

# How to Build A Gas-powered Camera Model

## PART NO. 1

Complete Information and Plans From Which You May Build a Plane That Will Take Aerial Photos Or Serve As an Efficient Contest Model

By **ELBERT J. WEATHERS**



Heavenly twins; two camera models; identical in looks and performance.



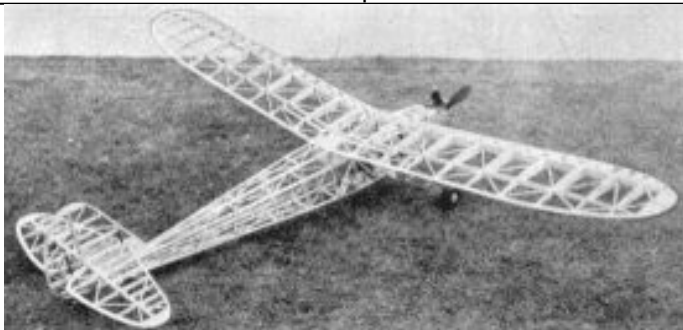
Here she comes! The model taking off for a reconnaissance flight and an aerial photo.



There she goes! The ship climbing for altitude at the rate of 250 to 300 ft. per minute.



An aerial photo taken from the plane in flight. Note the wing tip, road and mountains.



The structure of the camera model is carefully designed in detail. The cross bracing of wing and fuselage gives great strength.



The camera mounted in the fuselage of the plane. Pictures are taken through the opening in the side.

HERE, Mr. Gas Model Enthusiast, is a plane which has been thoroughly proven from several important angles. It is a ship of 8 foot wing span possessing the much sought after characteristics in present day gas models. As shown by past experience, it safely holds its own whets being

judged for construction, general design and clean lines in a precision contest. The takeoff is very even and graceful and the climb, with the engine wide open or fairly much so, is nothing short of spectacular, considering its size. It has been observed on many occasions "going upstairs" at an

angle approaching 30 to 35 degrees. The Grant X wing section and flying weight. (with full equipment, 5 lbs.) obviously have a lot of bearing oil this feature. On the other hand, the engine can be throttled way down, giving flights very similar to a Taylor Cub. Thus is the flexibility with it in flight. The glide is super-flat and soaring on the mildest thermal is common. Under gliding conditions, the forward speed is very slow, and when ready to finally land, it comes in as gentle as a kitten, with little or no bounce.

The writer's original job was designed to have a perfect glide with both the wing and stabilizer in a fixed position and each absolutely neutral, relative to the neutral line of thrust. In other words, the only adjustment that has ever been made to it has been that of the tab in the fin, to adjust it for the wide circling to the right, after the motor cuts. Should anyone, upon completion of the model, find that gliding adjustments are imperative (which is a remote possibility if plan: are carefully followed), it is suggested that small sheet aluminum tabs be made and installed on the trailing edge of the stabilizer to compensate.

Each wing panel slides out of the center section after lock pins are removed and the tail surfaces detach likewise, as one unit insuring maximum ease of transportation to the flying field.

The feature of being able to take aerial photos should prove of enough interest in itself to urge most gas modellers to try the model. It is probably the first gas model to obtain worth-while aerial photos. A standard Univex Model "A" camera is employed for this (very inexpensive, easy shutter action, and light weight) and makes surprisingly clear exposures considering the lens and flying speed (under power) of the model at the time of shutter action. When installed as shown, the left wing panel of the ship is included in the upper portion of each "shot," adding to the realism. This is clearly shown in the aerial pictures included in the article. The possibilities of taking photos from the air of gas model contests as your entry is flying overhead might also be mentioned in this connection.

