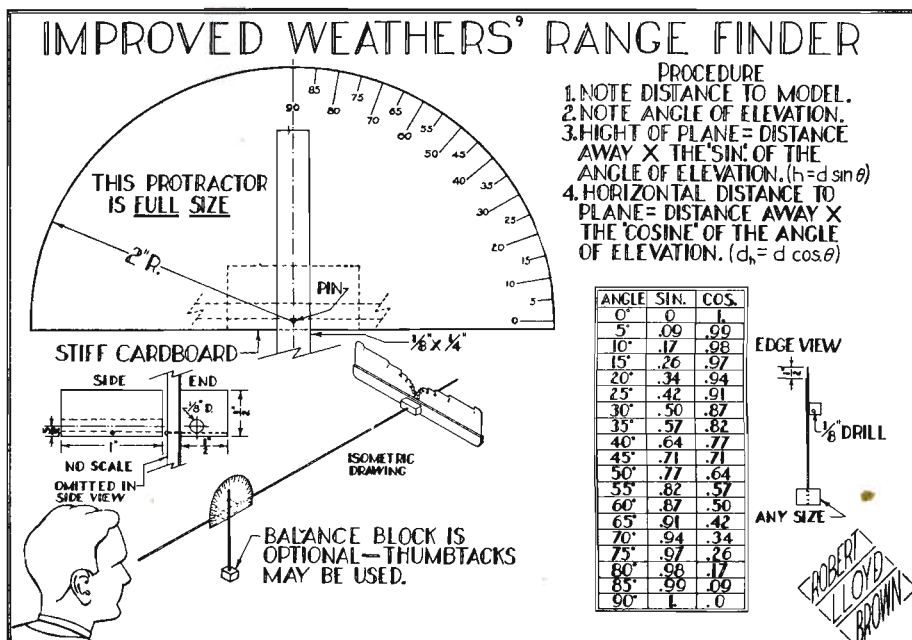
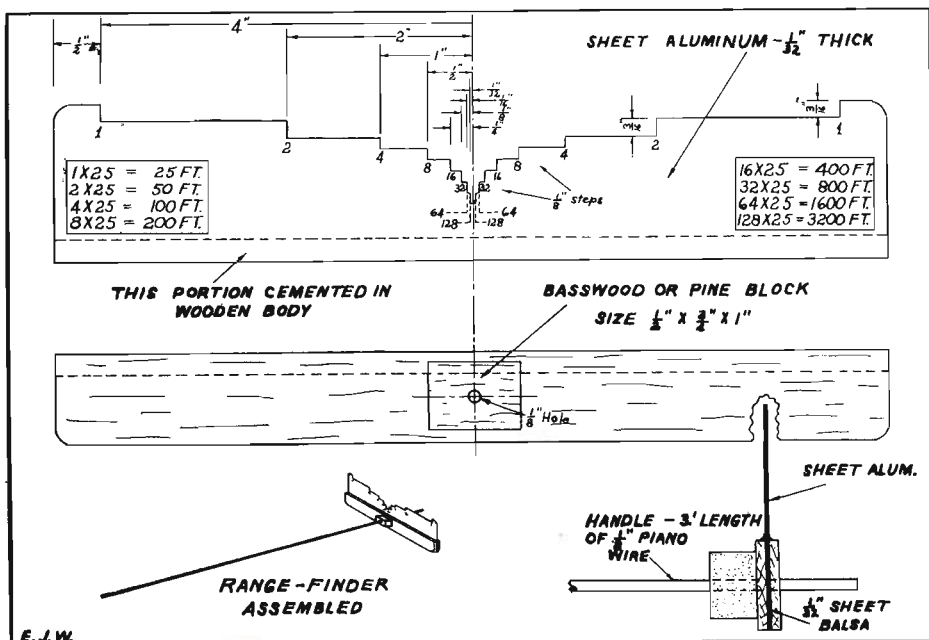
Analyzing Trouble

