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HAROLD STEVENSON
Introduction

FLYING MODELS has for many years set the pace for informative material which has been of help to both beginner and expert. The highly popular “Data Sheets” can be considered one of these pace-setters and many a beginner found it easier to start in this fulfilling hobby because of them. This material also jogged the memories of experts who had drifted away from many usable techniques.

It’s the effort of this handbook to compress the maximum of usable information into one handy reference. To do this, we’ve taken material which has created the greatest interest in modelers over the years and “compartmented” it into this publication. We feel that this material has been refined down to its most usable form.

It is to no amazement that there is a recurring request for material of this nature. The hobby and sport of model plane building is constantly finding new recruits in search of material to get started. Also, many of the oldtimers are seeking sources to replace material and information which was lost or misplaced. Then, too, there is the group that missed out getting the material as originally published because supplies were exhausted by the time of their request.

We feel that this book will prove to be an excellent guide for clubs and schools with projects in model plane building. It should also serve to indicate how broad the field of modeling spreads, its complexities and solutions, its simplicities and pleasures.

The simple gauging of the man-hours that went into drawing all of the lines, lettering all of the panels and plans — not to mention the man-hours of thought that went into producing the Handy Hints — is too formidable to contemplate. What you find here is a condensation of many years of effort by many excellent model builders, designers and artists.

We hope you enjoy this publication and gain many time-saving knacks to make hobbying more pleasant. And, we suggest that you keep close tabs on this edition. It is a limited printing and will prove to be a scarcity as have the 5 previous Handbooks in this series.

The Editors

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We would like to dedicate this publication to two staunch modelers whose designs and efforts have done so much for model aviation — Paul Del Gatto and S. Calhoun Smith. Both have passed from the modeling scene but they have left their marks for the many that follow. Much of what you find in these pages was created and drawn by them and we feel that MODEL PLANE BUILDING FROM 'A' TO 'Z' is a fitting tribute.
PLANT SAVER

All plans are usually folded tightly or rolled as they come from the box. In order to smooth them out flat, to put them down on the building board, try this trick: Cut a small square of Scotch tape at each corner (and several along the edges if the plan is big). The tape reinforces the paper so that it will not tear when thumb tacks are inserted and the paper is stretched smooth. WÄRREN McCANDLES, Toledo, O.

NUT HOLDER

When mounting blind nuts on the rear of a firewall, for radial engine attachment, try holding the nuts in place with HO rail spikes. Several spikes and liberal coats of cement will anchor the nuts firmly. Works well on smaller engines but 1/2" and 3/8" work too much. TOM HUME, Monrovia, Calif.

TORQUE COMPENSATOR

Adaptable rubber trim, to counteract torque on a rubber model, usually results in too tight a glide turn when power is spent. To correct this, make this automatic trim control: The rear motor peg is fitted in slots and attaches to the rudder horn. As tension on rubber motor becomes less, the spring or rubber-loaded reducer returns to neutral. Experiment to find the proper reducer trimming setting for power on and power off conditions. CECIL P. LEWIS, Beaufort, N. C.

EASY GEAR-MOUNT

This is one especially suited to 1/4 A engine with slim noses. Instead of mounting the landing gear on firewall, bend it to fit around the fuselage and clamp it with rubber bands. Eye-dropper tanks can also be held in place under the bands. Small blocks will hold the gear in position. The gear can be removed for VTO flying or a heavy-duty wheel, on an interchangeable gear, for experimental use. HOWARD G. EVANSON, Minneapolis, Minn.

PLUG ATTACHMENT

If your booster-leads tangle with the propeller when you are starting that engine, try moving the attachment point back out the way, as shown here. Mount two bolts at some convenient spot and run wires to the engine. One wire should be grounded on the motor at the crankcase mounting lug, the other connects to the glow-plug top. A slip-on connector could also be used at the glow plug, with wires leading to bolts for the alligator-clip booster connection. A two-prong plug and socket could be fitted into the fuselage side. DANNY RHODIS, Fremont, Ind.

QUICKIE FUSELAGE

A plastic beam shooter tube, obtainable in 5x10's, makes a good H/L glider fuselage. Add a plug in the nose, a wood pylon, and plastic beam shooter tube prop and rubber to make simple rubber model. Plastic cement may have to be used for adhesion to the plastic tube. Reinforce wing and tail joints with gauze or paper. HARRY MEYKINS, North East, Md.

Laminted Rubber Props

When a prop blank or block of the desired size is unobtainable, try this method on your next fan. It is similar to that used for full-scale light-plane propellers. Cut strips of 1/4" sheet balsa about 1/2" wide to the desired length. Cement them together as shown, spreading slightly fancy. Carve and sand to shape. Vary the thickness and width of the strips according to the size of the propeller needed. Cut the strips extra wide so that there will be plenty of wood to work with. Cement lines will aid in proper contouring. JAMES HARRIS, Chicago, Ill.

Tank Testing

Most modelers go about testing a fuel tank by plugging up the two breather tubes, attaching a small pump to the filler tube, putting the bottle works underneath six inches of cold water, and then pushing up and down on the football pump and looking for air bubbles. This is an old reliable method, and it always works, but it is not so handy when a leak develops on the flying field. So try this method of finding a leak in a fuel tank: Take some excess neoprene tubing, about 4" or 5", and attach one end to a breather tube on the tank that is to be tested, and then attach the other end of the tubing to the remaining breather tube. Now take the neoprene tubing on the end of the fuel pump nozzle and attach this to the filler tube on the tank. Start pumping until the tank is full of fuel—then keep right on pumping. If there is a leak, you will notice fuel coming out of the leak, along with a lot of air bubbles. If there is no leak in the tank, there is not enough pressure generated in most fuel pumps to cause any disastrous results. KENNETH SCOTT, Bellows, Wis.

Rubber-Model Prop Saver

Balboa rubber-model propellers take a beating along the leading edges. Try this link to make the props more durable: Coat the leading edges with a couple of layers of cement. On large props, a strip of silk or paper can also be added. Set in cement. LEROY WILLIAMS, Perryville, Ark.
**HINTS**

**PLYWOOD STOOGIE**

Here is a handy helper that can be made from scrap plywood or thin lumber. The base has two pieces of wood nailed in place vertically with space between them for the tailskid and tail-wheel of a model. One nail is fixed, the other one movable to release skid. Fish-line to center of circle pulls the release nail. One release nail may be used if the skid is bent with an eye in end. RAY BURNS, WILTON, Mt. Brydges, Ont.

**NOSE GUARD**

H/L glider noses really take a beating and soon get split and frayed. Slip a rubber pencil eraser over the nose and let the rubber do the brushing.

**ACCESSORY KIT**

If you need a kit to carry tools, props, fuel and batteries to the flying field, here is an inexpensive idea: Obtain a 5 gallon oil can and cut off the bottom, leaving the sides 6" to 9" high. Cut each corner down about 1" and then fold edge over inwards so there will be no exposed sharp edges. Rivet or bolt a belt or strap across top for a carrying handle. Put in plywood partitions as required. WESLEY GLISSON, Titusville, Fla.

**FINGER SAVERS**

When using double-edged razor blades for cutting balas, protect your fingers with this handy wrinkle. Tear off the stricker end of a paper match book and then slide razor blade between the match cardboards and up against the staple. This will avoid quite a few nicks in the fingers. CHARLES KELLOGG, JR, West Newton, Mass.

**Plug-In Booster Leads**

If you use a field box to keep your fuel, props and booster batteries handy to your model, this trick will help you. Mount your booster batteries inside the box and run leads to a socket mounted on the side of the box. Attach a plug to one end of your booster leads and alligator or Kwik-clip to the other end. Booster leads can then be plugged in to use, and unplugged, rolled up, and put in box when not in use, thus preventing possibility of shorting out. If available use small plug and socket of the type used for R/C models. MURRAY HEARD, Lima, Peru.

**Profile Cockpit Canopy**

To help dress up your solid plank profile model, make a cockpit canopy as shown. Cut out the center of this solid wood canopy and then cement clear plastic on each side. Put in a silhouette pilot's head if desired. ARTIE WIESE, Bay Shore, N. Y.

**NO-SHORT BOOSTER LEADS**

Booster battery leads with alligator clip ends often touch when dropped after starting an engine. To keep the clips from touching, shorting and draining the battery, twist about a 4" or 5" length of 1/4" diameter coil spring onto the leads and wrap with electrical tape. Spring will keep clips apart when not in use, but is flexible enough so that clips can be put on the engine easily. BILLY CENTNER, Westport, Conn.

**FUEL-LINE GUIDE**

Screw-eye stoppers from cement tubes can be used to hold down floppy fuel lines leading from tank to engine on profile models. Drill a small pilot hole in fuselage side at the desired location. Screw eye into place, and thread the fuel line through the eye. It will keep the fuel line away from engine heat. WAYNE BROWN, Drumheller, Alberta, Canada.
Hi-Fly Glide Test

Ever wished for some method of glide-testing your models at a higher altitude, to determine necessary adjustments before trying a powered flight? This kite-launch system really works well. The kite has a small slide-tied to its tail. The model-kite is hooked onto the timer, the timer is set for about one minute, and the kite and model are sent aloft. When the timer releases the model, it can make a prolonged glide down, giving the builder plenty of time to watch glide performances.

Tests have shown that an ordinary 2'-kite will lift a light 30° 1 3/4' model in a 14 m.p.h. wind. But this amount of wind is undesirable for most testing, so you need a larger kite to lift more in less wind. Remember that increasing the size twice increases the area by four. A 50° newspaper-covered kite.

Tank Anchor

Here's a successful fuel-tank mounting for your profile trainer, stunt or combat ship.

Place the tank in position on the side of the nose and mark its outline on the side with pencil. Then, cement strips of rubber bands around the fuel tank and fuse:

Grind or File to Point

RUBBER BANDS

4" square wood around the outline, as shown, to form a shallow slot for the tank side. Slip a few husky rubber bands around the fuel tank and fuse:

TOWED A 1/4 FREE-FIGHT MODEL IN A 9 M.P.H. WIND

When flying in a strong wind, use a long thin tail. In a light wind, when no tail is needed, tie the timer to the end of a piece of string running at least 10' from the kite, to prevent the model from swaying and upsetting the kite.

Plumber's Helper

When neoprene tubing on vent pipes pulls away from short vents on models, you can locate and wrap tightly with copper wire to hold blade firmly. Re-wipe when blade is replaced—R. WOODSON, JR., Roxbury, Mass.

Speed Wings

Strong, easily built wings for your speed job can be turned out using the procedure shown. Lay out basswood leading and trailing edges, add ribs and tips, and cement dry thoroughly.

Cement-Proothing Plans

Being caught short without any waxed paper when some important building is in progress need not make things difficult. Lay the plans out on your workboard and get an ordinary candle. Light it and, holding it on its side, allow the wax to melt and drip off onto the paper. Dip only onto the junctions of the structure pieces, where cement is liable to overflow. While still soft, spread the wax puddles out with your finger or wait until it cools and then scrape the flat with a knife, so that the surface will be smooth to build over.—M. KRIM, Bronx, N. Y.
Wheel Retainers
Robbing the kid brother’s Erector set may stir up a family fight, but some of the small hardware comes in handy in the model workshop. The U-shaped shaft collars with set screws, for example, can be used for wheel retainers. Simply tighten the set screw down on the axle end.—DAVID ARTHUR, Jackson, Ohio.

Baby Engine Tanks
Small fuel tanks for Class ¢A engines can be made easily from bottle or fuel-can caps. First, remove the paper liner, then cut a sheet of tin slightly larger than the lid size and solder it directly to the bead on the lid. Or, join two lids at the bead with open ends facing each other. Solder the fuel and filter lines into the caps before joining. Solder on lugs as needed.—DON MANSMANN, Pittsburgh, Pa.

Decal Patterns
A good stencil guide for the modeler who likes to make his own numeral and letter decals can be found in any five and ten cent store. Lay the guide over a decal sheet and trace the outline the hardwood. Thrust adjustments can be made by enlarging the holes in the strap for the wood screws and sliding the strap to adjust.—JOHN KIDWELL, Dinuba, Calif.

Free-Flight Finder
If you are flying where conditions are hilly, with tall grass, or where the corn is tall, you may be able to use this idea for locating that wandering free-flight model.
Attach a smoke bomb (type used in control-line) to your model with some dethermalizer fuse attached to the bomb fuse. Use as long a D-T fuse as needed. Then, when the model gets down and the bomb fires off, the smoke will be visible for a good distance. (Check with your hobby dealer to see whether local laws permit you to use smoke bombs).—JIM JANSEN, Manitowoc, Wisconsin.

Primer Can
The new Ronson lighter-fuel can with the switch spout makes an inexpensive, pocket-size, fuel and primer can for ¼ tank. The switch spout is open when straight up and closed when moved to either side. Made of fuel-proof plastic, it can be pried off with a screwdriver for refilling the can with fuel.—GEORGE WEHRFRIEDT, Jacksonville, Fla.

Trailing Edge Clamp
A sheet trailing edge presents a cementing problem since it is difficult to apply pressure to the joint along its entire length. The clamp shown will solve the problem and insure smooth sheet trailing edge construction. Rip slots in a length of scrap pine with a table saw at the approximate angle of the trailing edge. Vaper the rear edges of trailing edge sheets, cement together, and add the clamp tapping it lightly into place. Cemented trailing edge sheets can be put on the rib now or let dry. Wax the inside edges of clamp to prevent excess cement sticking to it. VERNON H. VAN DIVER JR., Woolford, Md.

Jetex Fun
A real jet-powered bomb can be made from a Jim Walker 10' glider, Interceptor or Hornet. Mount a Jetex 35 or 50 engine under the balance point or on the fuselage top if desirable. Cement tail pieces permanently in place so the jet blast won’t dislodge them. Then let ‘er rip. DOUGLAS HILL, Denver, Colo.
**HINTS**

**Glow-Plug Clips**
If your booster clips keep sliding off your glow-plug top and shorting out against the cylinder head, simply file a notch in the jaws of the clip, large enough to fit over the glow-plug top, as illustrated.—KROME BOWEN, Gainesville, Florida.

**Balsa Stripper**
An easily constructed stripper can be made as shown. Cement two blocks of thick sheet together to form an angle. Imbed a razor blade in the lower block at the desired distance from the vertical block. Allow only a corner of the razor to extend upward and have it slant into the block.

Use heavy blades, such as an Injector, or single-edged blades with the backs off. A couple of nails driven through the side of the block behind the blade will hold it firmly in place.

To use the stripper, simply push sheet stock against the blade, with the edge snug against the vertical block. Hold the sheet flat on the lower block for a smooth cut. Mind those fingers, too.—JAMES SCOTT, Quebec, Canada.

**Forming Sheet Wings**
Getting a constant airfoil section on solid model or glider wings has always been a problem, but this sending block will do a neat job. Carve the block to the desired airfoil shape and then sand away. A little rough carving on the wing will shorten the labor.—LAWRENCE RODRIGUE, Kamloops, B.C.

**Lead Salvage**
Rubber and twine model builders should welcome this suggestion: Instead of cutting up good solder for ballast, try reclaiming the lead in your used cement tubes. When the tube is used up, flatten it with a hammer and roll it tightly. Cut off the clip and spout ends to make a smooth roll. These weights can be trimmed with shears or a knife to the required size.—GLENN GESELL, Worcester, Mass.

**Pop-Off Wing Tie-Down**
Usually modellers can think of many ways for holding the wings tightly onto a free-flight model. But what about those wing-low landings and spirals?

The idea shown here will get the wing off the fuselage with a minimum of damage. Simply cock the front tie-down dowel up slightly so that the rubber will slide forward and off with ease. Tension will hold the rubber in place under normal flying conditions.—GORDON WARD, York, Pa.

**Substitute Thinner**
If your hobby dealer happens to be sold out of thinner, you can substitute lacquer thinner sold at body shape, hardware and paint stores. You won't be able to buy as small a quantity as is sold in hobby stores, but the investment will keep you in thinner for a long time. A word of warning, though: fuel-proof dopes do not mix with lacquer thinners. Butylate dope thinners, obtainable at airport supply shops, will do the job however.—BOB KOPSKY, Freeport, Pa.

**Glider Adjustments**
Fine adjustments on hand-launched gliders can be made with these trim tabs. Simply cut out portions of the control surface to form the tabs and hold in place with a length of Scotch tape. Make good cure cuts so that the tabs will bind slightly and therefore hold the adjustments.—ROBERT HAN- DALL, Greenfield, Mass.
Model Tie-Down

Ever been out on the flying field on a windy day and had your model flipped over and damaged? Well, this is a sure fire preventive. Take two coat hangers and bend as shown. Cover coat hanger bent and wrapped with tape.

Flying-Wire Ends

To make a strong loop in the ends of control-line flying wires, add a shoe eye or similar eylet. Pass the wire around the eye twice and double-wrap for a strong loop. Don't rob a new pair of shoes for the eyes or Poppa's shoes!—JAMES C. LITTLE, Tiskilwa, Illinois.

