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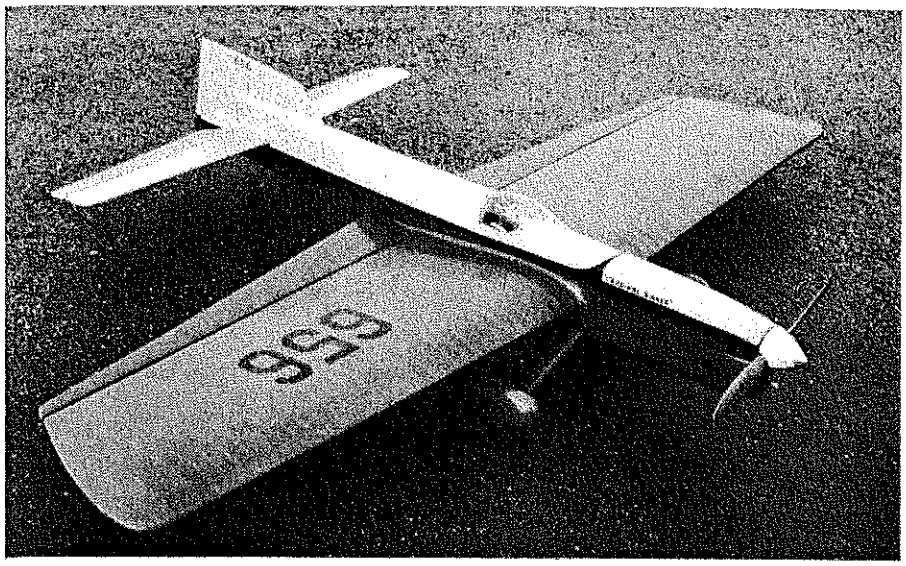


Purposeful and pretty, the model is displayed here with elevators and flaps displaced to 35 degrees—which is adequate. It's light construction contributes to tight turning ability. Although light, the model is strong.

Cardinal Sinner

THROUGH THE YEARS control-line stunt has provided the author with many hours of pleasure, both in the construction of a long line of models and in the thousands of patterns flown. The ever-present challenge to make all the intersections, keep proper elevations and turn radius provides the incentive to practice harder and develop better designs.

A good competitive-level flight pattern requires a good airplane. Many so-called stunters do more to set back the state of the art and discourage potentially good fliers than to improve the flying skills. A properly designed and constructed stunter will settle into the "groove" and requires little or no thought to flying the model, allowing full concentration on perfecting the maneuvers. If the flier is busy fighting an unstable, over-sensitive, under- or over-powered model, or one simply out of trim, his chances of putting in an acceptable pattern are minimal. In other words, a good model is a must. The Cardinal Sinner is a good model.

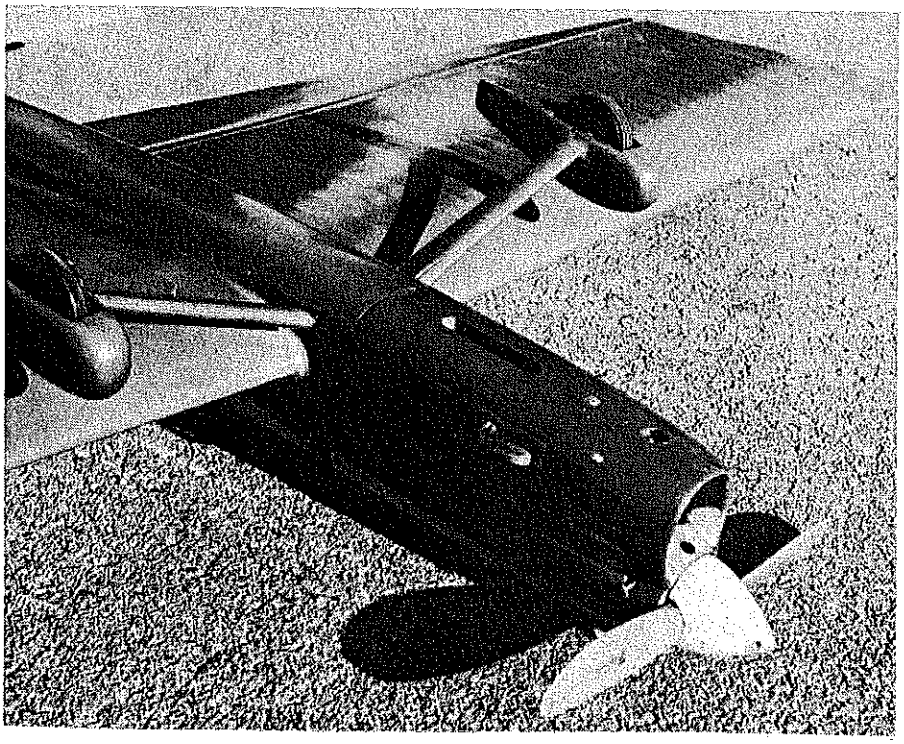
Most stunt designs evolve from a long line of experimental models. In the case of the Cardinal Sinner this is not entirely true. My previous stunters were developed around the partially sheeted D-tube wing construction with a few foam-cored wings thrown in for variety. Moment arms began to show some standardization and wing areas and airfoils were worked up to optimum values for the old standby Fox 35 stunt engine. A constant battle with weight led me to investigate the virtues of the "Detroiter" type or bird-cage wing structure. This method of building a wing had always fascinated me but I was leery of its strength and the apparent delicacy of all those strip ribs without the protection of sheeting. I finally gave way to curiosity and built the Cardinal Sinner with a bird-cage wing. After flying this design three years I am totally satisfied that its strength is more than adequate, with normal care it is not fragile, and most important, it is a much lighter structure.