A. Short Fast Run.

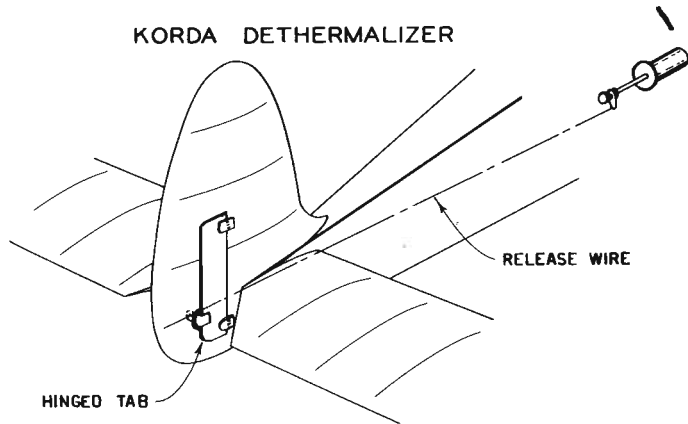
- Open needle for more gasoline. Check for loose connections and low batteries.
- Slow Running.
Too rich a mixture. Close needle. Test for good spark.
Motor has too much gas in crankcase. Flooded.

A Gas Model Range Finder

By ELBERT J. WEATHERS

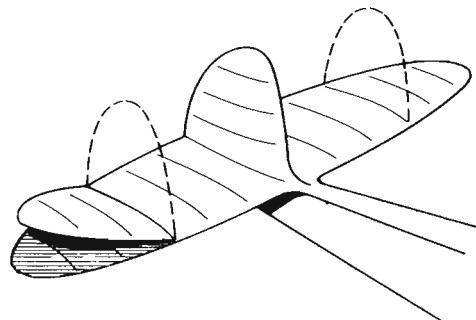


KORDA DETHERMALIZER



TIMER PULLS WIRE FORWARD, RELEASING TAB, WHICH IS PULLED TO THE RIGHT BY A FINE RUBBER BAND OR SPRING. ANGLE OF TAB IS 20° TO 40°, VARYING ACCORDING TO DEGREE OF SPIRAL DIVE DESIRED.

EHLING DETHERMALIZER



UNTIL TIMER PULLS RELEASE PINS, OUTER RUDDERS LIE FLAT ON TOP SURFACE OF STABILIZER. THEN THEY POP UP INTO VERTICAL POSITION. EXCESS RUDDER AREA CAUSES SHIP TO HEAD INTO WIND AND SLOWLY GLIDE BACK TOWARD FIELD

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.

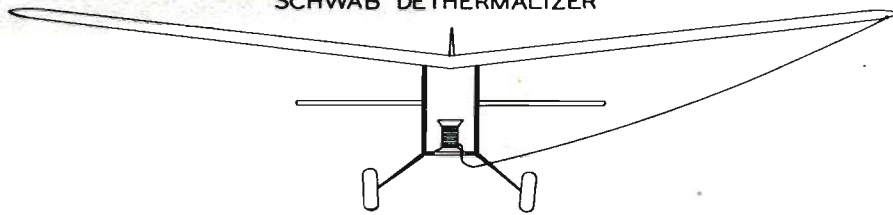
But in general, most modelers were pretty well occupied with the problems of getting their models and motors to perform with reasonable dependability. Instinctively they turned away from taking on a new and rather mysterious job; to put it is a nutshell, there were enough worries in getting the crate high enough to make a decent flight, on the skimpy 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-notch 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.