Finger Protection

Knuckle busting seems to be a definite part of starting model engines, but you can protect those tender digits by wearing a three-fingered archer's glove as shown. This glove is made of heavy leather and is obtainable wherever archery equipment is sold. J. PAUL MAY JR., East Aurora, N. Y.

Tow-Line Tricks

The rubber-powered flying-SCALE model has always been a popular favorite across the pond, and from England comes this trick for getting longer flights from this type of ship: Rig a hook for a towline on the underside of the model. Mount a brass tube in the nose close to the propeller to hold a wire pin, which extends forward across a propeller blade. Attach a slack line to the pin from the towline so that, when the towline is pulled loose, the pin also will pull loose and release the propeller. This will enable the power to the vertical face for the front crankcase-cover mounting screws and the crankshaft bearing. The horizontal face of the angle is drilled and bolted or screwed directly to the fuselage bottom. If desired, the mounting legs can be sawed and filed off the sides of the engine to make the narrowest silhouette possible. Use machine screws slightly longer than standard for mounting the front crankcase cover and the dural mount, to allow for the thickness of the added metal.—ALAN GILKINSON, Rochester, Minn.

Can Holder

When the fuel can keeps tipping over in the grass or on rough ground, try this wrinkle:

Bend a piece of sheet tin into the shape shown and solder a large spike into the bottom. Push the holder spikes into the ground and drop the fuel can into it. This will keep the pump spout from collecting dirt.—ROBERT AREHART, Gary, Ind.

No More Shorts

The old problem of preventing booster clips from short-circuiting is solved by this method:

Slip a length of rubber tubing over one alligator clip. Cut the tubing long enough to completely cover the clip and make sure you get a snug fit. Use this clip for attachment to the glow plug—it's easy to open the jaws far enough. Cover the battery terminals with friction tape so the clips cannot short out there.—HERB WATSON, Terre Haute, Ind.
**HANDY HINTS**

**Fire Starter**
To help light Jetex fuse or desalterizer fuse, cement a match head to the working end. When ready to use match head with flame from another match, there will be plenty of heat to ignite fuse.

A good method for making desalterizer fuse is to soak mason string or similar absorbent rope in solution of one part saltpetre to three parts of water for about 15 minutes. Let the string dry thoroughly before using it. PALTINERI ARZEO VDO Jr, Silverton, Penna.

**Lead Out Ends**
Steel steel wire leadouts on your control-line should have the ends fixed as shown. This is essentially a safety pin type clip and is easily fastened or unfastened to attach or remove flying lines. TERRY HABER, Brooklyn, N. Y.

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**Clean Jig-Saw Cuts**
When cutting 3/4" or thicker balsa with a powered or hand jig-saw, the saw blade sometimes has a tendency to wander as it goes through different wood density and grain.
To smooth out the cuts, try this: Cut the wood with a sharp knife before making a jig-saw cut. The cut need only be about 3/8" deep. This cut then serves as a guide for the saw blade. Make the knife cut with a straight edge where possible and by hand on curved lines—S. C. SMITH, JR., Red Bank, N. J.

**Boat Stand**
Model boats usually spend more time on their stands than in the water. To prevent marring the bottom finish and denting the wood while transporting the boat in your car, cover the portion of the stand touching the boat with a good layer of padding. This can be of various materials. Felt weather stripping is good. Sponge rubber is good if covered with cloth (rubber gets gummy as it ages). Or, a strip of cotton covered with soft cloth can be tacked in place—ROBERT LAHAS, Glendale, N. Y.

**Landing Gear Mount**
Here's an inexpensive way to fasten landing gear wire to a plywood firewall or bulkhead. Slide cotter pins onto the bent wire and drill the firewall as shown. Push the cotter pins through holes, put washers over the pins and bend the ends outward. Tighten with a hammer to tighten. Cut off excess ends of cotter pin, and cement in place on the model. C. N. ELPHICK, Maitland, N. S. W., Australia.

**Soft Sanding Block**
To sand curved surfaces smoothly, try wrapping sandpaper around a piece of cellulose sponge. The sponge will bend to conform to the curve of the surface. PHIL COBURN, Detroit, Mich.

**C/L Handle Marker**
In order to prevent mix ups when picking up the control handle, simply paint the up half of the handle green and the down half red. TOM BALUCH, Fontana, Calif.

**Line Guides**
Solder a washer to the head of a bolt to make this simple line guide. Attach it to built-up wings by bolting it to a spar or double rib. Drill holes for the bolt in a solid wing and fasten the guide with nuts and washers. TOM SHAFER, Fremont, O.

**Hidden Swivels**
Why not put swivels permanently into a control system inside the wing? Attach the swivels to leadouts between the two outer ribs and add short leadouts extending out of the wing tip. This will save a bit of drag. KEVIN J. LIERSCHE, Victoria, Australia.

**Tank Cover**
When you install that eyedropper tank on your 1/4A model, don't throw away the rubber bulb. Use the bulb as a cover to keep dust and dirt out of the tank when the model is not being used. RANDY KLEINERT, Norton, Connecticut.
HANDY HINTS

Revised Tail Assembly
I recently built a Jasco "Streak" and since then have had many flights. However, with the single strut landing gear I used, takeoffs were pretty tricky. To remedy this I cut off the balsa tip, added a 1/16" sheet balsa rudder tip plate, and at the same time decreased the main rudder area about 15%. Performance proved equally as good, and chances of ground looping on take-off were eliminated.—FRANK NEELY, Chicago, Illinois.

Side Tow Tip
Though Enterprise’s "Towline Ter-"...
Bottle Holder
To keep your dope bottle from wandering around or tipping over on your workbench, try this simple gadget:

Take a length of Stretch or masking tape, fold ends over, and thumb-tack or tape it to your bench, sticky side up. Then place your dope bottle on the sticky area to hold it in position. -LINWOOD CATLIN, Pinetta, Va.

Prop Rack
To store spare props out of the way at your workbench, use a pegboard and mount it on a wall or shelf. Drive lengths of wire or dowel in the board for the various sizes props you use. A glance at the board will let you know when your supply is low for any particular size. -R. E. GRAHAM, West Palm Beach, Fl.

Storing Dope & Rubber
Here are a couple of useful ideas for keeping model supplies in tidy shape: If stored upside down when not in use, bottled or canned cement and dope will not evaporate and harden to any degree. Model rubber should be stored in an airtight container in a dark place, as it is affected by both light and air and will lose its elasticity. A fruit-juice painted black, with a little talcum powder inside, is ideal. —ARThUR GINSBURG, Revere, Mass.

Firewall Nut Plate
Here is a neat, hidden, radial mounting for smaller engines. Before closing up the nose of your model, make a nut plate to fit the rear of the firewall. Drill into the stock to match the engine mount holes, and solder nuts over the holes. Bend over the ends to hold it in position against the firewall. The engine is then bolted to the front of the firewall. —MIKE KERTESZ, Gary, Ind.

Fuel Line & Tank Cleaner
After prolonged storage, glow-engine fuel lines get plugged with caked center oil. You can buff and pull but they often stay plugged. Fiddling with a piece of wood doesn't always clear the sticky mess. The answer? A supply of pipe cleaners in your tool kit. —DOUGLAS CAIN, Taile, Texas.

Design Short-Cut
Make cardboard templates of your engine side and top views and mark the location of the engine lug and mounting holes. Then, when making drawings of your new designs, all you need do is relocate the engine template to check if the engine will fit. Works fine with speed models where tight cowplings are a must. —RICHARD SIMONTON, Jackson, Michigan.

Improved Performance
Monogram's "Speedee-Bilt Mono-coupe," because of its scale proportions, proved sensitive to adjustments and as a result, I found it difficult to adjust for consistently good flights.

To improve performance, I enlarged the tail surfaces approximately 25% more than the original area, retaining the scale outline. —JOHN RICHTER, Newark, New Jersey.

Control In Wind
To help compensate for the bouncing around your controller gets in high winds, try this trick. It will help maintain line tension better and prevent loss of control. Make wingtip guide wide enough to allow for another set of guide holes in the regular ones. Make the holes large enough so that the lead end loops can pass through easily. If the wind is moderate, place leads in front guide holes. In strong winds, move leads to rear holes. This will swing the nose of model outward more when flying. —SYDNEY WARD, Guelph, Ont., Can.

Trimming Stencil
Here's a handy substitute for masking tape, that can be used for putting designs on models. Cut the desired design out of the center of a piece of writing paper or smooth bond note paper. Wet it and place it in position on model. When almost dry, dope the open space of the design. Let dope dry a few minutes then peel up paper quickly. Surface tension holds the damp paper in place while drying. —DIANE H. LA-VINKA, Lark, N. Dak.

Better Cement Joints
When sheet balsa is joined at right angles for such parts as formers and fuselage sides or tail surfaces, the cement applied to the joint pulls out from the crack when dry. This leaves a web of cement with an air space under it along the crack. For making such joints doubly strong at points of high strain, try this wrinkle: Punch a hole through both ends of the cement web. Hold cement tube snout against hole, and squeeze cement into the pocket until the cement runs out the hole at the other end. —TED SCHNEIDER, Evansville, Ind.
**HANDY HINTS**

**Better Frameworks**
Use thick sheet, together with small blocks, to make a really accurate jig for fuselage sides. Since it is hard to drive pins into building board dead square, resulting frames may not be accurate. Pins also may cause light strips to crack at sharp bends. The blocks will prevent this. —G. WOOLLS, Bristol, England.

**Rudder Control**
To help stunt ships stay out on the end of the line, why not get help from the rudder? This system utilizes a second pushrod hooked to the bellcrank, which moves the rudder outward when up or down control is given. Travel is slight at the bellcrank, so the horn or rudder should be fairly large to get enough movement. Neutral setting should have about 10° offset, with about 20° full offset. —ROLAND E. WOOD, Richwood, Ohio.

**Lightweight Stabilizer**
To reduce the weight of sheet balsa tail surfaces on control-lineers, try this construction method: Cut out the center of the surface, leaving about 3/8" to 3/4" balsa all around. Add ribs of square stock of the same thickness as the sheet surface. Cover with paper. On bigger models two layers of paper should be used. —RICHARD SARPOLUS, Cranford, N. J.

**Tightening Brush Bristles**
Dope and thinner have a way of loosening the hairs in even the most expensive brushes. If your brushes leave hairs on that fine finish, try this trick. When you buy a new brush, squeeze the metal ferrule just above the hair end. Use pliers or a vise. This will lengthen the brush's life and prevent hairs from dripping out. —ROBERT BRUAR, Stockholm, Sask., Canada.

**Slow Go**
For testing those glow-plug free-flight ships, just put the propeller on backwards, instead of running the engine rich as some modellers do. This slows down the plane enough for testing. Later, when the plane is fully adjusted, just turn the prop over and fly full speed. —DON OWEN, Galveston, Texas

**Score Board**
If you've won a few contest awards with your favorite model, why not keep a record of it? Make a scoreboard of plywood and paint your listings on it. Trim-File can also be used. A miniature trophy, with location, contest and how you placed, can be shown. A similar listing can be put on the model itself, along the cockpit, in the same manner as combat kills are recorded on real airplanes. Team racers can have small checked flags. —DICK NEAL, Thornport, Ind.

**Handy Clamps**
Holding scalable plastic model parts together while cement or solvent dries can be aided by using spring-type clothespins. These can be used on most thin parts such as wings and tails and small diameter fuselages. Patches of Scotch tape or masking tape across seams can be used in same manner where clothespins won't fit. —DON HERTZFELD, La Crosse, Wis.

**Booster Leads**
Get a length of the 300 ohm twin-lead wire used for television installation to make your next set of booster leads. Solder lugs and alligator clips on ends, and separate center insulation at ends as shown. —RAY GREENING, Buffalo, N. Y.

**Tuning Tiny Throttles**
If you have difficulty turning the needle valve on the smaller engines while they are running, try this trick: Take the needle valve out of the engine and file or cut a notch across the knob, using a thin file or hacksaw blade. The needle valve can then be turned with a screwdriver while the prop is turning. This also is helpful when the engine is cowled in and the needle valve partially covered. —JERRY HARTER, Bothell, Washington.
Circular Cowlings
Cowlings for 1/4 or small A engines can be made from mailing tubes. Make the front ring from sheet balsa, then carve the front and fuel-proof the inside thoroughly. Dope outside to suit. Mount with screws or clips at rear.—ANTHONY DELUNA, Brooklyn, N. Y.

Stunting P-40F
On Monarch's "Curtiss P-40F" the movement of the bellcrank was restricted because of its scale proportions, limiting the extent of its maneuverability. To get around this, I decided to mount the control system on the wing. It does not look as nice now with the external bellcrank, but at least I can loop it and do other maneuvers as well.—RONNIE SPOKINS, Crooksville, Ohio.

Small Parts Storage
Clean out your old dope bottles and use them for hardware damage. Label them to indicate the contents. Screw lids to underside of shelf for handy access.—EUGENE GREEN, Muncie, Ind.

Handy Primer Bottle
An empty, nylon, squeeze, deodorant bottle makes a good primer bottle or tank filler for small engines. Pry out the inner stopper and force-fit a 1/16" length of 1/16" diameter brass tubing into the spray hole. This hole may have to be enlarged slightly to take 1/16" DIA. BRASS TUBING INNER STOPPER

NYLON SPRAY BOTTLE

Coarse Steel Wool
clog the fuel line and metering jet. Fill the tank with a venturi near its front so that the air flow will pressurize the tank. Place tubing for the venturi to a funnel-like shape.—G. LEE HALEY, Springfield, Ont., Canada.

Plan Transfer
On magazine plans, full-size patterns for various parts are frequently shown, sometimes on both sides of a page. To transfer these outlines without mutilating the magazine, try this method:

Carbon Paper

Vibration Reduction
A layer of rubber between the engine backplate and the firewall will often cut down vibration somewhat. Cut a disc of rubber from an old inner tube.—GEORGE GARVEY, Pawtucket, R. I.

Breakaway Engine Mount
Here's an engine mount that proved very popular with free-fighters back before the days of g-o-y. It still works well and could be used on control-liners to reduce engine and prop damage:

The inner engine bearings are spaced to suit your engine, and the outer bearings are built into the model with snug clearance around the inner bearings. The outer bearings can be regular hardwood stock or hardwood plywood. The inner bearings are bolted to the outer bearings at the front and the rear of the model.

Color-Coded Flying Lines
To prevent mixing the "up" and "down" wires when connecting to the leads on your model, try coloring both:

Dope Both Lead Ends Different Color.

Brush Cleaner
When your dope thinner supply runs low, use nail polish remover to clean dope brushes. The remover has a bit of oil in it, so wipe brushes well after cleaning. To keep peace in the family, don't raid Mom or Dad's supply—buy your own at the drug or variety store.—DAVID ANDRAS, Schenectady, N. Y.
HANDY HINTS

Glider Finger-Rest
The mighty brave used when flying hand-launched gliders is sometimes rough on wing trailing edges. To pre-
serve your glider wings, try installing this wire hook on the fuselage side.
Bend the hook to the shape shown, bury the short straight end into the
fuselage, and double-cement the hook into position so that the curved end
sticks out parallel to the wing. Cover the installation with a patch of silk or
gauge. The hook should be located on the fuselage just under the trailing edge, where your forefinger can get a com-
fortable launching grip.—REGGIE MILLER, Port Huron, Mich.

Cowlung Strengthening
Use ordinary surgical gauge to strengthen thin-curved cowlung or other model parts. Loop or cement gauge
strips over the whole inside area. Run the strips across each other and build up several layers if needed.—BERN-
ARD MARIEVILLE, Troy, N. Y.

Gear Mounting
Landing gears on profile models sometimes work loose because of hard landings and vibration. Try this method to
anchor the gear strongly:
Curtain rod hooks (obtainable at hardware stores) are bolted or screwed to the fuselage sides. The punched-out
center, forming the hook, is best around the gear wire. You can make a

similar anchor strip by cutting a groove in a flat strip of aluminum or
brass.—R. DUAIN, Bayonne, N. J.

Diesel Hot-Pod
The variable compression screw on a small diesel often gets very hot. To avoid burning your fingers, fit a short

length of neoprene or plastic tubing over the part you handle.—R. WEST,
WOOD, Middletown, England

R/C Tube Storage
Some brands of cigars are packed individuallu in an aluminum container. This is a good storage can for small
parts, such as radio tubes. The container will take two tubes neatly. Stuff
the cans with cotton so that the tubes won't roll around inside.—JIM
OBRIEN, JR., Bellmore, L. I., N. Y.