<u>Specifications</u>	
Wing span	8 ft.
Wing chord	10-1/2 in.
Wing area	967.8 sq. in.
Wing loading	.76 lb./sq. ft.
Aspect ratio of wing	9 to 1
Overall length	4 ft. 10-1/2 in.
Stabilizer span	2 ft. 9 in.
Stabilizer area (21% of wing area)	203 sq. in.
Fin area (8-1/2% of wing area)	84 sq. in.
Dihedral	6-1/2 degrees
Tread	1 ft. 3 in.
Moment arm (40% of wingspan)	3 ft. 3 in.
Flying weight (complete with camera & film)	5 lbs. 2 oz.
Power	Brown Jr.
Timer	Autoknips
Climb per minute in still air	250 to 300 ft.

## Fuselage

First lay out all parts of the plane, full size, by enlarging from the assembly drawing, making use of all dimensions as given. Show location of all vertical or diagonal members as well as spars, formers, etc., on your working layouts.

Begin the model by first constructing the fuselage. Make two side frames to begin the fuselage. (Shown in shaded lines.) The longerons are 5/16" sq. and should be of hard balsa. Use firm balsa for all bracing. Secure longeron stock in one length if possible, so as to avoid splicing. However, if this has to be done, merely make a long tapered splice with balsa sheet bracing on the two inner sides of the longeron. It will be necessary to steam the lower longerons at the nose in building the frames. Do not forget the removable door frame which is shade at the same time, where shown, in the frame to be on the left side. When both are dry and sanded smooth on their outer sides, build them together in the usual manner, pinning each upside down on the work-bench. For clarity, no diagonal bracing has been

shown on the top and bottom of the fuselage frame. This is to be 1/8" sq. balsa, installed from, the wing mounting block to the rear end of the frame. See photograph showing this part completed.

The next step is to build up the top, rear section of the fuselage, from the cabin back. Start it by constructing the sheet balsa covered "box" upon which the rear part of the center wing section is to be attached. Install four corner uprights of 3/16" sq., followed by the filling in of all sides (except the bottom) with 1/8" sheet balsa fillers. This must be very firmly attached to the fuselage. Cut two 1/4" sq. hard longerons and install them as indicated. Complete the top rear section by putting in all the vertical bracing, which drops down from these longerons to the exact vertical spot on the fuselage frame, be it on a cross-brace, main longeron, or both.

Cut from 1/4" sheet balsa of firm grade the rear anchorage for the motor beams. Install it in the frame so as to receive the hardwood motor beams when ready. Install two lengths of extra hard balsa, size 1/4" x 1/2", to mount

the landing gear on, where shown. The actual installation of the landing gear will be made later. Now cut the nose formers Nos. 1, 2 and 3. Nos. 1 and 3 are 1/8" sheet balsa, while No. 2 is made from 1/16" sheet stock. After each has been cemented in position, cut some lengths of 1/16" x 1/8" balsa from sheet stock for the nose stringers. Each is cemented in place as shown. On former No. 3, all stringers are cut at an angle and are cemented on the underside of it, with the exception of the top center one, which is inserted in the notch provided. The firewall may now be cut and installed. Use very hard balsa of 3/8" thickness for this. Remove two rectangular holes, the size of the motor beams, and all other wiring holes shown. The stringers on the sides of the fuselage are cut from 1/16" sheet and have a long taper from each end to the middle. Cement them where indicated. The top stringer must be made later. The method of making the spring leaf tail skid is simple; the drawing of this part is self-explanatory. It is then installed in its correct position, first being fitted to a 1/8" sheet balsa filler block which is cemented in place securely. Use metallic type cement to anchor the skid to the block.

The landing gear is made next. Form three frames (front side, rear side, and center shock strut) from 1/8" spring piano wire, using vise and hammer, laying each one over full size templates to compare. Install the front side frame first, on the balsa brace in fuselage. Use metallic cement and binding of copper wire abundantly, and also make corner braces to put against the main mounting piece. Next, install the rear section in same manner. Bind with the copper wire, both at the fuselage and at the axles. The center shock strut is of course held in position at each axle. Solder well to make a good union at each crotch, bound first with copper wire. Cut 2 sets of landing gear ribs from 1/16" sheet balsa and put them in landing gear with metallic cement.