I cannot emphasize enough the importance of keeping the weight down on any stunter. The Cardinal Sinner was designed to use contest grade 4-6 pound per cubic foot balsa throughout with the exception of the wing leading and trailing edges and the spar caps which should be firm stock. Built and finished as recommended should give you a finished model around 45 ounces. I'm firmly convinced a light model will beat a heavy one *every time*, especially in the wind when the heavy ships build up terrific speeds in the consecutive maneuvers to the point of being practically uncontrollable. A light ship means a light power loading making the engines work much easier in windy conditions. A light wing loading fights bad effects of centrifugal force and gravity.

Perhaps I should mention that the name has no relation to the performance of the model. It was named after the Cardinals of North Idaho College, which provides me with employment.

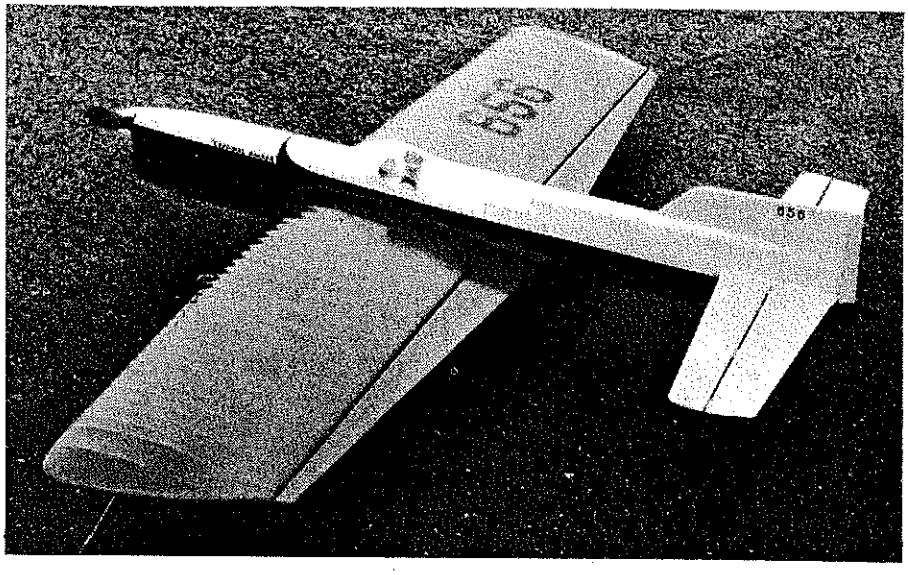
Building a model of this type is a little different than a conventional stunter; being sort of a unitized body, the ship builds all together. Maybe that's why bird-cage wings are called "Detroiters."

Start by building up the wing spar. You will note the plans call for both wings equal span. I quit building the outboard wing shorter several years ago and found that the models fly fine this way and look much better. The plywood doublers on the top and bottom center are to make up any



The large air scoop provides ample cooling. Air flow is regulated by 1/2 x 2-1/2 in. exit slot. Glow plug access, exhaust opening metal lined.

Moments and areas are typical of the all-out stunt machine. Slight rudder offset is used. No engine offset is required. Ship is adequately powered by a .35. The model is named after the Cardinals of North Idaho College.



A sound design to please the discriminating CL stunt pilot. This .35-powered model makes use of the "Detroiter" bird-cage wing for structural lightness

Clarence Haught

strength lost by bellcrank clearances in the spar web.

Cut out 1/32" plywood fuselage doublers and bond to 3/16" sides with contact cement. Cut spar, leading and trailing edge holes in sides using doublers as a guide. Taper sides to 3/32" thickness at rear with sanding block and add motor mounts. Cut out all formers and the bellcrank platform.

Clear a tee shaped space on your building bench large enough to accommodate the wing and fuselage assembly.

Slide the fuselage sides over the spar and fit up to formers F-1, F-2 and the bellcrank platform. Place this assembly inverted on your bench over wing plan. Check alignments carefully: spar level, fuselage square, formers straight. Glue securely and allow adequate drying time.