Still Another Stooge
If you fly alone, you'll find this a handy helper. It features an improve-
ment over other stooges in that there is a guide to keep your model in proper
launching position while you are getting
to the center of the circles.
Use a piece of board or plywood for the base. This can be near y any size,
1/4" PLYWOOD 1" X 2"

Tank Mount
Having trouble keeping the fuel tank in place on your profile model? Try
this wrinkle: Hardware stores can supply spring clamps of the type used for
hanging up boxes and tools. Simply screw or bolt two of these clamps to the
side of your model. Slip tank in place in the jaw of the clamps. This system is also handy for removing the
tank when cleaning the model or for changing to a larger size tank.—
HILTON RIVERS, Astoria, L. I., N. Y.
Breakaway Engine Mount

Here is a variation on the beam mount for 1/2A engines. The mount is strong enough to hold the engine rigidly in place, but will come apart if the model hits something solid. Drill holes in the beam mount in the regular manner, under the engine mounting lug. Then instead of using bolts, insert dowels through the lug and beam. Let the dowels project a bit above and below. Hook a rubber band over the dowels and stretch it tightly under the engine over the dowels on the opposite side. A bad blow will break the dowels or pop the rubber bands off, saving the engine from serious damage.—PAUL R. BIEN, Cincinnati, Ohio.

Regulator Clamp

This clamp, made of 1/4" plywood and a 4-40 motor mount bolt, when cemented to the motor mount or a slot in the fuselage, will reduce vibration and keep the pressed-in connection on the Walker fuel regulator from working loose and leaking air. The regulator may be readily removed for cleaning or replacing, without removing the mount.—C. H. ROBISON, Ottumwa, Iowa.

Balsa Filler

The never-ending search for a perfect balsa grain-filler still goes on. Here's another idea: Add powdered Fuller's earth to sanding sealer or clear dope to make creamy thick mixture, dope on and sand in regular manner.—BRUCE SHERWIN, Central Valley, W. Y.

Simplified Snauto

For the control-line fans who want to fly when there is no one around, here is a very simple helper: Bend a wire around a spike so that it pivots, one side visible, or strap on to outside.—DON MILKENT, Kenosha, Wisc.

Free-Flight Fuel Tank

A visible fuel supply is helpful for timing glow plug engine runs when no timer or engine cut-off is used. The use of an eye dropper for the small engines has led to this idea: Use a small dope bottle for a fuel tank with the larger engines. Clean thoroughly and solder the fuel lines into the cap, as shown. Bury tank in fuselage structure with

Shock Absorber Nose

Sailplanes and gliders take a real beating in the nose section. Try adding a shock absorber to your next model. Cement foam rubber between two of the nose formers and cover with silk or nylon sewn in place. Use Plasbond to fasten rubber to wood.—PETER SAYER, Warwickshire, Eng.

Short Preventer

To prevent your booster battery from shorting while being stored in your tool box, try this wrinkle: Place an ordinary plastic bowl cover over the top of the battery. This will prevent the binding posts from coming in contact with the sides of the box or the various tools in the box. Remove wires first.—LAIRD CROWE, Okahoma City, Okla.

Ignition Fuel Hop-Up

Add a bit of glow to your ignition fuel to start a balky engine or do cold weather flying.—P. BLAISE, Montreal, Canada.
HANDY HINTS

Glider Insurance
To prevent minor dents and splits in the leading edges of glider wings, fold a strip of 5/8 or 1" wide cellulose tape over the length of the leading edge. The same trick applied to the nose and belly will save the surface at these points.—MICHAEL KIRM, N. Y., N. Y.

Wheels Hubs
Lightweight wheel hubs for rubber-powered or free-flight gas jobs can be made from a short length of hardwood dowel. Drill the axle hole first, then cut dowel to the desired length. The wheel disc can either be drilled for the dowel or the dowel can be cut in short lengths and cemented on each side of the wheel.—JAMES H. HARVEY, Santa Maria, Calif.

Prop-Hole Reducer
Frequently the prop you wish to use on a certain engine has a hole larger than the prop shaft or shaft screw. If you fly B4A or small Class A engines, you probably have come across this problem.

To save the trouble of finding or making a metal reducer for the shaft, slip a short length of fuel-line tubing into the prop hole. Use tubing with an outside diameter which is a snug fit in the prop. If the screw or shaft is too large for the tubing, let the threads cut the inside of the tubing to size by turning the tubing onto the shaft.

Engine heat will soften tubing, so it will not last long—this is a good emergency trick only.—MELVIN FARRER, Fort Bragg, Calif.

Wing-Rib Pattern
When cutting out a large number of wing ribs of the same size, make a sheet-metal pattern to use as a guide. Punch two holes in the pattern and solder a thumb tack through each hole. The tack points are pressed into the wood stock to keep the pattern from shifting while you cut around it with a knife or razor.—RONALD KENNEMER, Fontana, Calif.

Combat Ribbon Hook-Up
For a quick, secure attachment for the ribbon on your combat job, fasten an alligator clip under the tail of the model. Flatten the rear part of the clip and either drill a hole through it for screw attachment to the plane or bend its end and cement this into the tail.—PHIL HARVEY, Seattle, Wash.

Storage Tray
A plastic tray for silver makes a good storage tray for tools, brushes, cement tubes, etc., in your workshop. Such trays can be purchased at hardware or kitchen-furnishing stores.—CLINT SCOBLE, Hamden, Conn.

Pin Cushion
A length of soft balsa sheet tacked up over the workbench makes a handy pin cushion, preventing pin pricks when reaching into a container full of pins.—LARRY HAMM, Dover, Ohio

Covering Wing Tips
Covering wing tips usually presents a problem because the paper must overlap compound curves. Try cutting segments as shown to produce a neat job. Overlap towards the trailing edge. Dope the rear segment down first, then work forward.—KENNETH TROXELL, Frederick, Md.

Wire End Loops
When making up control-line lead-out wires on flying lines, borrow the commercial trick of using tubing clamps instead of wire binding. For flexible wire, run the short end through the tubing twice, as shown. Regular steel wire need only be bent back along the tubing. Use soft copper or brass tubing of about 3/32" O.D. for wire up to 1/16" diameter. Clamp the tubing in a vise to square it around the wire.—ARTHUR PERGAM, Willow Grove, Pa.
Tightening Nose Blocks
Rubber models can use this idea to good advantage. If the nose block becomes loose through wear, damage or thrust adjustments, wrap Scotch tape around the rear portion. Build up layers as needed for a snug fit. —JOHN GIOVINE, Bronx, N.Y.

Backplate Spanner
Notched crankcase back covers on such engines as the O.C. Cub frequently need tightening, or must be removed for cleaning inside the engine. Don't try jabbing long-nosed pliers into the notches and twisting the cover. Instead, make a wrench or spanner from a piece of aluminum or brass, as shown. Select a thickness that is snug fit in the notch width. Then twist the wrench with your fingers or a pair of pliers. —HANNES LAUBE, Brooklyn, N.Y.

Drilling Straight Holes
This handy jig will enable you to drill prop blocks, nose blocks and wheels with perfect squareness, using an ordinary hand drill. The jig can be made of wood for light work or of metal for heavier work. Different drill sizes holes can be put through the same jig and bushings of the proper sizes added. Take the jig to a machine shop to have the guide holes bored with a drill press. —RUDY Prikosovitch, South Bend, Indiana.

Super Finish
When your current favorite solid scale model has been completely doped and all details and details are finished, paint it with several coats of a good clear hot-fuel primer. Do the job in dry weather, in a dust-free room, and allow ample drying time. The high gloss finish is worthwhile and durable. —CHARLES Goldstrom, Pittsburgh, Pennsylvania.

Wheel Retainer
If you wish to use one set of wheels on several models, or wish to have the wheels easily removable so you can change over to skis or floats, here is a neat way of doing the job: Solder a length of copper or brass tubing over the landing gear axle. Let the tubing extend about 1/2" or 3/4" beyond the wheel, and drill a hole through the tubing for a small cotter pin or soft wire keeper. When assembling, put a washer between the wheel and retainer. —D. Blackmore, Austin, Texas.

Motor Sealer
Model outboard boats have been known to turn over or have engines strike loose, with the valuable motor ending in the "deep six." Also, motors sometimes move during running, changing the desired direction on the water. Try this wrinkle to solve both problems:

Motor or steel over the gear, as shown. The gear is easily replaced when bent or broken. —EDDIE Cincotta, Brooklyn, N.Y.

Control Tamer
Control-line beginners have a universal tendency to overcontrol during their first flights, with resultant disaster to their models. Since most models have more than adequate elevator travel up and down, slightly reduced travel will help cut down that tendency to overcontrol. —Ted Sarler, Florida, New York.

Simple Landing Gear
Stunt and Combat fans who fly profile ships can use this method for gear attachment (It can be made for either single-wheel or two-wheel gears): The gear-wire end is bent to form an eye, at this end is fixed to the engine-attach bolt with a large washer. Other attach bolts have a piece of aluminum or steel over the gear, as shown. The gear is easily replaced when bent or broken. —Eddie Cincotta, Brooklyn, N.Y.

Bend a 1/2" wide strip of 1/32" aluminum or brass, as shown, and bolt or screw it to the transom. This will keep the motor rigidly in position during operation. —Ted Sarler, Florida, New York.

control. Attach metal strips, bent as shown, to the top and bottom of the stabilizer. Bend so that travel is restricted during early flights. As your technique improves, the "Tamers" can be opened up, and removed entirely when proficiency has been reached. —Terry Huff, Cedar Springs, Mich.
HANDY HINTS

Long And Short Of It
Have you ever been caught without a short type glow plug when flying your ½A ship? If you have a long thread plug from a larger engine available, the trouble can be solved in this manner: Add enough washers (plug gaskets) to shorten the threads. Then, upper camber, lay a spar of about 3½ by square. The size will be determined by the thickness of the airfoil.

Little Squirt
If you wish to water-tighten the tissue on your model, try this: Use an empty window-cleaning spray bottle, filled with water. Clean spray pump thoroughly before using. Spray model evenly to avoid excess warping—RICHARD RIEGER, Houston, Texas.

Pulling Pins
Here's a simple trick that may be overlooked by most modellers. When pulling pins from cemented structures, grasp the pin head with pliers and turn or twist the pin to break it loose from cement that may be surrounding it. Then pull the pin out. TOM MARKLAND, Cincinnati, Ohio.

Free-flight Fuel Tank
Engines such as the Fox and K&B Allyn with recessed crankcase backplates are well suited to this trick. Obtain an additional backplate and drill for filler, vent, and fuel line as shown. Attach the backplate over the regular backplate with another gasket between them. Use longer screws if necessary. Use steel wire for anchor pins and release rod. Return actuator can be a spring or rubber band. SP2 JOHN M. BROWLAND, Denver, Colo.

Wire Ends
For extra safety when putting the eyelets on control-line wire ends, it is a good idea to squeeze the rims of the eyelet together so that the wire won't come off. This also helps to keep the eyelet in place when binding the short wire end down—MARTIN GOSKEY, Lakewood, Ohio.

Warp Prevention
To keep tail surfaces and wings from warping while being stored, this method is a good one: Get a good piece of flat board or plywood a little larger than the surface and pin the surface down on the board as shown. Small clamps can also be used. Make them from a short strip of thin plywood and hold down with a small wood screw—BOB CRAWFORD, Muncie, Ind.
Cool Cowling

With enclosed engine installations such as those used on team racers, scorching and burning of the inside of the cowling sometimes occurs. Try lining the inside surfaces around the engine with asbestos paper. On small models, use the thinnest grade paper available. On larger models, where weight isn’t such a problem, you can use 2½” sheet asbestos. Use water glass as an adhesive for applying the asbestos paper.—Ralph Jollie, Jamaica Plain, Mass.

Towliner Stoge

If you want to fly your towline glider without resistance, bend up coat hangers as shown. Push the wires into the ground, in the location indicated. Be sure the glider is aimed into the wind. Lay out your towline and start your launching run in the usual manner.—Virgillo Hagan, Gorona, Tarlan, P. I.

Float Spray

New clear spray plastics which are on the market (such as Quik or Krylon) provide an excellent lightweight "seal" for float bottoms of R.C.W. models. The plastic seals both tissue and clear dope without adding weight and without scoring. Post-process qualities are not fair, however. NORMAN MICHEL, Madison, Wis.

Flying Scale Decoration

Instead of trying to paint scale details (such as insignia or numbers) on the fuselage and wings after your model is completed, try this:

Hatch Cover

Here is an idea that will help keep dirt, field mice and grasshoppers out of the rear end of your rubber model.

Glow-Plug Booster Clips

If your alligator booster clips get lost, strayed or stolen, try these equally good substitutes: Take an ordinary round heavy-duty soldering lug and cut out a small notch to allow the lug to be slipped over the knob of the Glow Plug. With some glow plugs, the regular high-tension ignition wire clip can be used. These clips can be used on both booster leads—sliding the other clip over the cruise bolt or onto the exhaust-stack edge. Pinch back together with pliers when the clips open up through use.—GERALD HAMLOW, Bloomington, Ill.

Removable Pop-Up Tail

After fumbling around on the field for many an hour trying limit strings on a pop-up tail, it was found that a very simple and much-used device could be applied with success. By the addition of a simple dress snap on either end of the limit string, removal of the tail assembly is made both easier and faster. Be sure to cement half of the dress snap very securely to either the tail assembly or fuselage. This works well with Class A or smaller models, and for larger ones a snap fastener of the type used for control-line ends is needed.—Fred Otten, Brooklyn, N.Y.

Pushrod Fairlead

On profile planes, the pushrod has no brace and sometimes bends from the opposite forces formed by the bellcrank and the slipstream over the elevator, resulting in a lack of control. Many braces are in use, but an unusual one that works easily is this: Cut the snap end off a safety pin, thread the pushrod through the loop on the other end, and push the two sharp ends into the fuselage, bend over and cement well. More than one may be needed.—Stuart Culp, Bethany, Mo.
HANDY HINTS

Bent Pin Kink

- To prevent splitting or piercing small-size balsa strips when building model parts on the work board, bend pins as shown. Stick pins into board on the outside of curved sections to hold in place. The right-angle bend will hold the work tightly against the flat surface.—JOE W. WRIGHT, Gormley, Ont., Canada

Gloss Work Top

When working on plastic or other models that don't have to be pinned to plans, put the plans under a sheet of glass and work over it. This will hold plans in place, give you a smooth working surface without danger of marring table or desk, makes plans easier to see, keeps them from being mislaid, and cement and paint can be cleaned off easily with a razor blade. ROBERT EVANS, S. Canonasville, Pa.

Handy Glow-Plug Boosters

If large dry cells are temporarily unobtainable, try using four large flashlight batteries wired in parallel as a substitute. This pack also makes a light to cut out the right size piece of covering and is also more economical since odd sized scrap can be compared with the drawing before being applied to the model.—DAN LIBS, Ulysses, Kansas.

Rudder Flip-Over Insurance

- To prevent damaging the rudder on your control-line in those flip-over landings, try this wrinkle: Make a guard of 1/16" music wire and mount securely in the rear portion of the fuselage. Wire should extend at least one inch above top of rudder.—GRADY LEE WALKER, Ninety Six, S. C.

Securing Nuts

- Your model cement can be used for other things besides sticking balsa wood together.

Where a nut and bolt is used to mount some necessary or hardware part permanently on your model in a place which will be inaccessible when structure is finished, spread a line of cement over the nut and the nearby wood. This will prevent the nut from working loose from engine vibration. This works well on control-plate pivot bolts, landing gear "P" or eye bolts, and Solder the wire into a 1" square strip of tin and liberally cement to a strip of hardwood or 1/8" plywood. Cement assembly securely into fuselage structure.

This guard looks like a radio antenna mast and will take the shock in the event of a flip-over.—E. J. SAUNDERS, Toronto, Canada.

Clamp Substitute

- When it is necessary to clamp two parts of your model structure together to let cement dry, this trick will help if you don't happen to have "C" clamps in your tool box:

can be used on engine mount nuts if the nuts are surrounded with Plastic Wood packed down well. Cement under and over the Plastic Wood. Always mount nuts and bolts with flat washers and either lock or star (radio) washers. Then the cement will act as a good "safety".—BILLY WRIGHT, Jackson, Miss.

Tight Mount

A large automobile-type star washer placed against the firewall behind an Infant or Torp Jr. engine will prevent the engine from slipping in its mount ring.—JIM RUSSELL, Lansing, Mich.
Detail Brush

Painting fine details on plastic models can be made easier by this idea. Very fine brushes are quite expensive, but ordinary dope brushes can be worked over a bit to do a better job. Cut away most of the bristles with a razor blade so that only six to a dozen hairs remain.—DAVE CHULICK, Cadillac, Michigan.

Pop-up Dethermalizer

This pop-up tail dethermalizer system does away with the small rubber bands used to hold tail hooks together. The wires are bent as shown so that top hook slips down through bottom hook, with the fuse acting as locking pin. When no fuse is to be used a small dowel will serve as a lock.—DENNIS PHILLIPS, Lamesa, Texas.

Tube Bender

In order to prevent flexible fuel line tubing from collapsing when bent sharply, insert small spring from wire collar “stay down” gadget available at most 5 and 10 stores. Push this spring into tubing before attaching to engine and bending.—HERB TALABERK, Walla Walla, Wash.