The two hardwood motor mounting beams can be made next. Each is size 3/16" x 15/16" x 7-1/4" and should be made of a hardwood with the necessary "spring" in it. Black walnut is recommended for this, although maple or teakwood will do. Drill each one to take the metal plates, which serve as the actual motor and tank mounting. Then slide them through the slots provided in the firewall and the rear motor beam anchorage, using metallic cement very generously.

The aforementioned plates should be made as the next step. See plans for detail. Each is mounted on the wooden beams with sets of screws and nuts, of the type designated in plans. The engine and tank holes shown in the plans are for the Brown Jr. engine with old-style tank and should be altered slightly for the new type Brown tank. Also, if a different make of engine is to be installed, merely alter the plate itself, where bent at right angles, to secure the proper spacing.

Carve the lower portion of the nose block from a medium hard balsa block, removing only enough wood from the interior to allow the engine, engine timer and tank to sit in position without touching. It is left solid for a good reason - to absorb any severe shock to which this area may be subjected. The top section of the nose block or engine cowl, is made from a solid balsa block, but must be nothing more than a shell with thin walls. It is used on the original merely

for added appearance on the ground or photographs, never being in place when the plane is flown. This, however, can be used for flying just as readily. Cut holes in it as shown, to allow for sliding over the cylinder, needle valve and spark plug cable.

The engine accessories can be installed at this time. The battery box is simple to construct and is cemented to the 1/16" sheet balsa cabin floor, between the camera mounting and condenser. The condenser is also mounted on the floor between the battery box and the coil. Mount the coil with two supports as shown, in a vertical position against the rear motor beam anchorage bulkhead, about 1/2" away from the floor. Make sure the high tension line (to the plug) is on the top. Study the wiring diagram on drawings, wiring up everything as shown, with the exception of the Autoknips timer, which comes later. Also put in the main switch and booster plugs in the right side of fuselage where indicated. Use the small lacquer-finished stranded and tinned wire if possible, laying all runs out on the floor in systematic fashion (spot with cement). The camera mounting is built up from 1/16" sheet balsa, being directly in front of the door in the left side of the fuselage. (Pictures taken straight out through open doorway.) Lay a length of 1/8" sq. balsa on the outer top edge of the mounting to insure that the camera will be tilted at the proper angle to include left wing in photos. The Univex camera is held in position by a strong rubber band which hooks from one side of camera mounting to other. Round off the lower fuselage longerons with a plane and sandpaper.

To complete the general construction concerning the fuselage, construct the fin stub and fuselage extension (actually part of the fin). This is where the tail surfaces detach as a unit. Cut the front sections of the ribs (installed over fuselage proper) from 1/8" sheet. Install two lengths of 3/8" O.D. aluminum tubing in the front and rear sections being constructed. Use metallic cement for this. Cut and cement in place the 1/8" sheet balsa fillers, in the fin base. When this unit is complete, ready to take the tail surfaces, make a paste of corn starch, clear lacquer (or dope) and aluminum powder, using it to make a generous fillet at the junction of the fin stub and fuselage.

## **Center Section of Wing, Windows and Timer**

Begin the center section of the wing by first making two spars, each built up from three separate pieces as shown. Use 1/8" hard sheet balsa for these. This method takes care of the dihedral angle in the spars with a great safety factor. Cut four of the full size wing ribs from 3/16" sheet balsa. Leave the underside of two of them flat, for over the fuselage. The leading edge is 5/16" sq. (three sections), while the trailing edge is 1/8" x 1/2", tapered. Drill 3/8" holes in the four ribs to receive the 3/8" aluminum tubing. Be accurate in this operation. Cut the lengths of tubing. When center section is built, install the tubing with metallic cement. Follow with the fillers in the center section, which are 1/16" and 1/8" sheet. Now mount the wing center section on the fuselage. It is supported at the leading edge by the two vertical window struts at that point. Cement it (using pins here and there) in place with the utmost care, noting that it is in perfect alignment with fuselage. Anchor

the forward vertical braces most securely. Add the center cabin window braces next.