Install temporary spacers at F-3, F-4 and F-5 locations and join fuselage sides at tail with ⅛" sq. spacer.

Work flap horn into position through trailing edge holes and slide ½" sq. trailing edge into the position. The splice should be reinforced with a ⅛" plywood doubler as shown on plan. Align trailing edge with plan and block up at tips until perfectly level. Repeat process with leading edge. Anchor tips of spar to prevent movement in any direction. Install ⅛" sheet wing tips to aid alignment. Install full length sliced ribs to the bottom surface of wing beginning with the ½" root rib. Trim ribs to length at trailing edge. As you progress toward tip you may need to trim a slight amount from the leading edge of the ribs to get them to seat on the spar. Add false ribs. When dry and before moving the model, carefully sand ribs in a chordwise direction using a sanding block that spans at least six ribs to insure a uniform airfoil. Turn model over and repeat for upper wing surfaces. Cement ⅛ × ½" laminations in place on wing tips and give wing a finish sanding, rounding the leading edge and shaping the trailing edge as shown on plan.

Install a 3" nylon bellcrank and flexible leadouts. Secure leadout guides to bottom of wing tip in location shown. Epoxy tip weight to right wing.

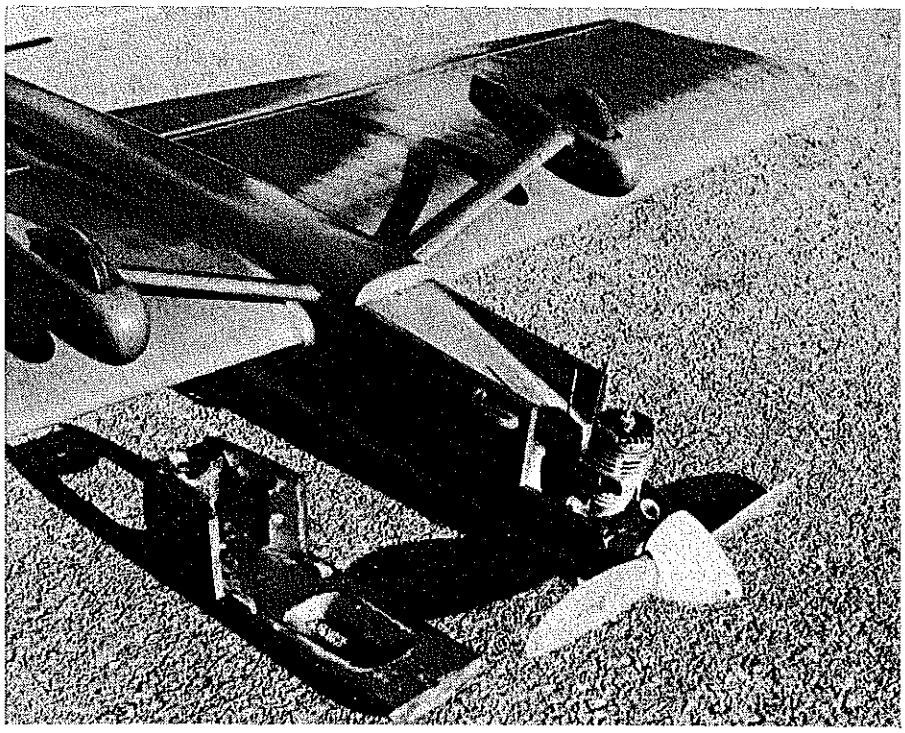
Bird-cage wings tend to be a little snag prone around the shop in the uncovered state, so I suggest giving the structure a couple coats of clear dope and covering with wet GM Silkspan followed by two or three more coats of clear dope.

Select some light ¼" stock for the flaps. Sand to shape and hinge the wing fitting carefully to flap horn. Similarly, fabricate stabilizer and elevator assembly tapering to ⅛" at tips and assemble, paying particular care to insure proper alignment horizontally and laterally. Be sure the flap and elevator horns you select have some type of bearing and that you anchor the bearing securely. For long life you should bush pushrod holes with a short length of brass tubing secured with soldered washers on each side.

Install fuselage formers and plywood pushrod guide. Hook up all controls using 3/32" music wire pushrods. Note holes used on plan.

A low wide-stance landing gear adds grace and class while providing the shock absorption for smooth landings. Often such landing gears tend to sag and distort or crack their fairings. To eliminate this problem and to provide a better mounting for the leg fairings and wheel pants fabricate a reinforcement from .046 music wire. Bind in three places with copper wire as shown and solder to main gear legs. Fair-

Cowl is retained by bike spoke, aligned by dowel at rear. Cowl splits at needle valve, preserves adjustments. All pictures by author.



ings are made from two pieces of 3/16 × ¾" balsa sandwiching the gear leg. The wheel pants are built around the installed wheels. Solder a washer to the axle on the inboard side of the wheel and retain the wheel with the wire retainer-pant mount. Wheel pants mounted in this fashion are extremely durable. Complete the landing gear through the sanding stage before installing it to F-2.