Tank Mounting

Mounting fuel tanks on the outside of small 1/2A ships can easily be done using this method. If model has sheet balsa wings, put tank in position and using a needle and heavy thread sew around tank and through wing. Go around numerous times until tank is held firmly in place. Tank can also be attached to profile fuselages in same manner. Coat thread with hot fuel proofer.

Various stunt tanks can be tried out to determine best performance using a variation of the above method. Use light single strand copper wire passed through fuselage and around tank with ends twisted together.—RONNIE FIKES, Soquel, Calif.

Workboard

An excellent material that can be used for a model workboard is “Nu-Wood” available at most lumber yards. “Nu-Wood” is inexpensive and soft enough to take pins easily. You may wish to put legs on a panel and make a regular table, or simply lay on workbench or table when building.—RUSSEL HEIN, Fairbank, Iowa.

Wire Skinner

For an easy way to skin or strip battery or ignition wires, try this: Clamp an alligator clip on the wire, squeeze the clip so that it cuts the insulation, and pull the clip off the wire end. This method works well with wire that has an all-plastic insulation.—DICK ARNOLD, St. Clair Shores, Mich.

Free-Flyer Floats

Modelers who favor the tail float design for R.O.W. will welcome this suggestion. Small plastic toy boats can be used for floats under the stab. Cut the deck off and cover with 1/4” or 3/16” sheet balsa, depending on size. Attach cut off deck and cabin cement sheet balza to edges of hull.—KEN JOHNSON, Seattle, Wash.

Rubber Motor Installation

If you have ever tried to fish a rubber motor through a long, narrow fuselage or stick model, you will appreciate this one. Run a length of picture wire through the model from front to rear.

Attach the rubber motor to the rear hook. Attach other end of the rubber motor to the picture wire and pull through to the nose block. Be careful, when inserting the wire, to prevent punctures of the fuselage covering.—CHARLES E. BAMBERG, Lexington, Mass.

Making Round Parts

To make old-sized wheels and other round parts such as cannons, a motor tool can be used as a miniature lathe. Simply cut out the part to rough outline and then mount on a mandrel in the tool. Use sandpaper held against the part with the motor running to bring the part to final shape.—NORMAN CHRISTIANSEN, Pocatello, Idaho.
HANDY HINTS

Needle Valve Extractor
The next time a tapered-shank needle valve breaks in one of your engines try this method of removing the broken piece. File a piece of piano wire to match the taper of the needle valve end. The wire should have the same diameter as the needle valve. Insert the tool from the nozzle side of the spray bar and turn the broken needle out of the spray bar. LEE HOWER, Tamaqua, Penna.

Tissue Shrinker
To water-shrink tissue covering, use a small soft sponge and rub gently over the tissue to apply water. THERON TAYLOR, Balzer, Okla.

Dummy Radio Mast
Pocket comb teeth make neat radio masts for scale models. Break a tooth about 1/8" and slip the split end over the needle valve knob. Tightly wrap the split ends with soft wire around the needle valve knob as shown. Leave about 1/8" of tubing outside the needle valve. This can be bent back out of harm's way while turning the engine.

—EDDIE GRANT, Columbus, Ind.

5/8" Tank
Here is a new tank that can be used with the small engines: Obtain the metal cap from an old or cheap fountain pen or pencil. Pull the clip off, and solder up any clip mounting holes as well as the small breather hole. Drill holes for the fuel-line filter and vents.

Bottle Cap Seal
The cardboard seal in dope bottles always sticks and tears after the dope is used a few times, preventing a tight seal. Substitute a 1/16" plywood disc to overcome this. —STUART CULP, Bethany, Mo.

Unsinking Joints
If you cemented that joint in the wrong place, brush some dope thinner very generously on the cement. This will loosen the cement from the wood. Also apply thinner or nail-polish remover around the lid of those hard-to-open dope bottles (Turn bottle upside down). This will loosen the hard dope and make for easier opening.—D. OLSEN, Mora, Minn.

Flying Fish
Towline gliders can be launched neatly with the aid of a light fishing pole. This is not allowed in competition, but is handy for sport flying. The rod can be used to help guide the glider on tow, and the reel makes it easy to wind up the line when flying is over, and to store the line when it's not in use.—RICHARD CONDE, Providence, R. I.

Circular Clamps
Two-piece solid or slotted models with circular cross sections are often hard to join while carving or cementing them together. To hold this type of work firmly, simply use an ordinary automobile or aircraft hose clamp. These clamps come in various sizes and the screw adjustment allows any desired tension, as well as considerable variation in diameter.—Mr. J. LUSKER, Cherry Point, N. C.

Gauze or Fabric, Cement Liberally
fabric coated liberally with cement. This will fuel-proof the usually oily area and will greatly strengthen the structure. RONNIE ANZALONI, Kenmore, N. Y.

Adjustable Push Rod
Where the elevator pushrod is mounted externally, try this kink for getting a bellcrank and elevator neutral setting: Bend a "V" in the rod at some convenient location along its length. Bend the ends to connect to the bellcrank and elevator horn as close as possible. Then, spread the "V" apart or together as needed to get the exact setting.—BOB ELLIS, Trenton, Texas.

Variable Incidence
For test-flying experiments, with various changes of wing and tail incidence, this gadget will insure careful and accurate adjustments. It can be used on pylon or cabin-type models, and will not interfere with the knock-off rubber attachment.

A lowly nut and bolt form the basis for the idea. Two nuts are mounted firmly in the wing or tail structure, above the outer edge of the fuselage top, and the bolt is threaded through to bear against a flat plate on the pylons or fuselage top. Then, simply screw the bolt in or out to raise or lower the leading edge. The rubber bands hold the surface in place against the adjustment.—BOB LARSON, Erie, Pa.

Wheel Retainers
The battle of the wheel collars goes on! If you can't solder retaining washers on the axle, to keep wheels on the model, try this method: Cut a short length of plastic fuel line and slip it over the axle. Bind it with a few turns of soft wire to anchor it in place. JACK WHITEHOUSE, Dawson, Canada.

Cement Gun
How often have you wanted a longer nozzle on your tube of cement? Here's an answer: Drill out the cement tube nozzle to fit a 1" or 2" length of 1/8" i.d. brass or aluminum tubing. Push the in tube nozzle and squeeze the nozzle with pliers. Plug with a pin or brad when not in use.—DEAN BARBER, Wyacoona, Mo.

Aligning Elevators
Here is an easy way to make sure that the elevators of your control-line model are set in neutral when installing the control mechanism:

Sandwich the elevators and stabilizer between two pieces of balsa and hold firmly together with a "C" clamp as shown.—E. FITZSIMMONS, New York, N. Y.
**Handy Hints**

**Soldering-Iron Stand**
Finding a place on the workbench to lay that hot soldering iron is sometimes troublesome. Why not cut a 3" wide strip from a large tin can and then slot as shown. Bend tabs over at right angles to the can sides to complete the holder.—Gerald Thornton, Fort Bragg, Calif.

**Spotting Engine-Mount Holes**
To locate engine mounting-bolt holes accurately on your model's engine bearers, try this simple method: Hold the engine firmly in place and mark wood at front, back, sides and parts of the hole. Remove engine and connect the lines, center, punch each hole, and drill to the size of the bolt.—Wilson W. Elliott, Waynesville, N.C.

**Battery Carrier**
Here is a simple way to carry booster batteries in the field. An old belt, or a leather or cloth webbing strap is run around the batteries lengthwise. Two other straps are run around the batteries and over the lengthwise strap.

**Slick Radial Mount**
Instead of cementing engine mount nuts to the back of the firewall, or soldering nut plates, try this wrinkle:

1. **Mark Outside of Lugs**
2. **Connect Lines**
3. **Punch and Drill**

Cut a notch in your firewall large enough to hold a strip of aluminum. Then, drill and tap holes in the aluminum strip for the engine mount bolts.

**Balsa Filler**
To smooth workbench dents and crushed spots on balsa before doping, water will do a nice job. Water will swell the wood to its original surface as it dries. Run a warm iron over the spots to hasten drying, if desired.—Bill Hufpling, Greensboro, N.C.

**Stringer Clamp**
Here's another wrinkle for holding down stringers while the cement dries:

- Bend two pins as shown and tie a short length of rubber band to the heads.
- To use, just hook the pins across the stringers, stretching the rubber band so that its tension holds down the stringers being cemented.—Loyle Erickson, Grantsburg, Wis.

**Towliner Auto-Rudder**
Towel glider landing can be tricky, but here is a gadget which will solve most of the turning problem:

The rudder tab is pivoted and spring-loaded into the turn position. A light line runs to the tow hook, which is built as shown here. When the glider is launched, tension on the tow line pulls the rudder tab into the straight position, allowing straight climb. When the tow line is released, the glider drops to the turn position for a circling guide.—J. P. Curtis, Middlesex, England.

**Line Reel**
A good reel for your control-line wire can be made from the long tin can. Select a can 6" or greater in diameter (coffee cans are good, if you've still drinking that expensive commodity).

**Fuels Tanker**
Timming a 1/4 engine run for free-flight can be tricky. Try this wrinkle for simple and accurate timing: Use an eyedropper for a fuel tank, mounted on the side of the fuselage close to the engine. By trial and error, determine the length of the engine run, and mark eye dropper accordingly. Scratch marks on the glass or paint marks on the fuselage will serve as a scale.

**Home-Made Handle**
In an emergency, a strong and simple control-line handle can be made of readily available scrap material. Use any 1/2" x 2" x 4" hardwood block and shape to the bottom and tow hooks from landing gear and gear. The wire will also serve as nose ballast when clipped to proper length. Be sure to mount it securely in the nose and leave enough space between the wire and the bottom of your glider to allow for good shock absorption.—C. A. Grell, Hondo, Texas.

**Engine Speed Control**
Glow plug engine speed control has been a toughy, but is a very desirable feature for team racing and such events. This system uses a choke plate over the intake stack actuated by a third line. The choke plate is mounted on the outside of the intake, side of the engine, length of wire fastened to the plate runs back to a tube of tubing acting as a guide for flexible cable running out of the ship to the control handle. A short coil spring moves wire and choke plate over intake, slowing engine. When cable is pulled, plate uncovers intake, permitting high speed. Coil spring acts as return pressure when cable is released. A small bellcrank can be used in place of tubing guide and whole action can be reversed if desired. Use flexible cable for third line and make good positive action on trigger on handle. Some engines may need one or more 1/4" holes drilled in choke plate for proper low speed running.—Bill Sproed, Escondido, Calif.

**Renewing Screw Holes**
Most 1/24 engines are mounted on a plywood firewall with wood screws. After the engine is taken off and put back a few times, the screw holes become enlarged. Fuel soaking the wood doesn't help either. To correct this,

*Fill the holes with pieces of toothpicks set in cement, and make new screws holes through the toothpicks.—David Lake, South Pottstown, Pa.*

**Rubber Motor Anchor**
Large rubber models can utilize this system for rear motor anchoring: Use a piece of 1/4" diameter (or larger) aluminum tubing as the rear anchor. Before winding the motor, insert a piece of dowel through the tubing.

*The dowel will serve as a better handle for the anchor man and will prevent the accidental tearing of the paper covering through the hole. After winding the motor.—R. W. Danielson Jr., San Mateo, Calif.*
HANDY HINTS

Glow-Plug Boosters
To save time and trouble with alligator clips for glow-plug starting, try wiring the glow plug and engine to a socket mounted permanently on the side of your model.

The glow-plug wire should have a regular spark plug clip, for easy removal. Booster leads from the battery are then soldered to a plug fitting socket on the model. Use a small radio tube socket and tube plug end, or a portable radio battery plug and socket. This is a good gadget to use on team racers for fast restarting—BILL WINTER JR., Oyster Bay, N. Y.

Line Storage
To keep control-line flying wires neat and straight, some kind of a reel is a must. So, save the cardboard reel the wires come on when sold to you. With the addition of two handles, this reel can be used for line storage. Jump-ropes handles or cabinet knobs can be used. You can bend up the reel with a disc of plywood or balsa removed to one or both sides—G. FORBES, Fairbanks, Texas.

Wheel Retainers
If all the methods for holding wheels on axles were laid end to end, they would reach from here to East Hatrack. Here is still another good idea to add to the pile:

File a notch in the axle end, outside the wheel position. Slip a washer over the axle and squeeze it down into the notch with your pliers. Bend if needed to make a tight fit. To remove wheels, just break the washer off with pliers.—BOB KIMM, Vinton, Iowa.

Controller Elevator Horn
Solder an ignition lug to a bolt head and mount it in the center of the elevator. Pass through elevator and tighten nut down. Use lugs of good thickness and fit the hole.

Contest Repair Kink
To carry dope and fuel-pooter in your tool box for on-the-spot repair work, use this trick: Obtain some empty finger-nail polish bottles, clean thoroughly with gasoline, and fill them with dope, fuel-pooter, or other needed liquids. The bottles will take up little space, and the small brushes built into the top will serve for applying the liquid. This will eliminate the need for carrying separate brushes and thinner to clean them.—PAUL KOELZ, Freeport, Pa.

Wing Aligner
Try this method for keeping wings and tails in alignment, instead of the usual dowel or strip key arrangement.

Cement fine grit sandpaper to mating surfaces of the wing and fuselage, grit side out. The friction between the two rough surfaces will prevent the wing from shifting due to engine vibration or flight loads.—DANIEL NOVAR, Chicago, Ill.

Brush Cleaner
One usually runs out of thinner at the wrong time, with brushes still left to clean. To clean brushes adequately, scrub them out in clear dope and wash as dry as possible. There will be some dope left in the brush, but this can be dissolved before using the brush the next time by soaking it in thinner or dope for a few minutes.—MIKE BRESSEN, Alton, Ill.

Speed Wings
Control-line speed model wings must be light and strong. Try this construction method: Lay out plywood wing form and build up laminations of balsa sheet plastic. The surface tension will hold the paper in place long enough to cut out the plastic to the paper outline. Then pull off the paper and cement windshied in place.—D. R. BASTON, Muncie, Ind.

Crush-Proof Box Fuselage
Here is a neat adaptation of the Warren truss bracing used on full-scale aircrafts, as applied to free-flight fuselage construction. This lends itself to the smaller size models (¼ A, A or B), where standard size wood can be used. The grain of the sheets inside the fuselage should run across the fuselage. Use ½” sheet for a class ¼ A and small class A models, and ⅜” sheet for large class A and B models. Assemble the fuselage from the nose to the tail. Use the “cut and try” system for getting exact taper to the internal setting for good glide.—FRED KAUTZ, Minnetonka, Minn.

Shock-Absorbing Gear
Here’s the added something that can change a sheet aluminum landing gear into a real shock absorber. Instead of mounting the axle directly to the aluminum leg, use the short strip of aluminum over the axle hole. Mount the axle on the front end of this strip, and place a length of coil spring shown. Note, however, that one side of the wire frame must be cut and bent into a catch effect, to facilitate replacement of the rubber motor.

Use a large diameter compression spring, and mount this between the wire frame. Then, bending both ends of the frame towards each other, solder them to the top of the spring. One end of the frame is now cut short, while the other continues on as the pushrod. At the far end of the pushrod is attached to an underslung horn as shown, it will give up-elevator; mounted above the stabilizer it will produce down-elevator in the glide.

When the rubber is fully wound, the spring will be compressed and the elevator trim set for best climb under power. As the tension on the rubber diminishes, the spring will move outward, moving the trim gradually to a new position.

Clear Plastic
When you need celluloid for windows, windshields, or other parts of your model, try using old photo negatives. Soak the negatives in hot water and peal the celluloid off, leaving a clear sheet of celluloid.—EDWARD WEHRLE, Pittsburgh, Pa.

Topping Ignition Connections
Scotch tape makes good light-weight wrapping to connect wires in ignition circuits. It is much stickier than regular friction tape and it is transparent—you can check connections without removing the wrap.

Try lining the bit-tension lead to the spark coil to insure a tight connection when the coil is mounted in some hidden, hard-to-get-at location in the model structure. Do not use the tape in the vicinity of the fuel or engine.—EDDIE KENNEDY, Short Hills, N. J.

Baby Engine Tank Filler
Filling the small gas tanks of ¼ A engines requires eyedropper techniques. The filler pipe should not protrude from the model, it must be covered by some care of the problem neatly, and can also be used for priming, where single drops of fuel are put into intakes or cylinders.

Obtain a needle valve of the type used for inflating footballs or basketballs having a rubber valve on the blad- der. If the needle has a blunt end with a hole in the side of the needle, cut off the hole and file off any burrs. A length of ⅛” or ¼” (1/16") of neoprene tubing is forced into the threaded end of the needle valve. The tubing then is pushed onto fuel pump housing as shown.—JOE KISH, Zelger, Ill.