Paint the whole cabin area, where "raw" wood is visible, with a colored dope. Also paint the cabin roof (formed by center section) and nose former No. 3. Cut a length of 1/8" O.D. aluminum tubing and cement it in place in the center, between the wing center-section and former No. 3. The windshield can now be installed, followed by the side cabin windows. Use .015" celluloid of good quality. Refer to the windshield template on drawings. Install all celluloid with cement, using pins to secure till dry.

The Autoknips flight timer should be built in place at this point. (This timer, its use pioneered in the west, is rapidly becoming known to eastern gas modellers.) Secure it in the position shown, in center section of wing, on a sheet balsa support, making certain that the top surface of the case is just flush with the two center ribs at that point. Make the switch as shown, being certain it functions properly. Also, it will be necessary to make an extension for the timer brake, to operate this through the covering. Solder a length of galvanized sheet metal, as shown on plate 1, endways against the timer hook, which travels into the case as the timer winds down. A small hole should be in the opposite

end, so the string shutter cable to the camera can be attached. Make or buy a small pulley (about 3/8" diameter) and install it against the motor beam bulkhead, on the left side of the fuselage. It should be in line with the timer hook extension. The camera shutter cable then leads from the extension on timer arm, through the cabin ceiling (at about 45° angle), straight down to the pulley and then straight back to attach on the extension on the camera shutter. (Merely a pin with loop on end, soldered on.) The procedure used in taking the pictures is described at end of article.

Now form the 1/16" stringer which extends along the top of the fuselage, in the center, from the flight timer to the fin stub at the rear. Cement it in place. Also cut and install the wing fillets at the trailing edge, between the fuselage and center-section of wing. Each is cut from 1/16" sheet stock and extends 2" each way from the corner and is actually a quarter circle around the rear edge. After cementing each against the two uppermost fuselage longerons and the wing stub trailing edge, fashion two filler pieces (about 3/16" deep at center) which are installed over the two center wing ribs and extend back on the fuselage longerons. These should be cut with along tapered curve to fit and allow for a good blending of the wing center-section.

***Scanned From May 1938  
Model Airplane News***

# How to Build A Gas Powered Camera Model

## How to Complete a Consistent Contest Flier Which Will Also Carry Aloft a Camera to Snap Aerial Photos

### PART No. 2

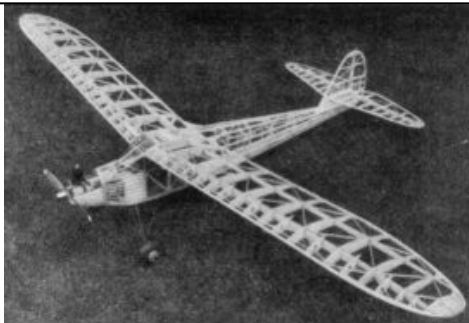
By **ELBERT J. WEATHERS**

THE first part of this article, "How to Build a Gas Powered Camera Model," was published in the May issue. Readers who may wish to build the model should read over the first part carefully before considering the instructions which follow. This plane is a very unusual ship in many respects.

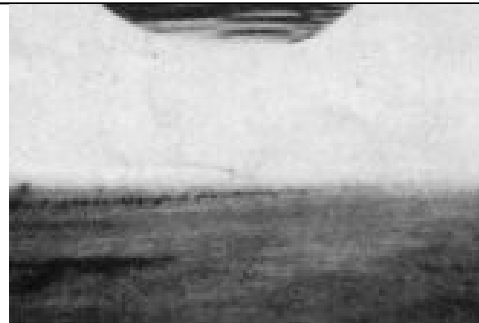
First of all, it is constructed to carry a small camera which, by means of a timer, takes a picture from the plane when it is in flight. On the whole the plane is a very fine performer. It climbs steeply but steadily when fully loaded,

camera and all: and it has a glide that compares with the "best of them." It is not of makeshift construction but rather is a carefully engineered job that is worthy of the finest craftsman.