The tailwheel mount may seem a little beefy. It has been designed to withstand the loads imposed by a take-off stooge if you fly alone.

Use very light ⅜" balsa sheet for the bottom. If you don't have the proper material, tack glue, shape, remove and hollow and reinstall bottom permanently. As you begin to seal up the fuselage be sure the controls are free and well lubricated with petroleum jelly.

Install 3/32" sheet turtle deck sides. Sand top even and cap with ⅜" sheet. Sand to shape blending in with ¼" sheet fin and rudder. Note rudder offset.

Drill engine mounts for your favorite engine. You may use one or two degrees right offset if you wish. Install 4-40 blind nuts. Tack glue ¾" top block in place and carve to shape. Remove and hollow as indicated. Reinstall securely. Build up cowl from ½" sheet. Reinforce inside corners with ¼" triangle stock. If you have an old engine for a construction dummy, install it with an old 2" spinner mounted or carefully plug the exhaust and intake ports of your good engine and install it.

Trim the interior of the cowl to fit and tack glue over engine. Fit 1/16" plywood nose ring. Sand nose of model to its final contours. Pop off cowling and install alignment dowel, bike-spoke retainer and plywood reinforcement. I recommend lining the following openings with metal: exhaust port, glow-plug access, needle-valve hole and "carb" air intake. The cooling air exit may or may not be lined. Assorted brass tubing and tin can stock are good for these uses.

Revent a 4 oz. T-21 E Veco stunt tank as shown and mount to lower edge of engine mounts behind F-1. Cover tank compartment with ⅛" sheet balsa. This procedure allows you to shape the nose without the vents being in the way and provides easy access to the tank if necessary later.

Give the entire model a light sanding and fill any dents or scars with filler. Finishing a stunter is nearly as controversial as politics. I'll offer my method for your consideration.

First of all, I prefer dope finishes. I believe they are lighter, easier to work with, much easier to repair and last at least five years, which is adequate for our purposes. I also like to use nitrate dope for the base because of its less severe shrinking qualities and its excellent bonding ability. Butyrate is used from the color coats on. Butyrate is totally compatible over nitrate but the reverse is not true! Butyrate can be used throughout with good results.

Begin by applying two coats clear to the bare wood, sanding with 400 grit after each coat. Cover all wood with tissue adhered with a mixture of 75% thinner and 25% dope. I suggest Japanese tissue on all areas with a single curvature. Just lay the tissue in place and brush the above mixture on. This will adhere the tissue in a wrinkle-free manner. If Japanese tissue is not available use "00" or "rubber power" Silkspan. Cover any compound curved areas with "00" Silkspan, dampened with water spray from a Windex bottle and adhere in the same manner. Use more pieces of smaller size if necessary and avoid overlapping seams if possible. Try for neat butt seams with no gap.

Brush on approximately five more coats of clear dope, sanding lightly with well-worn 400 grit or 600 grit paper used dry. Be very careful when sanding over wing ribs as you can easily sand through. Sand in the direction of the ribs. Try to sand only between ribs and the rest will take care of itself.

At this point apply fillets to wing, stabilizer and rudder to fuselage intersections. I like micro-balloons mixed with Formula I Hobbypoxy best. Just mix micro-balloons in the epoxy until a workable putty is formed. Apply mixture with a bare finger. Smooth to approximate dimension. Dip a clean finger in dope thinner and smooth and work fillet to finished shape. Let dry, sand lightly and admire! No shrinking! No fuss or bother!

The purpose of waiting until this point in the finish procedure is to keep the dope build-up on fillets to a minimum. Butyrate dope *never* quits shrinking and if you have a thick build-up in an inside curve, such as a fillet, lifting is the usual result.

Any desired cockpit detail and interior finish should be added now and covered with a well-fitted canopy. Mask off canopy and fair into fuselage with micro-balloons and epoxy.

Prepare a filler by adding talcum powder to clear dope to a brown gravy consistency. Thin for brushing and apply one coat to all wood areas except over fillets. When this is dry, sand back to clear, leaving filler in grain only. Spray on one final coat of clear, sanding very lightly when completely dry. You should now be ready for color.