Pickled Engines
Still another household product is handy for cleaning up your pet engines when not in use: Wrap the engine in several layers of "Pickled Wrap." This will seal it completely against dust and moisture. Put a couple of rubber bands around the wrap to hold it in place.—AL PRIVEN, Jericho, N. Y.
Adjusting Pushrod Length
How many times have you bent the ends of a pushrod, only to have the length come out wrong so that "neutral" at the bell crank came out full "down" at the elevators? Well, this simple trick will change all that:
Make the pushrod in two pieces. Bend the ends to fit the bellcrank and elevator horn, then trim the middle ends so that they almost touch. Make sure there is room to work in. Then slide a length of brass tubing over the rod ends and solder well. Hold the bellcrank and elevators in neutral position while you center the tubing over the bellcrank. -BOB WADSORTH, Eranger, Kentucky

Prop Shaft Holes
Modellers using engines with large crankshafts or prop-spinner adapter nuts (such as the McGee and Ohlson "90") generally have at least one trouble (at one time or other) in making the shaft hole on the prop fit easily and accurately. Of course modellers having a drill press can easily solve this problem, but some of us are not so fortunate.

Try using a tapered pipe reamer, preferably with a 1/2" handle, available from your local hardware store. The No. 8 pipe reamer will give diameters from 3/16" to 1/2" and is most satisfactory for enlarging shaft holes. If this hand reamer is not available, then a regular pipe reamer can be adapted by having your local machine shop drill

ENGINE CLEANER
When your model bites the dust and the engine becomes packed with dirt, try using "Gunk" to clean it thoroughly. "Gunk" is the trade name of a product used to clean aircraft and automobile engines, generally available at motorcycle or auto supply stores. "Glin dex Metal Cleaner" is a similar product that will do the job. Be sure to remove all cleaner before rolling time.

Apply light oil after cleaning. -DICKIE NORTHAM, Fort Worth, Ark.

Patch Paper Covering
Minor tears and splits in paper covering on your model can be quickly patched with clear Scotch Tape. This is particularly handy when flying at a contest, and saves time and trouble fumbling with dope and paper. -JOSEPH MESSING, Lancaster, New York.

Drill Substitute
For those modelers who do not have access to the small drills used for motor mount holes, here is a simple substitute: Take a nail, the same size or a little smaller than the mounting bolt to be used, heat it red hot, and push it through the firewall where the hole is to be. This method will work on most plywood firewalls and it will make as clean a hole as a drill.-JERRY NORDINE, Litchfield, Minn.

Sizing It Up
If in doubt about a certain wire diameter, try this gizmo: Use a spark plug gauge of the type having wires of various sizes. Just compare the unknown wire with the gauge wire to find the size of the nozzle. The gauge is also a handy addition to your tool kit if you are running ignition engines. Use it for its original purpose of setting spark-plug-point gaps.-MERRIS E. CERDANEL, Vale, Iowa.

Cambering Sheet Wings
If your engines lend themselves ideally to sheet-balsa airplanes, giving sheet wings to a good airfoil shape can be recomended using the method shown. Cut out and sand the top of a 3/16" or 1/8" sheet to the desired airfoil shape, notching it slightly on the bottom at the front and rear. Cut enough of these dummy ribs to spaced 1/2" apart. Make the gauge also a handy addition to your tool kit if you are running ignition engines. Use it for its original purpose of setting spark-plug-point gaps.-MERRIS E. CERDANEL, Vale, Iowa.

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FM DATA SHEETS
MODEL BUILDING MATERIALS

SHEET BALSA
- WING RIBS
- LEADING EDGES
- CENTER SECTION
- CAP STRIPS
- FUSELAGE SIDES, TOPS, BOTTOMS

PLYWOOD
- FIREWALLS
- GUSSETS
- DIHEDRAL GUSSETS
- SPEED MODEL STAB.

BLOCK BALSA
- WINDSHIELD
- WING ROOT FAIRING
- WINGTIPS
- COWLINGS

BAMBOO
- REED
- STABILIZER OUTLINES
- WINGTIP OUTLINES
- WINDING HOOP SLEEVE

RUBBER TUBING
- SCALE TIRES
- WHEEL MOLD-ONS

[Cockpit Combing, Fuel Lines, etc.]

EXPANDED POLYSTYRENE
- FLOATS
- WINGTIPS
- DECKING

SHEET DURAL
- MOTORMOUNTS
- LANDING GEARS

PIANO WIRE
- R/C LANDING GEAR
- T/F
- PUSHPRODS

FIBRE GLASS
- SHELL WINGTIPS
- WHEEL PANTS
- COWLINGS
- BEEFING UP NOSE SECTION

SHEET ACETATE
- CANOPIES
- WINDSHIELDS
- WINDOWS

COTTON CLOTH
- PINKING SHEARS
- HINGES
- DIIHEDRAL RE-INFORCEMENT

BOB COON
DESIGNIFICATION FOR BASIC HAND-LAUNCH GLIDER

WING SIZE: Select a span and chord which will give a wing area from 30 to 50 square inches in area. The span should be six to eight times the length of the chord, the approximate thickness of the wing section, 1/16" to each 1" of chord.

WING AREA: To determine the amount of wing area, multiply the span by the chord. If the new area is too large to be used, reduce the span for a smaller area. If the new area is too small, increase the chord. In this case, the maximum fuselage depth should be no more than one-third the wing chord. The maximum fuselage thickness should not exceed one-quarter of the fuselage depth.

DIHEDRAL: Dihedral is the angular setting of the wing panels with respect to the horizontal plane of the fuselage. It should be maintained at an angle of 2° to 5°.

INCIDENCE: Incidence refers to the fixed angle at which the wing or aileron is set with reference to the horizontal reference line of the fuselage side view. The recommended angle is 1° to 3°.

Rudder Incidence: Select the values which identify the type of rudder used. For a single rudder, the incidence should be the same as the incidence of the fuselage. For a double rudder, incidence should be 2° to 3°.

INCIDENCE: Only a small amount of incidence is recommended with a hand-launched glider to maintain a moderate amount of stability without affecting the altitude obtainable in launching.

RéCOMMENDÉD AIRFOIL SHAPES:

STAB INCIDENCE: -1° to 0°

STAB AREA: The stabilizer should be approximately 10% to 15% of the wing area. It should be at least 15% of the wing area.

POINT OF RECOVERY:

RIGHT TURN IN CLimb

WINO DIRECTION

FLIGHT PATH

START OF LAUNCH

DESIGN LAYOUT FOR CONTEST HAND-LAUNCH GLIDER

WING SIZE: Select a span and chord which will give a wing area of 40 to 60 square inches. The size is preferably between 40 and 50 square inches. If a hand-launched glider is used, the recommended airfoil shape should be used.

RéCOMMENDÉD AIRFOIL SHAPES:

WING INCIDENCE: -2° to 0°

CENTER OF GRavity: APPROX. FORWARD OF T.E.

NOSE MOMENT ARM (N.M.A.)

TALI MOMENT ARM (15" TO 21" N.M.A.)

STAB INCIDENCE: 0° to 1°

STAB AREA: The stabilizer should be approximately 20% to 30% of the wing area. The maximum fuselage depth should be more than one-third the wing chord. The maximum fuselage thickness should not exceed one-eighth of the fuselage depth.

PÓLYHÉDRAL: Polyhedron, as shown, is a form of wing panel arrangement preferable to the V type dihedral, except possibly when the span-to-chord ratio is low. In the design shown, polyhedron is used to best advantage for contest flying.

Rudder Incidence: Select a rudder which identifies the type of rudder used. For a single rudder, the incidence should be 1° to 3°. For a double rudder, incidence should be 2° to 3°.
FM CONSTRUCTION SHEETS
BUILT-UP FUSELAGES

BUILDING PREPARATION

VARIATIONS ON BASIC FUSELAGE STRUCTURE

START BY BUILDING UP BEARER/FORMER ASSEMBLY

TRIM HARDWOOD MOTOR BEARERS TO NOSE CURVE

F/F GAS TYPE

PLYWOOD

ANTI-WARP W BRACING

LAUNDERED NOSE BLOCK

NOTE: HALF-NORMAL WIDTH SPACERS—ADD TWICE AS MANY MAY BE NEEDED

BEND L.G. TO SPACERS

REUBBER POWER TYPE

LAMINATED NOSE BLOCK

USE SIMILAR BRACING ON TOP AND BOTTOM

DETACHABLE NOSE BLOCK FOR WINDING

PLANKED TOP—CUT OUT TO SUIT MOTOR

SHEET RECTANGLES

DETAIABLE FLYING SURFACES

USE MODELING KNIFE TO CUT OUT BALSA PARTS

DRAW UP FULL-SIZE TOP AND SIDE VIEWS

CUT ALL SPACERS IN PAIRS TO INSURE ACCURACY

WHEN MARKING PARTS ONTO SHEET, SEE THAT THEIR GREATEST LENGTH FOLLOWS GRAIN

PARALLEL SIDES AT WING POSITION

FORMERS

CENTRE LINE

SHEET

STRINGERS

NAS BLOCK

SHAPE FUSELAGE TOP TO MATCH WING DIHEDRAL

ATTACHABLE FLYING SURFACES

NOTE OVERLAP

MAKE ASSEMBLY FORMERS FROM STRIP BALSA

BUILD SECOND SIDE OVER FIRST AND SEPARATE WHEN DRY WITH RAZOR BLADE

BUILD SIDE FRAME—PINNING DOWN LONGERONS, THEN ADDING SHEET PARTS AND SPACERS

JOIN SIDES AT CABIN POSITION WITH THE TWO ASSEMBLY FORMERS

ADD CABIN SPACERS BEFORE JOINING AT NOSE AND TAIL

HOLD WITH RUBBER BAND UNTIL DRY

PULL IN AT NOSE AND TAIL—THEN ADD ALL REMAINING SPACERS

CEMENT FORMERS AND STRINGERS IN PLACE

ADD SHEET, STAB PLATFORM

DOWELS

CELLULOIDE

THIN CARD

FILL IN WITH SHEET

HOLLOW OUT NOSE BLOCK—FOR LEAD WEIGHT

SIDE STRINGER

TOWHOOKS MOUNT

WELL CEMENT HERE

CHECK ALIGNMENT AT THIS STAGE

BASIC FUSELAGE CONSTRUCTION
(GLIDER SHOWN—BUT SIMILAR FOR RUBBER AND GAS)

BILL DEAN.
FM DATA SHEETS
FUSELAGE CONSTRUCTION

STEP I - STUDY PLAN:
Familiarize yourself with the fuse-
lage plan and the dimensions of the basic fuselage side to be con-
structed. Note the cabin and structure details on the plan. Add later, as on most models.

Fuselage sides such as this one, with one straightened and one bent-looker, make a good choice. The fuselage can be aligned. The wings are added later, as on most models.

*AN OPTIONAL METHOD OF INSTALLING DIAFRAGM IS SHOWN HERE. IF NECESSARY, DIAFRAGMS ARE SHOWN. USE THE DIAFRAGM, MOUNTED IN THE UPHOLSTERY AS REQUIRED.

DIAFRAGMS ARE NOT REALLY NECESSARY IF LONGERONS ARE ADDED TO THE FUSELAGE SIDE AT THIS TIME.

STEP II - LAY OUT LONGERONS:
SELECT MEDIUM-HARD STRAIGHT GRAINED WAX-PLEO
SIMPLE DESCRIPTION OF THE DIAFRAGM, BRACKET
LONGERONS TO PLAN WITH WAX AS SHOWN.
DO NOT BURNISH LONGERONS
WITH WAX, OR THEY WILL BE
SERIOUSLY WEAKENED.

STEP III - ADD FUSELAGE UPRIGHTS:
FUSELAGE UPRIGHTS
FUSELAGE LONGERONS
FUSELAGE SIDE ON WORKBENCH (FRONT VIEW)

STEP IV - CUT CROSS-PIECES:
FUSELAGE TOP PLAN VIEW MAY ALSO BE USED TO CHECK ALIGNMENT.

STEP V - ALIGN CROSS-PIECES:
DO NOT ADD CROSS-PIECES TO NOSE AS YET.
THE VERTICAL FOLD OF THE TRIANGLE WILL DETECT MIS-
ALIGNMENT IT DEVELOPS.

NOTE HOW THE RIGHT-ANGLE
CORNER OF THE TRIANGLE
MAY BE USED TO ALIGN THE
CROSS-PIECES IN RELATION
TO THE VERTICAL FOLD OF
THE LONGERON ITSELF.

BASE MUST FIT BETWEEN UPRIGHTS.

STEP VI - CEMENT CROSS-PIECES:
STARTING WITH THE STRAIGHTEND PORTION OF YOUR FUSELAGE, AS SEEN IN THE TOP PLAN VIEW, CEMENT THE REQUIRED UPRIGHTS TO THE FIRST SIDE AS ILLUSTRATED HERE.

STEP VII - CEMENT SECOND SIDE IN PLACE:
NEXT, APPLY A DROP OF CEMENT TO EACH CROSS-PIECE, AND DROP THE SECOND SIDE IN POSITION. ONCE AGAIN, THE BALSA ALIGNMENT TRIANGLE WILL COME IN HANDY.

STEP VIII - NOSE CROSS-PIECES:
MOST FUSELAGES FASCII TOWARDS THE NOSE, AS SEEN IN THE TOP VIEW AT THE EXTREME RIGHT. TO SIMPLIFY THIS PART OF THE ASSEMBLY, STRETCH A UPHOLSTERY AND CEMENT AT THE NOSE, AFTER THE CROSS-PIECES HAVE BEEN CEMENTED IN PLACE.

STEP IX - CHECKING ALIGNMENT:
WITH THE ALIGNMENT COMPLETE, THE REMAINING CROSS-PIECES MAY BE INSERTED.

STEP X - SANDING:
SAND THE ENTIRE STRUCTURE & GENERAL SANDING TO REMOVE ROUGH EDGES, LINES, AND EXCESS CEMENT.

CONSTRUCTION PRINCIPLES OUTLINED HERE ARE APPLICABLE TO MOST MODELS USING THIS TYPE FUSELAGE CONSTRUCTION.
FM DESIGN SHEETS
FUSELAGE PLANFORMS

FUSELAGE AND RUDDER PLANFORMS

BASIC FUSELAGE CROSS-SECTION SHAPES:

- CIRCLE
- SQUARE
- TRIANGLE
- DIAMOND
- ELLIPSE
- PARABOLA
- HEXAGON
- OCTAGON

GENERAL APPLICATIONS OF BASIC AND COMPOSITE PLANFORMS

CONTROL-LINE

TYPICAL SPEED:

NOTE: PLANFORM AND CROSS-SECTION SHAPES SHOWN FOR THE DIFFERENT TYPES CAN BE USED INTERCHANGEABLY, MANY TIMES TO GREATER ADVANTAGE.

TYPICAL STUNT:

TYPICAL TEAM RACERS:

FREE-FLIGHT

TYPICAL GAS:

NOTE: PLANFORM AND CROSS-SECTION SHAPES SHOWN FOR THE DIFFERENT TYPES CAN BE USED INTERCHANGEABLY, MANY TIMES TO GREATER ADVANTAGE.

TYPICAL RUBBER:

TYPICAL TOWLINE:

GENERAL APPLICATION OF MOMENT ARMS:

SPEED:

N.M.A.
TAIL MOMENT ARM
(2 1/2 TO 3 X N.M.A.)

STUNT:

N.M.A.
TAIL MOMENT ARM
(0 1/2 TO 2 X N.M.A.)

FOR MAXIMUM CONTROLLABILITY, LONG TAIL MOMENT ARM USES DESIRABLE CENTER OF GRAVITY; GENERALLY LOCATED AT THE MIDPOINT OF THE WINGSPAN. THE USE OF SWEEP FORWARD WING PANELS WILL AID IN OBTAINING A MORE DESIRABLE CENTER OF GRAVITY WITH MINIMUM FUSELAGE LENGTH.

RUBBER:

N.M.A.
TAIL MOMENT ARM
(1 1/4 TO 1 1/2 X N.M.A.)

MODERATELY LONG TAIL MOMENT ARM DESIRABLE, BUT NOT EASILY OBTAINABLE DUE TO LENGTH AND WEIGHT OF RUBBER MOTOR ARMS. TAIL MOMENT ARTICULATION WILL SPEED UP OF STABILIZING SURFACES ASSISTS IN OBTAINING A MORE DESIRABLE ARRANGEMENT.

TOWLINE:

N.M.A.
TAIL MOMENT ARM
(1 1/2 TO 2 X N.M.A.)

LONG TAIL MOMENT ARM BEST AND IS EASILY OBTAINED. BOUT AND SHORT TAIL MOMENT ARMS USED TO EASIER TOWING AND LIGHTER GLIDING. CIRCLE TAIL MOMENT ARM DESIRABLE. LONG TAIL MOMENT ARM DESIRABLE IN WINDY WEATHER. DELAYS IS USED TO OBTAIN CORRECT CENTER OF GRAVITY LOCATION.

GAS:

N.M.A.
TAIL MOMENT ARM
(3 1/2 TO 4 1/2 X N.M.A.)