This model will serve well as a contest ship, and as such, has a fine rate of climb and excellent soaring qualities. It has about seven feet of area and with the camera weighs five pounds. Without the camera it weighs slightly over 4-1/2 pounds. This ratio of weight to area produces a wing loading of slightly over ten ounces per square foot.



The uncovered frame displays the refined structural design prevalent in this plane. Though light in weight, it is strong.



What the camera saw from the plane several hundred feet "up."



Here she is taking off with the engine "opened up." Note the climbing angle.



A take off with engine throttled down.

The author is confident that those who undertake and finish the construction of this ship will be well repaid for

all the effort put into it. The second part of the instructions follows:

## Wing Panels

First cut out all the parts required, ready to assemble. Cut 12 full ribs front 1/16" sheet stock and 2 from 3/16" sheet balsa. Cut the remaining ribs for the tip area at the same time. Don't forget the necessary holes for the hardwood dowel pins. (Put dowel in after wing panel is constructed.) The leading edge is 5/16" sq., while the trailing edge is 1/8" x 1/2", tapered. The spars should be very hard balsa, of the same grade used in the center section. The front one is 1/8" x 1", while the rear one is 1/8" x 9/16". The two strips on the leading edge, which prevent the sagging of the doped covering at this point, are 1/16" x 1/8" balsa strips. The wing tips are 1/16" sheet material. To construct a wing panel, slide the ribs on the spars in their approximate positions. Then pin the spars in place and cement the ribs in their correct locations. Follow with the leading and trailing edge, etc. All diagonal wing bracing is 1/8" sq. stock.

When a panel is entirely completed, slide both of the dowel pins in their respective lengths of center section tubing and through the wing panel ribs at the same time. Make certain that the wing panel lines up with the center section *perfectly* in every respect. The wing stubs of the center section should be in perfect alignment, obviously. The importance of this operation cannot be emphasized too much. When satisfied, including sighting down the edges of both the panel and wing stub, cement the dowel pins in place, using metallic cement. When dry, each set of panel pins will be permanently in a correct, fixed position. Next, near the ends of the wing panel dowel pins as they rest in the tubing in position, drill a hole in each, right through the tubing and dowel together (about 1/16" diameter). These are for the safety wires which are dropped through when the ship is being assembled for flying. It will be necessary also to put balsa strips between the wing ribs (flush with rib surfaces) and install short lengths of 1/8" O.D. aluminum tubing between them and the larger tubing housing the wing panel pins. Do this on top and bottom. When wing is covered, a hole then remains straight through the wing section so that safety pins of aluminum wire can be dropped through and bent over.

## Tail Surfaces

The construction of this unit is more or less conventional. Both the fin and stabilizer have been designed for maximum efficiency. The rather high position of the stabilizer on the fin adds greatly to the stability. This ship is absolutely guaranteed by its designer not to spiral dive under lower under any circumstances.

First cut all materials for the fin and stabilizer. All ribs are cut from 1/16" sheet balsa, with the exception of several where additional strength is required. To construct either one, first lay down the spar, raising it 3/16" at each end, because of the equal taper to each side of it. Pin in place the leading and trailing edge, and also raise them to correct positions from the workbench. The fin and stabilizer tips are 1/16" sheet material. Diagonal bracing is 1/8" sq. balsa. When both are completed, remove a section of rib No. 7 in the fin (just ahead of spar) so the stabilizer may be slipped in position. Be very sure that it is at right angles with the fin. Then cement it in place securely. Now, slide the hardwood dowel pins through the fin ribs and also place

them in the aluminum tubing in the fin base which was installed earlier. Be certain that the stabilizer meets the surface of fin rib No. 8, equally, and also that it lines up with the wing (slide wing panels in center section to check this). To complete this operation, cement the pins securely and do not withdraw the empennage unit until dry. Between fin stub ribs Nos. 8 and 9, at the forward dowel pin, prepare another safety-pin hole, as was done for the wing panels in the center section of the wing. Mix some more paste of corn starch, clear lacquer, and aluminum powder and apply it in the corners between the fin and stabilizer, as you did in streamlining the fin stub and fuselage.