Apply color with spray gun or air brush. Use just enough to cover as pigmented dope is very heavy. Allow to dry two or three days before masking for trim. You can run tape through your fingers to remove some of the sticking ability and lessening likelihood of tape lifting base color when removing masking tape. I apply large trim areas with a spray gun but resort to a brush for striping. If you do use a brush for trim, seal the edges of your masking tape with a light coat of clear before applying the color to avoid seepage under the tape. After all trimming and lettering have been applied sand raised edges lightly with 600 grit paper. Give the model a minimum of six sprayed coats of clear butyrate dope. Be sure no plasticizer has been added and do not apply all coats at one session. Let dope dry well between coats. Butyrate dope has a tendency to soften all coats at each application and hurrying this step will give you problems by over-softening the finish too deep.

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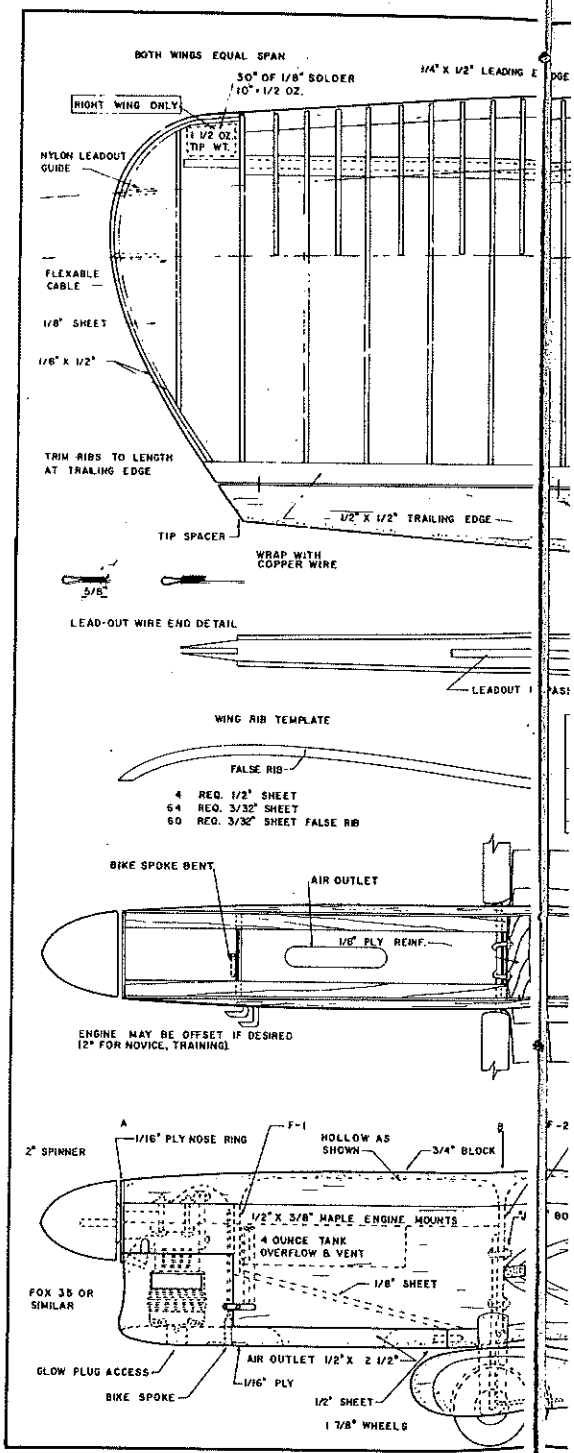
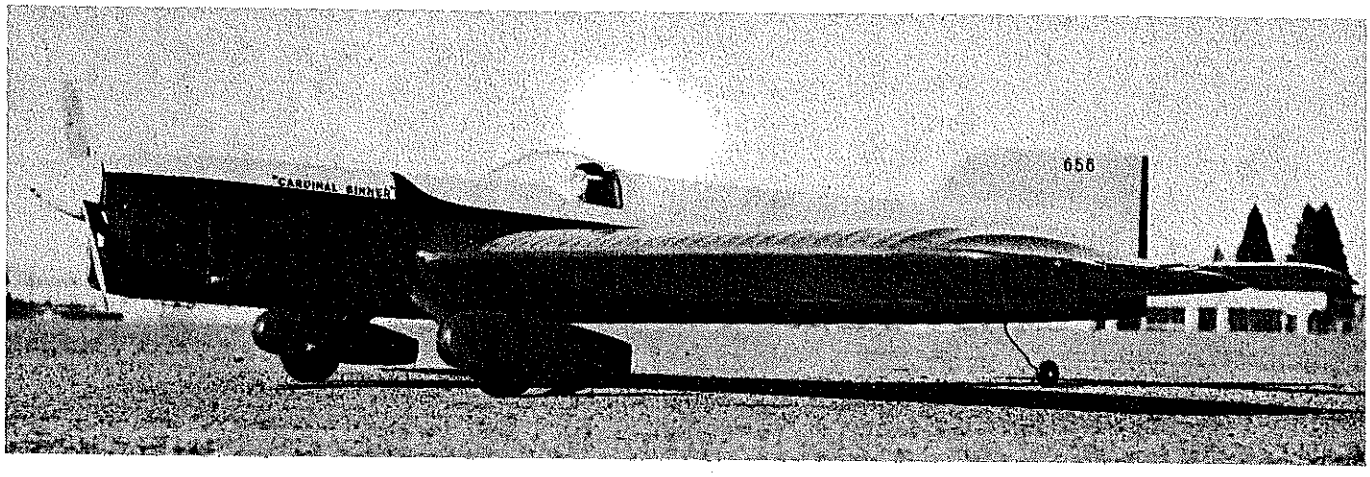
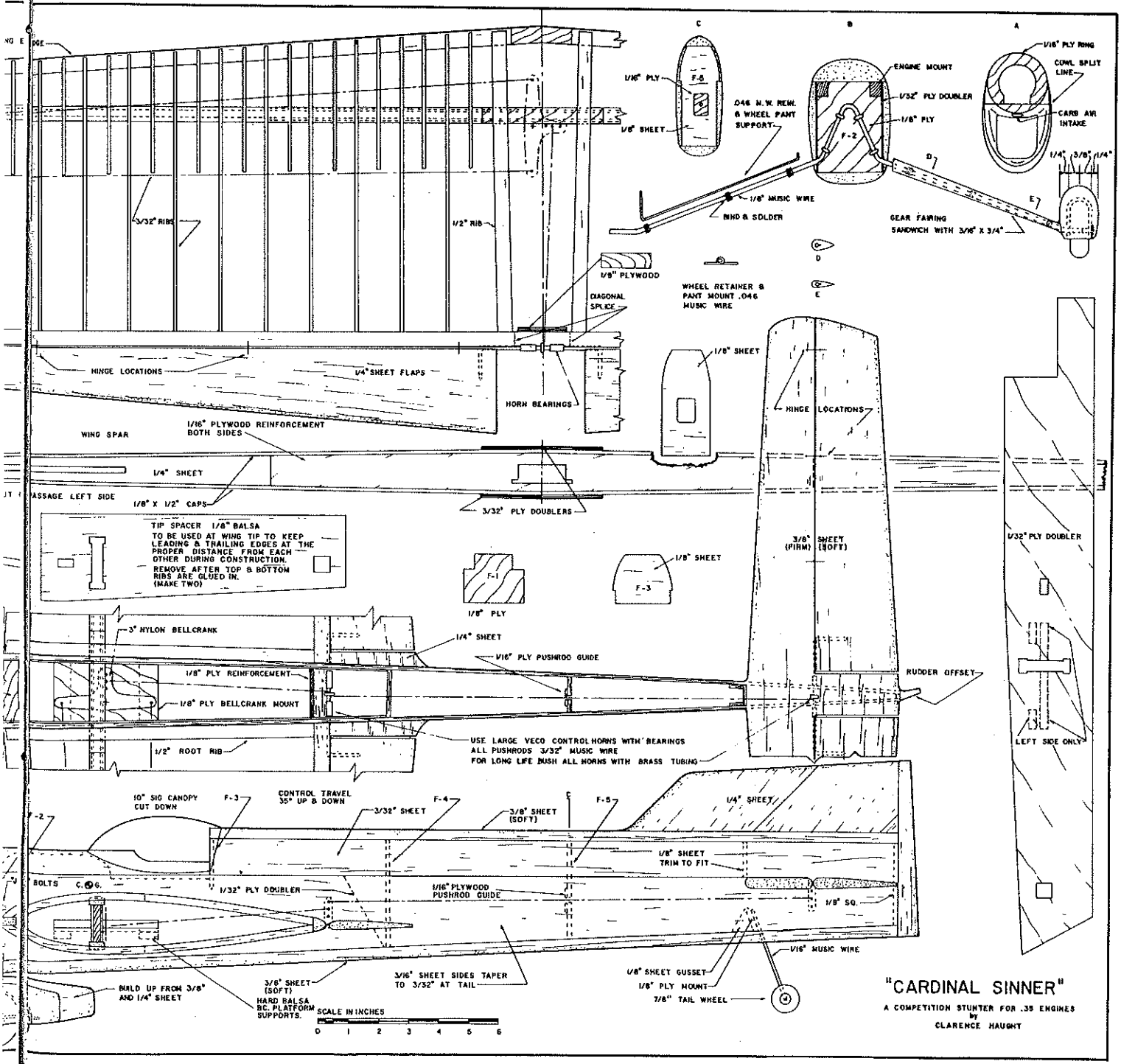
Low, racy appearance is pleasing to the eye. Ship takes full advantage of ground cushion for smooth landings. Ground attitude is easily adjusted by bending tail-wheel wire. Tail wheel securely mounted to allow holding loop —attached for use with solo flight stooge.