LONG TAIL MOMENT ARM COMMONLY USED, BUT NOT ESSENTIAL. CENTER OF GRAVITY GENERALLY LOCATED IN 1/2 TO 1/3 FROM THE WING LEADING EDGE—EASY TO OBTAIN BEST POSITION BY SHIFTING LOCATION OF THE RADIO EQUIPMENT.

P.D.G.
STEP I - STUDY PLAN
THOROUGHLY FAMILIARIZE YOURSELF WITH THE PLAN BEFORE STARTING CONSTRUCTION.

STEP II - CUT OUT RIBS
IN MOST KITS, RIBS ARE ALREADY DIE-CUT.

STEP III - NOTCH TRAILING EDGE
WITH A RAZOR, NOTCH T.E. AS SHOWN, USE TAPERED TRAILING EDGE Stock.

STEP IV - RIBS
AFTER PULLING THE T.E. TO THE PLAN, CEMENT SOUTH END INTO THE HOLE AS INDICATED.

STEP V - LEADING EDGE
SELECT STRAIGHT-JOINED WARP-LESS WOOD FOR THE LEADING EDGE. PIN TO PLAY AS SHOWN, BRACKETING RATHER THAN PIERCING THE BALLS.

STEP VI - WING SPARS
THE WING SPARS ARE CEMENTED IN THE SAME NOTCHES, GLUING WITH THE TOP CAMBER OF THE RIB.

STEP VII - DIHEDRAL CHECK PLAN DIHEDRAL ANGLE FOR REQUIRED SLANT OR BEVEL ON THE SPAR AND WING EDGES.

STEP VIII - CEMENT GUSSETS
Cement Gussets to the Spans of One Panel Only, and allow to dry before joining both panels.

STEP IX - PLYWOOD GUSSETS
Most models, especially those larger than 1/2 inch plywood gussets at the dihedral and polycrystal breaks.

STEP X - CEMENT TO L.E.
FIRST CEMENT THE SHEET PLANKING TO THE LEADING EDGE AS SHOWN, AND ALLOW TO DRY FOR A FEW MINUTES, BEFORE GOING ON TO STEP XI.

STEP XI - JOIN WING PANELS
ALL END GRAIN SHOULD BE GIVEN A PRELIMINARY COAT OF CEMENT BEFORE THE PANELS ARE JOINED. AS SOON AS THE JOINT HAS GAINED SUFFICIENTLY, INSERT THE CENTER RIBS.

STEP XII - PLANKING
IF THE WING IN QUESTION REQUIRES PLANKING ALONG THE LEADING EDGE, FIRST CUT ITS WIDTH DOWN TO THE DISTANCE BETWEEN THE LEADING EDGE AND THE SPAR.

STEP XIII - CEMENT TO SPAR
APPLY CEMENT TO THE RIBS AND SPAR, AND PLAN PLANKING IN PLACE, UNTIL THOROUGHLY DRY.

STEP XIV - PLANK CENTER SECTION
THE TOP CENTER SECTION OF THE WING IS NOW PLANKED IN SUCH THE SAME MANNER AS THE BOTTOM CENTER SECTION. THE PLANKING PREVENTS DAMAGE FROM HANDLING AND WING RUBBER, AND ADDS STRENGTH.

STEP XV - CARVE L.E.
WIN A RAZOR OR A MODEL KNIFE. ROUGH CARVE THE LEADING EDGE TO HERE, AND THEN SAND AS REQUIRED.

STEP XVI - PLANK BOTTOM
THE RECESS LEFT BY THE SPAR USES. STEP XVI WILL NOW PERMIT THE FLUSH MOUNTING OF THE BOTTOM CENTER SECTION PLANKING.

STEP XVII - WING TIPS
THE MOST MODEL USES WING TIPS ARE THOSE THAT CAN BE CARVED FROM A SMALL BLOCK OF BALSA, BECAUSE OF CONSTRUCTION EASE. ROUGH CARVE IT TO SHAPES, THEN PUT IT IN SAND AND LET IT CEMENT IT IN FINAL CONTOUR AFTER IT IS CEMENTED IN POSITION.

STEP XVIII - CAPSTRIPS
APPLY A THIN FILM OF CEMENT OVER POINTS OF MACHINERY STRESS, SUCH AS TRAILING EDGE BREAKS ETC. SAND ENTIRE WING THROUGHOUT MEDIUM Grit, THEN FINE SANDPAPER.

STEP XIX - FINAL SANDING
CONSTRUCTION TIPS OUTLINED HERE MAY BE APPLIED TO STABILIZERS AS WELL.
CONSTRUCTION OF AN ELLIPTICAL PLANFORM

STEP ONE: CONSTRUCT RECTANGLE WHICH WILL ENCLOSE PROPOSED ELLIPTICAL PLANFORM. (MAXIMUM CHORD AND SPAN)

STEP TWO: DIVIDE RECTANGLE INTO TWO SECTIONS—ONE THIRD CHORD FOR LEADING EDGE SECTION AND TWO THIRDS CHORD FOR TRAILING EDGE SECTION. THIS ARRANGEMENT WILL PRODUCE THE MOST POPULAR FORM OF ELLIPTICAL PLANFORM TO BE ALIGNED, HOWEVER, THE SECTIONS CAN BE DIVIDED EQUALLY, REVERSED OR ALTERED IN ANY MANNER TO PRODUCE A GREAT MANY OTHER VARIATIONS OF THE ELLIPTICAL PLANFORM.

STEP THREE: DRAW TWO HALF CIRCLE ARCS FROM POINT OF INTERSECTION OF CENTERLINE, TANGENT (TOUCHING) TO THE LEADING AND TRAILING EDGES RESPECTIVELY.

STEP FOUR: CONNECT CORRESPONDING UNIT STATIONS BY PROJECTING THEM UNTIL THEY INTERSECT, PRODUCING POINTS ON THE ELLIPTICAL PLANFORM.

CONSTRUCTION OF A PARABOLIC PLANFORM

STEP ONE: CONSTRUCT RECTANGLE WHICH WILL ENCLOSE PROPOSED PARABOLIC PLANFORM. (MAXIMUM CHORD AND SPAN)

STEP TWO: DIVIDE RECTANGLE INTO TWO SECTIONS—ONE THIRD CHORD FOR LEADING EDGE SECTION AND TWO THIRDS CHORD FOR TRAILING EDGE SECTION. (MOST POPULAR ARRANGEMENT AS IN ELLIPTICAL PLANFORM—CAN ALSO BE ALTERED TO PRODUCE OTHER VARIATIONS.)

STEP THREE: DIVIDE SPAN OF RECTANGLE INTO EQUAL UNITS, SUBDIVIDING LAST REMAINING UNIT.

STEP FOUR: DIVIDE EACH SECTION OF THE CHORD INTO HALF THE NUMBER OF UNITS ON THE SPAN OF RECTANGLE.

STEP FIVE: CONNECT CORRESPONDING UNIT STATIONS BY PROJECTING DIAGONAL LINES.

STEP SIX: USING FRENCH CURVES DRAW IN PARABOLIC PLANFORM BY FOLLOWING THE INSIDE PATTERN OBTAINED FROM DRAWING THE DIAGONAL LINES.
FM CONSTRUCTION SHEETS
Balsa Fabricated Wings

TYPICAL TEMPLATE LAYOUT

"V" DIHEDRAL

Before starting construction, make full-size plans or templates as necessary for your particular model.

SINGLE-CURVE SHEET-BALSA WING
Mark outline of wing with pencil or ball-point pen.

Flexible balsa for curved sheet wing and stiff balsa for shaped, uncurved wings.

THIN SHEET BALSA AIRFOIL-SHAPED
POLYNHERDAL
POPULAR ON GLIDERS

CURVED SHEET Balsa WITH OR WITHOUT RIBS
FOR SMALL RUBBER AND GAS

BEVEL WING EDGES AT DIHEDRAL BREAKS
FLAT SHEET Balsa FOR SMALL RUBBER AND INDOOR MODELS

DOUBLE-SURFACE SHEET-BALSA WING
"Gull" dihedral

PUT A COAT OF CEMENT OVER EDGES AFTER SHAPING AND SANDING

DIHEDRAL BREAK
SHEET INSTALLATION

REFERENCE LINE
VARATIONS OF DOUBLE-CAMBER SHEET-BALSA WINGS

POPULAR ON CONTROL-LINE
FREE-FLIGHT SPORT

ADD TIP-SHEETING SEPARATELY

BEVEL LEADING EDGE AND TRAILING EDGE OF BOTTOM SHEET TO FIT A LOOP WITH TOP SHEET.

PIVOT UP FOR LOWER CURVE

N.A.C.A. TAPER METHOD
PIVOT MASTER RIB TEMPLATE (LARGEST RIB) AROUND A POINT ON LEADING EDGE UNTIL IT INTERSECTS REFERENCE LINE AT THE REQUIRED LENGTH FOR BOTH SURFACES.

PIVOT DOWN FOR UPPER CURVE

NEW LENGTH

EVERY OTHER LAYER CAN BE CROSS-DRAINED

DIHEDRAL BRACE
SLOT

PRELIMINARY SHAPING CAN BE DONE WITH A MODELER'S KNIFE.

DIHEDRAL BRACE

VARIATION OF LAMINATED WING

TRAILING EDGE
**FM DATA SHEETS**

**DETERMALIZERS AND HOOK-UPS**

**WEIGHT-SHIFTING DETERMALIZERS:**
- Spool Type
- Wing-tip Timer-Spool Arrangement

**DROP-WEIGHT TYPE**
- Recommended for hand-launch gliders

**FUSE**
- Thread is tied to rear part of fuselage

**TINFOIL PROTECTION**
- Saddle (not for bolts is fastened to threads)

**Cement Thread to Winter Tip**
- Opposite normal glide turn to right (turn, attach thread to left wing)

**TIMER**
- False back on timer

**FALSE BACK**
- Wingtip timer-aid arrangement

**TIMER WATPRMED WITH APPROXIMATELY 50 FT. OF THREAD**
- Sheet balsa on sides and top, divorced for clarity

**RUDDER-DISTURBANCE DETERMALIZERS:**
- Spin-Tab Type
- Split-Rudder Type

**TAB "SPIN" DETERMALIZER DEVELOPED BY DICK KORDA, WHICH CAN BE OPERATED BY FUSE OR TIMER.**

**Rudder "Split" Type Developed by Paul E. Del Gatto is fuse-operated, recommended for tailless aircraft.**

**STABILIZER-DISTURBANCE DETERMALIZERS:**
- Pop-up Types (Most Popular)
- Timer-operated Pop-up Type
- Pop-around Type

**TRIPPING DEVICES:**
- Fuse Type
- Snuffer Type

**FUSE SECURED TO TIMER ARM**
- Rubber band (pulls tail down)

**REMOTE TRIPPING DEVICE DEVELOPED BY JOHN TATONE**

**FUSE**
- A burning fuse is the most common tripping device. Hazard is minimized by having fuse rest in snuffer tube. A cylinder of dry ice can be inserted in snuffer tube instead of burning fuse.
**FM CONSTRUCTION SHEETS**

**COVERING MODEL AIRPLANES**

**FLAT SURFACES:**  
(DRY COVERING)  
USE A 50-50 MIXTURE AS AN ADHESIVE.  

**TYPICAL BUILT-UP FUSELAGE**

**MATERIALS REQUIRED**  
DOPP  
BRUSHES  
SCISSORS  
SANDPAPER  
RAZOR BLADE  
WATER  
ATOMIZER

**COVERING MATERIALS**  
SILK  
SILKSPAN

**COVERING WITH TISSUE PAPER:**

1. PRESS OUT ALL WRINKLES FROM TISSUE PAPER WITH A WARM IRON.
2. CUT STRIP FOR ALL OR PART OF ONE SIDE, DEPENDING ON LENGTH.
3. APPLY ADHESIVE ONLY TO LONGERONS AND DIAGONAL MEMBERS AT EACH END OF FRAME, IF SIDE IS BEING COVERED.
4. TRIM EXCESS WITH RAZOR BLADE.
5. TOP MUST BE COVERED IN SECTIONS AROUND THE PYLONS.
6. DAB TRIMMED EDGES WITH COVERING ADHESIVE WHERE NOT SECURELY ADHERED, AND SMOOTH OUT WITH FINGERS.

**VARIATIONS ON FLAT SURFACE COVERING:**

- COMPLETELY WOOD COVERED FRAMES CAN BE COVERED WITH TISSUE FOR DURABILITY.
- COVERING PROCEDE FOR FLAT-SIDED FUSELAGE WITH MORE THAN FOUR SIDES IS THE SAME.
- FOR ADDED STRENGTH, MODELS CAN BE DOUBLE-COVERED.

**CURVED SURFACES:**  
(WET COVERING)

1. PRE-DOPE FRAME TO PREVENT EXCESSIVE ABSORPTION OF MOISTURE.
3. DAMPEN COVERING MATERIAL BEFORE APPLYING TO SURFACE.

2. CLEAR DOPE - SMOOTH SAND BETWEEN COATS.
4. APPLY ADHESIVE TO THE WING LEADING AND TRAILING EDGES AND AT EACH DIHEDRAL BREAK.

5. START FROM CENTER AND WORK OUT.
6. AFTER COVERING INBOARD PANELS, COVER TIP PANELS FOLLOWING THE SAME PROCEDURE.

**VARIATIONS ON CURVED SURFACE COVERING:**

- ROUND FUSELAGES CAN BE COVERED LENGTHWISE, COVER A SMALL WIDTH AT ONE TIME.

- COVERING CAN ALSO BE APPLIED "WRAP AROUND" STYLE FROM FORMER TO FORMER.

- "ZIPPER" TYPE PYLONS WITH WET SILKSPAN OR SILK USE PINS TO HOLD IN PLACE.
FM DATA SHEETS

ELIMINATION OF STRUCTURAL WEAK SPOTS

COMMON TROUBLE SPOTS IN CABIN TYPE FUSELAGES:

- Final tab adjustment should be cemented.
- Weakness of this tab could be improved by inserting strips of wood across the cabin.
- A dorsal, so mounted, is apt to crack open top fuselage tissue.
- A stab rest is very important. Stab must be keyed in addition.
- If end grain is not given a pre-impregnated coat of cement, abrasion will weaken the joint. This is very important.
- Only the best of balsa should be used for longitudinals.

GEAR INSTALLATION:

Panels with strongest grain is not is good at all. Necessary bends should be held to a minimum and made with a great deal of care to avoid overstressing from too much adjusting.

Sheet metal gear should be bent with a slight radius rather than abruptly.

One of the best methods of rounding gear is with template brackets.

Note planting ply mount for 5.5 bend landing gear.

Sheet metal gear should be bent with a slight radius rather than abruptly.

There are many methods of constructing fuselages and each is best in a different manner. The structures below will give little trouble.

INTERNAL DAMAGE:

Panels with strongest grain is not is good at all. Necessary bends should be held to a minimum and made with a great deal of care to avoid overstressing from too much adjusting.

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EXTERNAL DAMAGE:

Panels with strongest grain is not is good at all. Necessary bends should be held to a minimum and made with a great deal of care to avoid overstressing from too much adjusting.

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One of the best methods of rounding gear is with template brackets.

Note planting ply mount for 5.5 bend landing gear.

Sheet metal gear should be bent with a slight radius rather than abruptly.

There are many methods of constructing fuselages and each is best in a different manner. The structures below will give little trouble.

MOTOR MOUNTS:

Beam mounts should be strong enough for good support, will laminating in place.

Batteries before crash.

Just a bad stall in the axle is enough to send object clear across 4 or 5 sheet sections, as soon as the nose is struck. Brace & Gasket.

WING STRUCTURAL PROBLEMS:

The general tendency today is to construct a wing from as few pieces as possible. Experienced warfield builders and such out but they still retain their desired strength. A model's wing must be stout and necessary strength-weight ratio.

The other 99% prefer a Scary structure as it is the raw of least resistance, and that is when the trouble starts.

1. If upon glancing at Panels 1 and 2, you feel the structure is too much, then you are one of the 99%. Panels 3 and 4 are the real bottlenecks. For the wariness, strength and aerodynamic qualities will be poor. This is the initial building time of Panels 1 or 2 may be a few minutes more. The panel will stand up against the roughs of active flying. Construction defects and advantages of each panel are itemized below.

Panel 1:

Gear joint should be strong. Use selected sheet, for plywood and sheet. With an additional cross brace, sand to a streamlined section.

Lack of a fuel drum allows fuel to soak into balsa.

Airfoil problems:

One to the relatively small cementing surface of the rib-trailing edge, it should be strengthened as illustrated below.

Trailing edge:

One to the relatively small cementing surface of the rib-trailing edge, it should be strengthened as illustrated below.

Choice of balsa:

Your model, like all with a weak link, is only as strong as the weakest piece of balsa in it. Nothing but perfect balsa should be used for warfield members.