## Covering and Finishing

Bamboo paper is used for covering, although silk is permissible, of course. In using bamboo paper, the job is much simplified. Incidentally, don't forget to attach a length of fine, strong thread on the flight timer arm extension for the camera shutter, dropping it through the hole provided in the cabin roof and through the pulley, before covering. Use only as large a section of paper at a time as is practical, to insure a smooth job.

In covering the fuselage sides and top from the cabin back, use clear dope for sticking on the corners only (top and bottom) of the fuselage. Stretch the panel of covering tightly over the side stringers, so that only they are seen when surface is doped and shrunk. Cover the nose of the ship with small sections also. Proceed with the landing gear, wing, and tail surfaces. When completed, first water-shrink the covering, following with two coats of clear, full strength nitrate dope.

The writer's model was originally painted in bright red throughout, but after 5 months of continuous flying the color scheme was changed to all-white, with purple trim, and finished with a gold pin stripe between the two. Such a combination is very attractive and something "different." However, the color remains a matter of personal preference. In painting, all parts such as the cabin windows, timer arm, wheel axles, tail skid, and dowel pins must be masked off, using scotch tape (cellophane). Spray the paint job to obtain the finest finish. At least two coats of pigmented dope should be applied. Install the engine and secure the 3-1/2" air wheels on the axles by soldering washers on the ends.

To adjust the camera for operation, first secure it in its position on the mounting. Put a rubber band in the length of thread (coming down from the timer) between the pulley on the bulkhead and the shutter extension. On the end of the thread install a hook made from a pin. It is possible to make pictures any length of time after the take-off up to 50 seconds (about capacity of Autoknips timer) by merely inserting a series of "S" hooks in the line between the hook which was just put on and the shutter extension. In other words, the procedure of operation is to first wind up the flight timer, relieving the tension on the thread. The camera shutter is then snapped backward (holding the finger over aperture when loaded with film). As the timer brake is released and timer spring begins to wind down, the arm in the timer case which travels inward begins to pull on the shutter thread, over the pulley. Say for example it is done, and the camera shutter is found to snap forward in 20

seconds, and a longer period is desired. Merely add an "S" hook or two in the line at the shutter to raise the time. This decreases the tension of the shutter control thread slightly. Obviously, the camera is only able to take one exposure on each flight, but the film can be quickly rolled to the next exposure between hops.

### **Flying**

First, check it for balance. If it balances with the nose slightly down, holding the wing on the fingers a third of the way back from the leading edge, with all surfaces in neutral position, it should be set for a flat glide. Hand gliding is not recommended but can be done if launcher is running fast enough to give it flying speed. Do not adjust the fin tab

until the reaction on the glide has been observed. Torque does not bother the plane to any great extent due to the long moment arm. It should be adjusted for powered flight to the left and gliding to the right, in rather large circles. For test flights, set the flight timer for only about 25 seconds, and let it go with the engine about half throttle. The performance can be increased gradually by giving the motor more "supe" as the flight characteristics of the gas job are made evident.

The writer would be particularly interested in knowing of the results of flights with the model and also any good aerial photographs which are obtained by others. Anyone wishing further help on any specific part or parts of the construction may contact its builder, in care of MODEL AIRPLANE NEWS, and assistance will be gladly given.

## ***Scanned From June, 1938***

### ***Model Airplane News***