"CARDINAL SINNER"

A COMPETITION STUNTER FOR .35 ENGINES

by

CLARENCE HAUGHT

RC Scale/Atkinson

continued from page 21

late the concave parts or where the corrugations are lower than the surface. Having toyed with this for sometime I have come up with what I believe to be an easy way to achieve this. Most modelers have used, or heard of, the 1/64" ply sheets available through Sig Mfg. This versatile material is very strong, light and, with today's balsa cost, it is slightly cheaper than balsa.

The accompanying picture almost explains how to simulate the corrugation. Cover your wing and control surface with either balsa or the 1/64" ply sheet, then cut another 1/64" ply sheet the size of the surface to be corrugated. Using three-views, pictures, or whatever you have to prove corrugation and it's position, draw lines with a rule where corrugation will be located. Make sure the corrugations are straight and in line. There should be a margin top and bottom from ⅛ to ⅜" using brass tubing; in most cases, 3/32 to ⅛" O.D. are used as a drill. Sharpen the end of the tubing to a sharp edge so it will cut the plywood without tearing it. If possible use a drill press, also a hardwood board as the metal drill press base will dull the tubing very quickly.

Cut or drill a hole at the top and bottom of each corrugation. A regular drill will not do a good job and will tear the plywood, but the tubing will cut a clean round hole. Next, with a straight-edge as a guide, cut two lines between the holes with a sharp knife, taking care to stay in line with the outsides of the two holes. Lay the ply on a hardwood block to cut on, so it will not buckle. No doubt, there may be 100 or more corrugations but you will be surprised how fast it goes once you are set up for it. The end results are well worth it.

After the corrugations are cut on each surface, sand lightly on both sides, taking care not to tear the ply. Seal the control surface with two or three coats of dope. Next, using contact cement, apply the plywood to the control surface. After setting a while, feather the leading and trailing edges. One advantage of the 1/64" ply is that it has such close grain that no silking is needed. Just seal, under-coat and paint. You will find a realistic corrugation job made easy by this method.

With the contest season upon us it looks as if there are plenty of scale contests in the offing in most parts of the nation. The Kansas City Radio Control Association's 19th annual contest, to be held June 12, 13, has the usual Pattern event and Stand-off Scale to be flown both days. Lots of prizes and trophies.

Also received a colorful brochure from Harry Braunlick, N.Y. announcing the Sky Rovers Flying Club's Sport Scale and Multi-Wing Contest to be held July 10, 11. If the brochure is an indication it should be a bang-up affair! For more information call or write Harold Ford, CD, at 11 Stephans St., Clifton Spa, NY 14424. Phone 315-462-2235.

(My address is: 734 North 6th St. Terrace, Blue Springs, MO 64015.)

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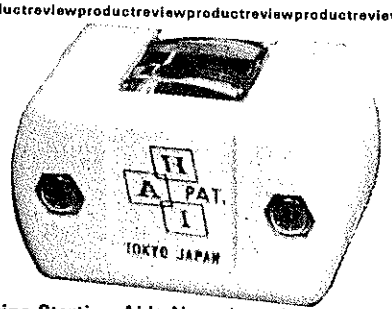

Engine Starting Aid: New glow plug meter indicates condition of battery, glow plug, without shorting or drawing additional current from battery. Puts an end to not knowing if sufficient voltage is left in battery when about to start an engine, or not knowing if the plug is shorted. Connects quickly to battery cord. Price, $4.95. **Aristo-Craft, 314 5th Avenue, New York, NY 10001.**

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Cardinal Sinner/Haught

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You must now wait three weeks to rub out the finish but you may fly the model in the meantime if you wish. Final finish involved removing the "cheap gloss" provided by the clear dope, usually by wet sanding with 600 grit paper. However, due to the number and spacing of the ribs on the Cardinal Sinner, I recommend you remove this shine with a damp sponge saturated with scouring powder. This method works well and reduces the possibility of sanding through the finish. When the model is dull all over, rub finish back to a deep luster using DuPont machine rubbing compound used by hand. This should keep you out of trouble for a few days!

Install engine, fuel filter, a 10-6 wood prop and your spinner. Ballast as necessary to bring center of gravity to a proper location. Check all controls for freedom of action and travel and you should be ready for the flying field.

You'll find the Cardinal Sinner a smooth responsive model. However, most any stunter can be improved by attention to flight trim. Check for level wings during upright and inverted flight. This is best detected by an observer or you may observe the alignment of the wheels. If a given wing is low when inverted and high when upright, misalignment is indicated and may be corrected by twisting the flaps. Grasp them securely where the horns are imbedded and twist correction in 1/16" at a time. If one wing is high during both upright and inverted flight, the wing tip weight should be adjusted. To add weight drill into tip with a sharpened 3/32" brass tube and insert epoxy coated solder.

Excessive yaw may be detected by one wheel leading the other one. Engine thrust or rudder offset will correct this.