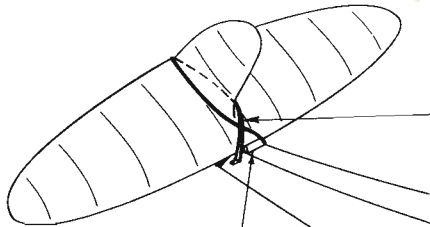
And now the controversy rose towards its full height. At first, many thought, "Of all the scatter-brained ideas—this takes the

SCHWAB DETHERMALIZER

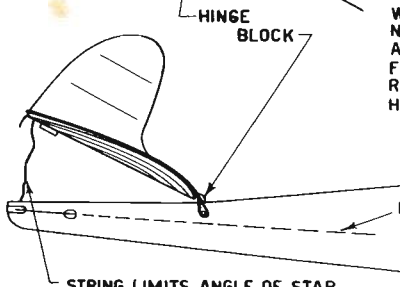


TIMER OPENS TRAPDOOR, DROPPING SPOOL OUT OF FUSELAGE. SPOOL UNWINDS, WEIGHT AND DRAG ON WINGTIP FORCING MODEL INTO SPIRAL DIVE FROM WHICH RECOVERY IS MADE WHEN SPOOL HITS GROUND

GOLDBERG DETHERMALIZER



RUBBER BAND HELPS PULL STABILIZER UPWARD; AUXILIARY SPRING MAY BE USED.

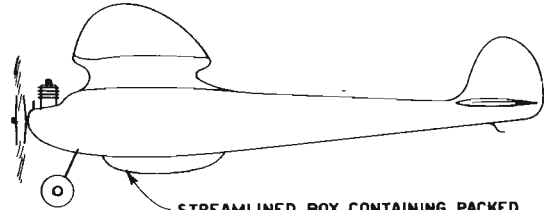


WHEN STABILIZER ASSUMES LARGE NEGATIVE ANGLE IT STALLS SHIP, AND HOLDS IT CONTINUOUSLY, FIRMLY IN THE STALL. MODEL SINKS RAPIDLY DOWN, REMAINING IN NEAR-HORIZONTAL ATTITUDE.

RELEASE WIRE TO TIMER

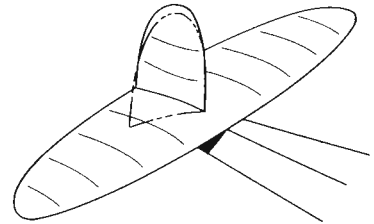
STRING LIMITS ANGLE OF STAB.

CHUTE DETHERMALIZER



STREAMLINED BOX CONTAINING PACKED CHUTE, EJECTION SPRING, AND TIMER. ATTACHED UNDER CENTER OF GRAVITY, WHOLE UNIT MAY BE TRANSFERRED FROM ONE SHIP TO ANOTHER.

HOW ABOUT THIS ?



IF THE RUDDER (EITHER ALL, OR MOST OF IT) IS SWUNG OVER ABOUT 60° TO THE LINE OF FLIGHT, WOULD IT PRODUCE THE SAFE, DESIRABLE, FLAT SPIN ?

cake." But others saw the true value of dethermalizers and began to fight for them. They could see that here lay our only worthwhile 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 maximum 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 unnecessarily 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 worthwhile 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