Landing impact:

A burlap bag,_{ insted of landing wires to prevent folding wings on hard landings, as the last.}

In the same order, you must get rid of the stresses for inverted ground contact.

In this way the top spar and sheet build the load.

Vibration:

Vibration is the unseen model killer!

Do not use pine mount holes drilled too close to end may cause out as produced. Racial mountains are in widest use. This may be adjusted easily, mounting is simple. Firewall must be cemented securely.

Warp alignment:

A drastic way to improve, and warp has flying surfaces, obscured the viewer. But if you don't understand the cause and effects of wind, you have better avoid supply results like the example above. Wing and star must be aligned in the same manner, star must be firm. Lock star with come pins to prevent side movement.

Remove warps with hot water or steam.

Repair:

Use good cement.

Wires must be returned to condition above can be reinstalled with flat gusset or splice.

Wires must be returned to condition above can be reinstalled with flat gusset or splice.

Gusset must be made at home. Double coat with slow drying model cement.

Do the job right to avoid a repetition on the field.
WOOD FINISHING:

MATERIALS REQUIRED:
- CLEAR DOPE
- MASKING TAPE
- PAINTING VARNISH (ANTHRAZINE)
- SOFT CLOTH
- BRUSHES
- WAX
- CEMENT

GENERAL PROCEDURE:

STEP ONE: FUEL-PROOF INSIDE OF FUSELAGE WITH CLEAR FUEL-PROOF DOPE. IF FUEL TANK IS INTERNALLY MOUNTED OR WHEREVER IT MAY BE EXPOSED TO FUEL.

STEP TWO: WHEN BASIC STRUCTURE HAS BEEN COMPLETELY ASSEMBLED AND SMOOTH-SANDING CERAMICS EXTERNAL, SURFACE FINISHING BY BRUSHING ON TWO TO THREE COATS OF SANDING SEALER; SMOOTH-SAND BETWEEN EACH COAT.

STEP THREE: IF LIGHT WEIGHT IS NOT AN IMPORTANT FACTOR, BRUSH ON TWO COATS OF AUTO-PRIMER, SMOOTH-SANDING BETWEEN COATS. THREE TO FOUR COATS OF MEDIUM-CONSISTENCY CLEAR FUEL-PROOF DOPE ARE THEN BRUSHED ON.

STEP FOUR: AFTER DIPPING, SPRAY ON AT LEAST FOUR COATS OF CLEAR-LACQUER DOPE OR BRUSH ON AT LEAST THREE COATS. PERMIT THOROUGH DRYING BETWEEN EACH COAT.

STEP FIVE: MASK OFF AREA TO BE COLORED. TRIMMED AND CLEAR COATING INSIDE EDGE OF MASKING TAPE TO PREVENT THE COLORED DOPE FROM SEEPING UNDER. SPRAY OR BRUSH ON THREE TO FOUR COATS OF CLEAR-LACQUER DOPE OR BRUSH ON THREE COATS OF CLEAR-LACQUER DOPE (COATING) WHEN DRY, RUB DOWN SURFACES TO A HIGH GLOSS USING A SOFT CLOTH AND RUBBER COMPOUND.

PAPER FINISHING:

STEP ONE: FIRST BRUSH ON TWO COATS OF UNTHINNED CLEAR FUEL-PROOF DOPE. PERMIT THOROUGH DRYING BETWEEN COATS; SMOOTH-SANDING BETWEEN EACH COAT.

STEP TWO: ADD SOME THINNER TO CLEAR DOPE TO REDUCE CONSISTENCY AND BRUSH ON TWO TO THREE COATS; SMOOTH-SANDING BETWEEN EACH COAT.

STEP THREE: BEFORE APPLYING COLOR TINT, MASK OFF AREA TO BE TRIMMED WITH MASKING TAPE.

STEP FOUR: CLEAR DOPE THE INSIDE EDGE OF MASKING TAPE TO PREVENT THE COLORED DOPE FROM SEEPING UNDER WHEN APPLIED TO WING SURFACES.

STEP FIVE: APPLY TWO TO THREE COATS OF MEDIUM CONSISTENCY DOPE TO MASKED LEADING EDGE SURFACES.

STEP SIX: APPLY DECALS TO SURFACES FOR ADDED APPEAL.

STEP SEVEN: SPRAY LIGHT FILM OF CLEAR DOPE OVER DECALS TO SECURE PERMANENTLY IN PLACE.

STEP EIGHT: FOR ADDED LUSTRE RUB DOWN SURFACES WITH WAX, USING A SOFT CLOTH DAMPENED WITH LIQUID OR SOLID WAX.
BELLCRANK AND CONTROL HORN DESIGN

HOW IT OPERATES: As the handle is moved, the lines move back and forth pivoting the bellcrank. The bellcrank moves the pushrod which connects with the horn to move the elevator.

TYPICAL BELLCRANK DESIGN

CONTROLLING DEGREE OF RESPONSE

CONTROLLING RATE OF ACCELERATION

FOR SPECIAL PURPOSES: HORN ON TOP FOR SLOWER RATE OF ACCELERATION

ASYMMETRICAL BELLCRANKS CAN BE USED TO VARY UP AND DOWN RELATIONSHIP

TYPICAL CONTROL HORN DESIGN

CONTROLLING RATE OF ACCELERATION

NOTE: A control horn is fundamentally one half of a bellcrank.

DESIGN REQUIREMENTS

TO MAINTAIN LINE TENSION:

A. Offset rigging
B. Stagger lines slightly rearward
C. Add ballast to opposite wingtip
D. Offset engine
E. Make inboard wing longer

FLAP CONTROL

NOTE: FLAP CONTROL DESIGN IS SIMILAR TO THAT SHOWN FOR ELEVATORS.

FLAP ROD ON OUTSIDE [Faster Rate of Acceleration]
ELEVATOR ROD ON INSIDE [Slower Rate of Acceleration]

FLAP HORN LONGER [Greater Degree of Response]
ELEVATOR HORN SHORTER [Lesser Degree of Response]

DESIGN REQUIREMENTS
FM DATA SHEETS

LANDING GEARS AND SYSTEMS

BASIC INFORMATION
PIANO WIRE IS THE MOST WIDELY USED MATERIAL FOR LANDING-GEAR STRUTS.
THIS IS TRUE FOR BOTH FREE-FLIGHT AND CONTROL-LINE MODELS.
IT CAN BE OBTAINED AT HOBBY SHOPS IN SIZES UP TO 0.0" IN DIAMETER.

DO NOT HEAT WIRE WHEN MOUNTING.
BEND OVER ROUNDED EDGE.
WIRE MUST BE CLEAN AND BRIGHT BEFORE SOLDERING.
HEAT SURFACES WELL ALLOW SOLDER TO FLOW THROUGH WRAPPING.
DON'T BEND WIRE OVER SHARP EDGE

TYPE "A" MOUNTING
"A" BOLTS THROUGH PLYWOOD FIREWALL

WASHER
NUT
PIANO WIRE
PLYWOOD

TWO-WHEEL LANDING GEAR
THE STANDARD TWO-WHEEL GEAR IS
BY FAR THE MOST POPULAR IN USE TODAY.
THIS TYPE GEAR MAY BE USED ON ALMOST
ALL KINDS OF MODEL PLANES USING FIREWALL OR FORMER CONSTRUCTION.
IT CAN BE MOUNTED EITHER BY METHOD "A" OR "B"

SINGLE-WHEEL GEAR
CAN BE SEWN WITH SMALL WIRE AND SOLDIERED AT BOLTS ARE NOT AVAILABLE

SHEET-METAL GEAR
WASHERS
PLYWOOD PANEL, FIRMLY ANCHORED IN FUSELAGE

BEND OVER ROUNDED EDGE
TAP OUT HOLE FOR AXLE
24-ST ALUMINUM SCREW USED AS AN AXLE
STRIPE WASHERS
NUT
LOC K NUT
BOLT
WHEEL OUTLINE

WING-MOUNTED GEAR
GEAR IS BOUND TO WING SPARS WITH HEAVY THREAD AND CEMENTED SECURELY IN PLACE

WING CENTER SECTION SHOULD BE REINFORCED TO TAKE LANDING SHOCKS

SCALE LANDING GEAR
MOUNT IN FUSELAGE IN THE CONVENTIONAL MANNER
Balsa Fairens May be Added
Shock Bars Made from Lighter Wire Than Main Gear

THIS TYPE OF GEAR MAY BE USED ON FLYING SCALE, STUNT AND SPORT MODELS.

POP-UP GEAR
BRASS TUBING
PIANO WIRE
PLYWOOD HOOKS
PIANO WIRE
BRASS TUBE BUSHING BURIED IN FUSELAGE

THREE TYPE OF LANDING GEAR USED IN MODELS THAT HAVE THEIR ENGINES MOUNTED HIGH ENOUGH FOR THE NEEDS WITHOUT NECESSITATING A CONVENTIONAL LANDING GEAR.

SINGLE-WHEEL SKID
PLYWOOD FORMER
HALF-HARD ALUMINUM STRAP
PIANO-WIRE AXLE

TAKE-OFF DOLLY
ALL PARTS OF DOLLY THAT CONTACT MODEL ARE WRAPPED WITH RUBBER TAPE.

DROP-OUT GEAR
WRAP ALL CONNECTIONS AND SOLDIER WELL

THE USE OF DROP-OUT GEARS HAS BEEN CONSIDERABLE IN SMALL MODEL MODELS ALMOST EXCLUSIVELY.

TYPES OF RUBBER-TIRED WHEELS
STREAMLINE SPIRES ON SOLID RUBBER WITH BRASS
TREADED SEMIMETALLIC ALUMINUM HUBS
BALLOON FULLY PNEUMATIC WOODEN OR ALUMINUM HUBS

WHEEL ATTACHMENT
FLOAT GEAR IS MOUNTED CONVENTIONALLY IN FUSELAGE

SKI ATTACHMENT
WASHER SOLDERED HERE
SOLDERING WASHER TO AXLE IS THE MOST COMMON METHOD
ON SMALL MODEL MODELS A PIECE OF FUEL LINE MAY BE FITTED ON THE AXLE TO HOLD THE WHEEL ON.
FM DATA SHEETS

FUEL TANKS AND SYSTEMS

FREE-FLIGHT

EVE-DEPOT TANK
TANK IS FASTENED TO SIDE OF FUSELAGE. COMMERCIAL VERSIONS ARE AVAILABLE.

FUEL LINE TO ENGINE

STRAIGHTENING ROD
CALIBRATIONS ARE DETERMINED BY LEVELS OF FUEL FOR DIFFERENT ENGINE RUNS.

HOLLAND INTERNAL TIMER TANK
ENGINE IS STARTED AND ADJUSTED USING FULL SHOCK LOAD OF TANK AT LAUNCH. THIS TANK ALSO ACTS AS MOTOR MOUNT.

ENGINE RUN FROM LOWER CELL IS ADJUSTED BY ADDING BALSA BLOCKS OR LEAD SHOT.

TANK IS USED IN MANY CLASSES OF MODELS.
A VARIATION OF THE "CLANK TANK" IS ALSO USED IN R/C (SEE STUNT TANKS).

STANDARD TYPE F-F TANK
AVAILABLE COMMERCiALLY IN MANY SIZES. ALSO HOMEBUILT FROM TIN-CAN STOCK.

VENT & FILLER
FUEL LINE TANK
CONSISTS OF A COIL OF FUEL LINE, THE LENGTH OF WHICH DETERMINES THE ENGINE RUN.

STARTING TANK
PULL OFF FUEL LINE AT LAUNCHING.

TIMERS TO LIMIT ENGINE RUNS

TIMER-FUEL SHUT-OFF
TURNING THE KNOB GIVES A WIDE SELECTION OF ENGINE RUNS. SINEE IT CONTROLS THE AMOUNT OF AIR RELEASED.

CLOCKWORK TIMER
TRAVEL ROD SQUEEZES THE FUEL LINE, SHUTTING OFF THE ENGINE.

TIMERS TO LIMIT ENGINE RUNS

TANKS AND ACCESSORIES MAY BE BOUGHT TO FIT YOUR MODEL.

RADIO-CONTROL

TYPICAL R/C TANK
THIS TANK IS PRACTICALLY A STANDARD FREE-FLIGHT DESIGN.

PLASTIC TANK
MADE FROM TIN-CAN STOCK.

VEE BOTTOM IS FOR LAST DROP CONSUMPTION.

JIM WALKER PRESSURE TANK
RUBBER BANDS APPLY PRESSURE TO FILLER CAP.

WALKER TANK ALSO USED IN MANY CLASSES OF MODELS.

CONTROL LINE

STUNT, SPORT & FLYING SCALE

TYPICAL "WEDGE" TANK
TYPICAL "WEDGE" TANK IN THE STUNT SHOULDS DESPITE THE FACT THAT IT OUTS PERHAPS WITHOUT WARNING.

THIS IS A VERY POPULAR TANK IN THE STUNT. SHOULDS DESPITE THE FACT THAT IT OUTS PERHAPS WITHOUT WARNING.

ENGINE SHOULDS BE STARTED AND ADJUSTED USING FULL SHOCK LOAD OF TANK AT LAUNCH. THIS TANK ALSO ACTS AS MOTOR MOUNT.

ENGINE RUN FROM LOWER CELL IS ADJUSTED BY ADDING BALSA BLOCKS OR LEAD SHOT.

STUNT TANKS MAY BE PURCHASED IN A VARIETY OF SHAPES & SIZES TO FIT YOUR MODELS.

TRUE PRESSURE TANK

TYPICAL R/C AIR-SSPEED TANK
BUILD SPEED TANK TO FIT EACH INDIVIDUAL MODEL.

AIR PRESSURE IS BLEED FROM CRANKCASE THROUGH A 3/8 IN. HOSE DRILLED IN A 4-40 FLATHEAD MACHINE SCREW TAPPED IN ENGINE BUSHING.

ENGINE SHOULD NOT BE STARTED JUST AS HIGH AS THE TANK.

FROM TIN-CAN STOCK, WELL SOLDERED.

TEAL RACING

LENGTH X WIDTH X DEPTH MUST BE MORE THAN 1.80 CU. IN.

NO MORE THAN ONE OUNCE OF FUEL ALLOWED IN THE ENTIRE FUEL SYSTEM.

NAVY CARRIER EVENT

TWO-SPEED, TWO NEEDLE-VALVE SETUP
CARVE SHAPE OF TANK FROM WOOD, SLIGHTLY UNDERSIZE.

TANK CONSTRUCTION

CARVE SHAPE OF TANK FROM WOOD, SLIGHTLY UNDERSIZE.

UNLAPSE SOLDER ON THE BLOCK KNOCK-UPS. THIS SYSTEM IS IDEAL FOR SMALL MODELS WHERE SPACE IS AT A PREMIUM.

SLIP OUT BLOCK & INSTALL TUBES
WRAP SHOULDS WITH TIN CAN STICK TO WIDTH.

FINISH OFF BY SOLDERING IN THE END PLATES.

1. MAKE FROM TIN-CAN STOCK.
2. WALKER TANK ALSO USED IN MANY CLASSES OF MODELS.
3. A STANDARD TANK IS USED IN THE "CLANK TANK".
4. THIS TANK IS ALSO USED FOR AEROBATICS IN RADIO CONTROL. "F-F" MODELS.
5. AN ELECTRIC STARTER SHOULD BE USED.
6. TRUE PRESSURE TANK
7. PEN-BLADDER PRESSURE TANK
8. BINDER BALLOON
9. PULL UP OR DOWN CONTROL ACTUATOR SHUT-OFF.
10. TEST SHUT-OFF SYSTEM THROUGHOUT OR ON THE GROUND BEFORE TEST FLYING.
11. FROM TANK TO ENGINE.
12. SECONDARY PUSHROD TO BELLCRANK TO STAR.
**FM DATA SHEETS**

**PROPELLER INFORMATION**

**PROPELLER CLASSIFICATIONS**
- GAS MODEL PROP
- RUBBER MODEL PROP
- INDOOR MODEL PROP

**PROPELLER FACTS**
- The purpose of a prop is to convert the energy of the power unit into forward motion (thrust).
- Diameter is the distance from tip to tip of the prop.
- The prop blade is the surface which pushes or pulls the model through the air. This prop has two blades.
- Low pitch props provide power for low air speeds.
- High pitch props provide power for high air speeds.

**PROPPELER MECHANISMS**
- The rotation of the propeller keeps the blades extended by centrifugal force while power is on. With power off, the blades fold back against the fuselage into the path of least resistance.
- Folding prop
- Free-wheeling prop
- Variable pitch prop
- Feathering prop

**POPULAR PROPELLER TYPES**
- Two-bladed & Four-bladed props are generally used for scale or sport models.
- Three-bladed & Four-bladed props are considered very efficient and have been used on all types of models.
- Single-blade props are most often used on high performance rubber-powered models, but have also been used successfully on gas models.