Sensitivity can be changed by shifting the center of gravity. The further aft the CG

Cardinal Sinner *(continued)*

moves the more sensitive the model will become. Line tension is also affected and increases with forward shifts in CG. Make only one change at a time and test fly.

Flight trim can get much more involved than this but these basics will take care of most problems.

I might mention one other thing. Detroiter wings seem to have a characteristic rumble in flight. This is due to the "drum" effect of the non-sheeted wing. You may not notice this from the center of the circle but it may be mentioned by your flying buddies.

See you in the winners circle!

Museum/Mills

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the "lucky" tinkerers that they are often made out to be. When the brothers became interested in flying, they assembled and studied all the scientific knowledge then available. They experimented with kites and gliders. When they found that the gliders did not perform as they expected, the Wrights concluded that the Lilienthal calculations on airfoil lift and drag commonly accepted were erroneous. Consequently they constructed in 1901, a wind tunnel that produced winds from 25 to 35 miles per hour. More than 200 airfoil sections were tested by the Wright brothers before they were confident that they had assembled the first reliable tables of air pressure on curved surfaces. And so, armed with more accurate information, the Wrights came up with a flyable plane. A replica of this wind tunnel was reconstructed by the Museum under the supervision of Orville Wright. It is part of the Wright brothers' exhibit.

If aviation has a "romantic period," it has to be the first World War and the years following. Certainly the collection of planes from the first World War is one of the most popular with visitors. When the United States declared war in April, 1917, the Signal Corp's Aviation Section only had 250 airplanes—not one of which was combat worthy! Despite a tremendous effort, American industry was not able to produce one American-designed plane in time to see actual combat. The Americans used the British designed de-Havilland DH4's. Most were built in Dayton by the Dayton-Wright Company. The first aerial victory was in April, 1918. It had taken a while to get "going," but the final seven months saw 756 airplanes and 76 balloons shot down. America had a new kind of hero! We had 31 aces with Captain Eddie Rickenbacker the most famous.

After the war came the barnstorming, the daredevils, the country fairs with wing walkers and mock dog fights. But beneath the flamboyance and excitement, there was a struggle going on between those who saw the significance of the airplane and those who saw it only as an exotic toy. Men of vision, notably Brig. Gen. "Billy" Mitchell, attempted to promote the military future of the plane.

The second World War ended this dispute explosively. Air power—especially American air power—was a decisive factor in the allied victory. Many of the best known planes of America and the other nations are here in the Air Force Museum. The arrangement is not only chronological but according to the theater of operation as well. For many visitors this part of the Museum is nostalgia tinged with sadness.

America's first jet, the XP-59A, made its initial flight in October, 1942. To confuse possible enemy spies it had a wooden propeller on the nose. A version of this plane is on display, but without its propeller! The Museum area devoted to the jet age and space is almost as popular as the antique planes.

The Air Force Museum is a must-see for anyone who is going to be in Dayton, Ohio. It is a comfortable Museum to visit. There is parking for 500 cars, a picnic area, and, inside the core building, are clean, well-marked restrooms. There is an elevator and restrooms for the handicapped. For those who need them, there are baby strollers and wheelchairs available. There is no admission charge or parking fee. Visiting hours weekdays are from 9:00 a.m. to 5:00 p.m. and from 10:00 a.m. to 6:00 p.m. on Saturdays and Sundays.

Balancing for Pitch/Lella

continued from page 41

because it will take less movement to utilize your necessary down. Consequently, with equal movement from the control handle, the ship will turn tighter outside maneuvers.

Unequal up and down movement of elevators and flaps: If the elevators and flaps do not deflect the same distance up and down, the ship will again turn unsymmetrically. This is caused by cockeyed assembly of the control linkage. Specifically, the alignment of the linkage should be as follows:

(1) The up and down arms on the bellcrank, which form a straight line, should be parallel to its connecting pushrod when the elevators and flaps are neutral. These in turn should be parallel to the longitudinal axis. (Fig. 4.)

(2) The plane of the bellcrank should be parallel to, or lie on, the longitudinal axis. (Fig. 5.)

(3) The flap control horn arm should be perpendicular to the bellcrank and the longitudinal axis when the elevators and flaps are neutral. (Fig. 5.)

(4) The elevator control horn arm should be parallel to the flap control horn arm. In other words, if the flap control horn arm is perpendicular to the flap, the elevator control horn arm should be perpendicular to the elevator. (Fig. 6.)

Improper aerodynamic balance around the lateral axis: The vertical position of the thrust line and the surfaces causing drag are of concern here. In this series of articles, drag has yet to be mentioned as a cause of imbalance. It was only alluded to as causing loss of lift. This is because the drag forces on a ship with respect to roll and yaw are for the most part symmetrical around their respective axes.

(more)