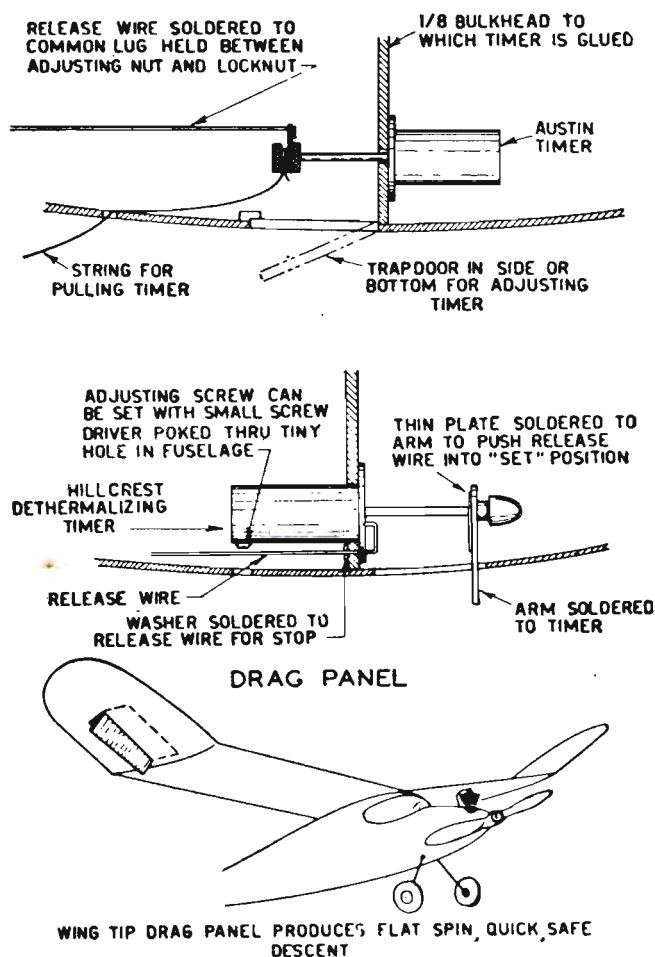
Association by much hard work was barely able to prevent harsh restrictions from being imposed on a national scale.)

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



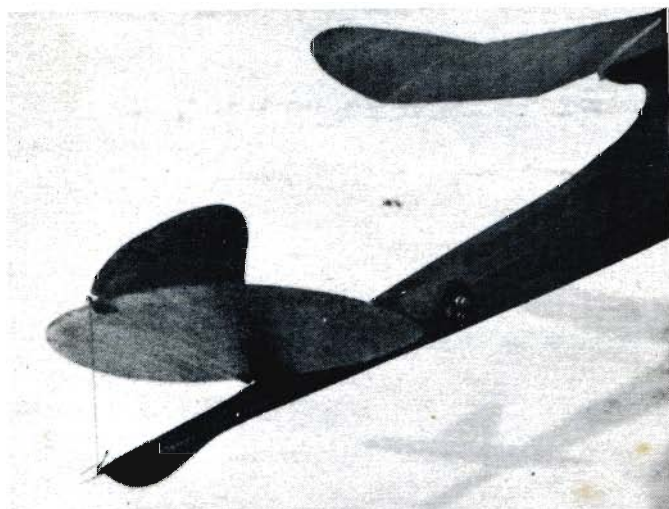
TYPICAL TIMER INSTALLATIONS



record-breaking activity and model losses in 1941, not much was needed to keep losses low in 1942. The war took care of it.

The great spurt of interest in aviation generally and in models, however, is a guarantee that before long a new crop of modelers will be advancing in the field of flying models, and looking for means to prevent out-of-sight flights. Altogether aside from contest flying, the use of a dethermalizer makes it practical to pleasure-fly all day long with full power and motor run on those beautiful hot summer days which in past years were the most dangerous because the powerful thermals would reach down almost to the ground to snatch away a ship cruising along on the most innocent test flight. So, let's take a look at some of the

A closeup of the tail stabilizer mechanism on Dave Kloepper's 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 spiral diving 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 from 150 feet 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 in a horizontal attitude. Burley built a compact little streamlined 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 center 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 Kloepper, 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 mount. His beautifully built ship 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 to be found, one in the model of Chester Lanzo, 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. Sometimes 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 fibres 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 Hershey Goldenberg, 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 sight of the model, although it 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° negative, 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 meets 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 has 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 fast 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 Ehling, 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!

One more method which may hold good possibilities is the idea of attempting to get a flat spin by turning the entire rudder, or perhaps just the larger portion of it, to an angle of 60° with the line of flight. Anyone experimenting with this proposal should report his results, whether good or bad, to the magazines so that the information can be quickly passed around.

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 a thermal 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, in just a moment now it will begin twisting its way down, down, down to safety and many more thrilling flights!

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