**PROPPELLER SELECTION**
(Recommended prop sizes, in inches, for various models)

**FREE-FIIGHT GAS CONTROL-LINE**

**LIMITED RUBBER WAKEFIELD**

**INDOOR STICK**

**INDOOR CABIN**

**THE PITCH SHOWN IN THESE TABLES IS THE THEORETICAL PITCH.**
RUNNING A NEW ENGINE

STEP 1
ESSENTIAL EQUIPMENT
- MOTOR MOUNT
- PROPELLER
- FUEL TANK
- CLAMP
- BOOSTER BATTERY
- FUEL LINE

STEP 2
- BOLT ENGINE TO MOTOR MOUNT
- SECURE TANK
- FASTEN COMPLETED UNIT TO WORKBENCH WITH C-CLAMP

STEP 3
- ADD PROPELLER RECOMMENDED FOR BREAK-IN PERIOD AT BEST POSITION FOR FLIPPING

STEP 4
- FILL FUEL TANK AND OPEN NEEDLE VALVE TO RECOMMENDED POSITION FOR STARTING, ACCORDING TO MANUFACTURER'S INSTRUCTIONS
- CHOOSE OR PRIME
- INSERT FUEL
- COVER WEBSITE BEFORE FLIPPING PROP THROUGH EXHAUST PORT

STEP 5
- CHOOSE OR PRIME ENGINE TO ALLOW EXTRA FUEL INTO THE CYLINDER HEAD FOR STARTING

STEP 6
- ATTACH BOOSTER BATTERY LEADS AND FLIP PROPELLER UNTIL ENGINE STARTS

STEP 7
- WHEN ENGINE STARTS REMOVE LEADS. THEN ADJUST NEEDLE VALVE FOR SMOOTH RUNNING

IF ENGINE REFUSES TO RUN CHECK FOR:
- WEAK BATTERIES: MOMENTARILY CROSS LINES AND CHECK FOR SHORT
- DEFECTIVE GLOW PLUG: REMOVE PLUG AND TEST FOR GLOW WITH TEST JEWEL CONNECTED
- FUEL MIXTURE: ALWAYS USE FRESH CLEAN METER RECOMMENDED BY MANUFACTURER
- DEFECTIVE IGNITION SYSTEM: CHECK FOR BROKEN WIRE OR FRACTURED STRANDS

P.O.G.
ENGINE SPEED CONTROLS

1, 2, and 3 are glow type engines. 4 and 5 are ignition.

**Exhaust Restrictor (Two Speed)**
- Exhaust Choke
- Torque Rod
- Bearing
- Wire Torque Rod
- Yoke
- Fuel Line
- Crank
- Air Bleed Hole for Low Speed

**Ignition (Two Speed)**
- Spark Plug
- Slot
- Crank
- Simple Single Escapement (Bonner)
- Coil
- SPST Switch Socket
- Plug
- High Tension Lead
- Plane Batteries
- Booster Batteries
- Dual Breaker Points
- Condensers

**Choke (Two Speed)**
- Self Neutralizing Servo (Bonner)
- Wire Push Rod

**Throttle (Infinite Speed)**
- Bramco Or K B B Throttle
- Fuel Line

**Two Speed Pressurized**
- High Speed Needle Valve
- Walker Pressure Tank
- Mount Vertical
- Air Line

**Two Speed Single Air Line**
- Bonner Engine Speed Escapement
- Size of this hole determines low speed
- Eyedropper Bulb
- Snap fit on intake
- Air Line
- Fuel Line

**Two Speed Dual Air Lines**
- Three Speed Dual Air Lines
- Fabricate Arm
- Remove & Relocate
- Added Clapper
- Bushing
- Spring

**Modification to Bonner Engine Speed Escapement**
- Both Open High Speed
- One Open Cruise
- Both Closed Idle

**Engine Speed Controls**

To adjust: Close high speed needle valve fully then set motor control escapement to low speed position. Air bleed closed then start engine and adjust engine needle valve for desired low speed rpm's. Move motor control escapement to high speed position and adjust air bleed needle valve for desired high speed rpm's.
FORCES AND ADJUSTMENTS:

THrust Adjustments:
The thrust of the engine is of primary importance in controlling the flight under power. Down thrust is used to control looping tendencies, while left and right side thrust control turns in climb.

PERPENDICULAR MOUNTED ENGINES MAY BE GIVEN SIDE AND DOWN THRUST WITH WASHERS INSERTED BEHIND CRANKCASE. IF TOO TIGHT TO LEFT UNDER LOW POWER, ADD RIGHT THRUST IN SMALL DROPS. IT MAY ALSO PROVE NECESSARY TO ADD MORE DOWNTHRUST.

ADJUST LEFT OR RIGHT THRUST TO BE PREPARING ENGINES IS MORE DIFFICULT. AT TIMES IT MAY BE POSSIBLE TO MOUNT YOUR ENGINE ON ITS SIDE, AND ADD WASHERS ON MOUNTING BS.15 AS SHOWN HERE. ORLING MOLD IN MOUNTS WILL ALLOW ADJUSTMENT.

TRIMMING GLIDE:
Test glide model into wind to check incidence and turn characteristics.

GLIDE TURN:
If model tends to dive, add incidence under leading edge of wing or stab trailing edge.

GLIDE TURN:
If slight stall increases with each dip, remove a little incidence.

FIRST POWER FLIGHT:
Place prop on back barrel and thrusts escape down. Call out a 45 degree angle. If and 2nd motor run is advisable. Test over rough terrain. Observe motor flight and glide for further trim.

WASH-OUT:
Warping trailing edge of wing tip down is called wash-out. This keeps tip from stalling. Leave out before the main panels.

WASH-IN:
Warping the trailing edge of wing tip down is called wash-in. When model is in tight circle, this helps keep nose up.

ALIGNMENT:
Both wing and stab should be kept tight to maintain alignment.

DANGEROUS ADJUSTMENTS:
Left clamp and glider, or right clamp and glider is a little tricky. So be careful. If model accelerates too much under power, and starts to spin in as motor cuts, the glide trim will not act to pull model out, as with an opposite circle.
TROUBLE-SHOOTING FOR BETTER FLIGHTS

The drawings on these pages illustrate the basic types of improper flight along with some of the solutions which are commonly used. But remember, correct flight adjustments are difficult to achieve when you have to combat structural or design defects. So, before you start trimming your model for flight, make preflight checks to see that everything has been done according to the plan and the designer's specifications.

The power plant you use is a very important factor. If it is larger than that which has been recommended, you will have to exert extra caution when adjusting. On the other hand, a smaller power plant gives you more leeway. Top-notch flights will depend on how good the adjustments are for the power that is available for the climb—and the glide trim.

Excessive warps which occur during the construction of the model should be doped or steam out. Minor warps generally can be disregarded. Detachable flight surfaces can be the cause of flight variations unless they are keyed into place. Check to see that each unit is correctly aligned with the other units. If flight performance is still erratic, try the suggestions here-with:

STALL ADJUSTMENTS
(Try one or more of these for stall adjustment)

TILT WING DOWN
DECREASE Rudder area
THICKENNESS OF WEDGE
AS NEEDED OR TILT STABILIZER UP
ADD WEIGHT
TO NOSE CENTER OF GRAVITY
TO RESTORE PROPER BALANCE

DIVE ADJUSTMENTS
(Try one or more of these for dive adjustment)

TILT WING UP
INCREASE Rudder area
THICKENNESS OF WEDGE
AS NEEDED
OR:
ADD WEIGHT TO TAIL
TO RESTORE PROPER BALANCE
OR:
SLEW WING TOWARDS TAIL
IT IS POSSIBLE TO DO THIS WITHOUT MOVING IT A LITTLE AT A TIME
OR:
INCREASE STABILIZER AREA
AS NEEDED OR AS IN MOST SCALE MODELS
OR:
FOR POWER DIVE ADJUSTMENT TILT ENGINE OR NOSE BLOCK
UPWARD FORCES WASHES, WINDERS OR OTHER MATERIAL BEHIND ENGINE OR NOSE BLOCK

RECOVERY ADJUSTMENTS
(Try one or more of these for recovery adjustment)

TILT ENGINE OR NOSE BLOCK DOWNWARD IF MODEL LOOPS UNDER POWER PREVENTING A GOOD CLIMB AND RECOVERY
OR:
CHECK WING POSITION TO BE IN WING OR HINGE NOSE BLOCK FOR IMPROPER SETTING WILL RESULT IN POOR RECOVERY
IF MODEL OR NONE AT ALL
OR:
CHECK BALANCE FOR MODEL MAY BE CENTER OF GRAVITY LOCATION SHIFTS POSITION WITH BALLAST AND RETRIM ACCORDINGLY

SPIN ADJUSTMENTS
(Try one or more of these for spin adjustment)

SEND THE RUDDER IN TO THE SPIN OR SPIN SPREAD OUT WHICH IS TOO TIGHT
OR:
ADD A TRIM TAB TO THE SPIN OR SPURAL OR SPIN BEND TAB
OR:
SLEW SPURAL OR NOSE BLOCK UPWARD FORCES WASHES, WINDERS OR OTHER MATERIAL BEHIND ENGINE OR NOSE BLOCK

RECOVERY TRANSITION
LOOPING IS THE RESULT OF INEFFECTIVE CONTROL OF HIGH POWER
STALLED RECOVERY IS THE RESULT OF NOT ALLOWING ENOUGH FLEXIBILITY OF FORCES WHEN POWER IS CUT OFF

TRUE SPIN BELONGS TO THE FREE-FLIGHT MODELS
EXCESSIVE SPINNING THROUGH NOT DESTRUCTIVE LIMITS PERFORMANCE

DO NOT FLY LIKE THIS
IF YOUR MODEL STALLS AND RECOVERS INDEEDENTLY THEN IT IS INCORRECTLY TRIMMED
DO NOT FLY LIKE THIS
IF YOUR MODEL STALLS AND YOU HAVE NO SIGN OF PULLING INCORRECTLY TRIMMED

DO NOT FLY LIKE THIS
NOTE: DO NOT CONFUSE A STALL WITH A DIVE
IF YOUR MODEL DIVES AND COMES TO A STOP OF PULLING INCORRECTLY TRIMMED

A GOOD RECOVERY RESULTS WHEN NO ALTITUDE IS LOST AND A CAMB OF ATTITUDE WHEN POWER IS CUT OFF
FM DATA SHEETS
R/C CONTROL SYSTEMS

DETAIL OF WINDING PLUG
RUBBER SLEEVE
RUBBER MOTOR
NEUTRALIZING SPRING [LIGHT]
SCREW WASHER
STABILIZER
BALSA STOP
RUBBER AND UP ELEVATOR
DRILL 1/16 DIA HOLE
SECOND POSITION
KICKER ARM 1/16 WIRE
ESCAPMENT ARM
BEARING
ELEVATOR NEUTRAL
ELEVATOR UP
OPERATION: ELEVATOR ARM IS CAUGHT BY THE ESCAPMENT IMMEDIATELY UPON LEAVING THE SECOND POSITION. THIS MOVES THE ELEVATOR UP. WHEN THE SIGNAL IS CUT OFF, THE ESCAPMENT NEUTRALIZES THE ELEVATOR ARM TO SLIP OFF AND NEUTRALIZE THE CONTROL. THE ELEVATOR MOVES TOO FAST TO BE EFFECTIVE WHEN ONLY THE RUBBER IS USED.

AILERON LINKAGES
NOTE: DIFFERENT TYPES OF BALANCED SURFACES, NOT TO EXCEED 25% OF TOTAL AREA.

1 AND 2 ARE CONCEALED TYPE LINKAGES, 2.5 AND 4 ARE ADJUSTED BY BENDING. 3 AND 6 ARE COMPLETELY ADJUSTABLE, USED ON ELEVATORS AS WELL. 7 GIVES UP ELEVATOR WITH RIGHT AND LEFT RUBBERS. SINGLE TORQUE ARM REQUIRED.

AILERONS MUST BE RIGGED DIFFERENTIALLY. IS SHORTER THAN B, THEREFORE THE AILERON WILL MOVE UP FURTHER THAN IT MOVES DOWN. EQUAL MOVEMENT CAUSES A YAWING ACTION OPPOSITE TO THE DESIRED TURN. THIS IS CAUSED BY THE MORE PRONOUNCED DRAG OF THE DROPHORN AILERON.
SEVEN CHANNELS WOULD BE DESIRABLE TO OPERATE A FULL COMPLEMENT OF CONTROLS, RUBBER, ELEVATOR, AILERON AND ENGINE SPEED. HOWEVER, WITH THE EXISTING FIVE CHANNEL EQUIPMENT A COMPLETE CONTROL SYS-

PUSHROD
1/16 WIRE
REVERSIBLE SERVO
BUSHING
YOKES ALTERNATE
PULLEY
TENSION SPRING
NYLON LINE
REVERSIBLE SERVO
ALTERNATE TYPICAL HORN

ALTERNATE REVERSIBLE SERVO

AILERON AND ENGINE SPEED, HOWEVER, WITH THE EXISTING FIVE CHANNEL EQUIPMENT A COMPLETE CONTROL SYS-

BOB COON

BOB COON
AIRFOIL TERMS—WHAT THEY MEAN:

UPPER CAMBER: The upper curvature of the airfoil.
LOWER CAMBER: The lower curvature of the airfoil.
POSITIVE VALUES ARE LOCATED ABOVE DATUM LINE.
NEGATIVE VALUES ARE LOCATED BELOW DATUM LINE.

DATUM LINE: A REFERENCE LINE ABOVE AND BELOW WHICH THE POINTS FOR THE AIRFOIL CURVE ARE PLOTTED.

STATIONS: Positions at which the points for the airfoil curve are to be plotted. Values are actually percentages of the airfoil length measured from the leading edge of the airfoil.

N.A.C.A. 6412

LEADING EDGE RADIUS: 1.5X SLOPE OF CURVE: 6/50

AIRFOIL ORDINATES: Each airfoil has a table of values which when transferred to the corresponding stations on the layout, above and below the datum line, will indicate the points for the airfoil curve. The total airfoil length is considered as 100% with the table of values directly related. Example: 123/123% located below datum line at the specified station.

N.A.C.A. CODE BREAKDOWN

N. A. C. A. 6 4 1 2

MAXIMUM AIRFOIL THICKNESS IS 16% WITH RESPECT TO ITS LENGTH.

SLOPE OF RADIUS: When a slope is given for the leading edge radius, it is to indicate that its center is not located on the datum line but rather on a diagonal line referred to as the SLOPE OF THE RADIUS. A proportion is given as in the N.A.C.A. 6412 FOR ITS CONSTRUCTION.

PLOTTING THE AIRFOIL

STEP ONE: SELECT AN AIRFOIL LENGTH TRYING TO USE A SIZE WHICH CAN BE EASILY SUBDIVIDED INTO TEN MAIN STATIONS AND WHERE REQUIRED INTO SUB-STATIONS. EXAMPLE: A 64 AIRFOIL LENGTH WILL BREAK DOWN INTO TEN MAIN STATIONS & APART, ONE PERCENT EQUALLING .

STEP TWO: LOCATE TEN MAIN STATION POINTS.

STEP THREE: LOCATE ALL OTHER STATION POINTS.

STEP FOUR: DRAW GRID LINES PARALLEL TO ABOVE AND BELOW DATUM LINE AND SPACED APART 1% - 2% OF THE AIRFOIL LENGTH. WRITE THIS STEP OPTONAL, BUT ADVISABLE FOR MODELS WITHOUT PREVIOUS PLOTTING EXPERIENCE.

STEP FIVE: USING TABLE OF ORDINATES LOCATE VALUES FOR UPPER AND LOWER CAMBER AT DESIGNATED STATIONS. NOTE: HORIZONTAL LINES SHOWN FOR CLARITY.

STEP SIX: USING FRENCH CURVES CONNECT THE PLOTTED POINTS TO OBTAIN THE AIRFOIL OUTLINE.

STEP SEVEN: USING TABLE OF ORDINATES LOCATE VALUES FOR UPPER AND LOWER CAMBER AT DESIGNATED STATIONS. HORIZONTAL LINES SHOWN FOR CLARITY.

STEP EIGHT: USING FRENCH CURVES CONNECT THE PLOTTED POINTS TO OBTAIN THE AIRFOIL OUTLINE.

SIX POPULAR AIRFOILS

CLARK Y
RECOMMENDED FOR FREE-FIIGHT GAS, RUBBER, TOWLINE AND U-CONTROL SPORT OR BASIC DESIGNS.

GRANT X-8
RECOMMENDED FOR U-CONTROL SPORT AND SPEED DESIGNS.

R.A.F. 32
RECOMMENDED FOR U-CONTROL SPORT AND SPEED DESIGNS.

DAVIS
RECOMMENDED FOR FREE-FIIGHT GAS, RUBBER, TOWLINE AND U-CONTROL SPORT OR BASIC DESIGNS.

N.A.C.A. 6409
RECOMMENDED FOR U-CONTROL SPORT AND SPEED DESIGNS.