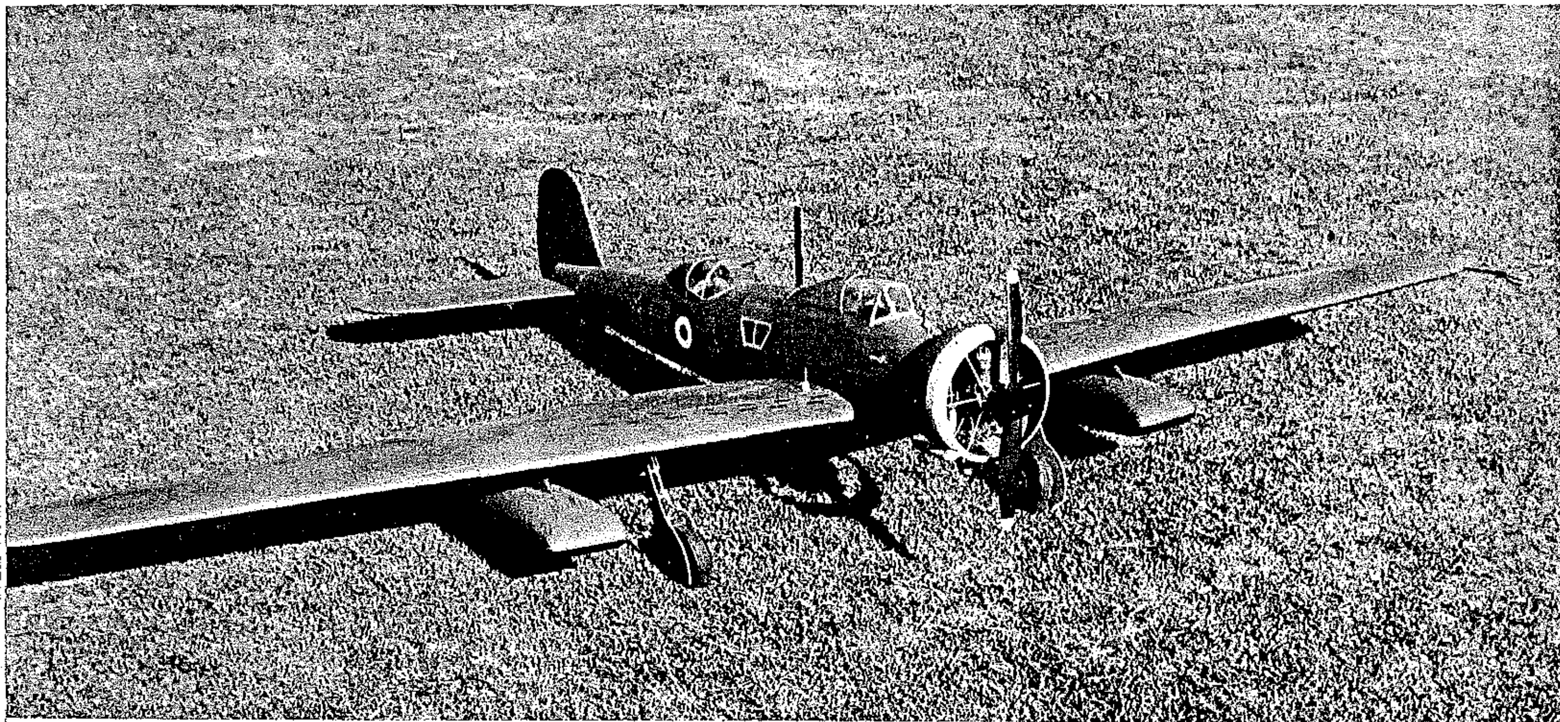


■Group Captain James Pelly-Fry

Vickers

Unique construction was the hallmark of this RAF bomber the British used in Ethiopia against Mussolini during the early years of WW II. This RC model design and bit of history come to us from one of the men who actually flew the full-size plane in action.

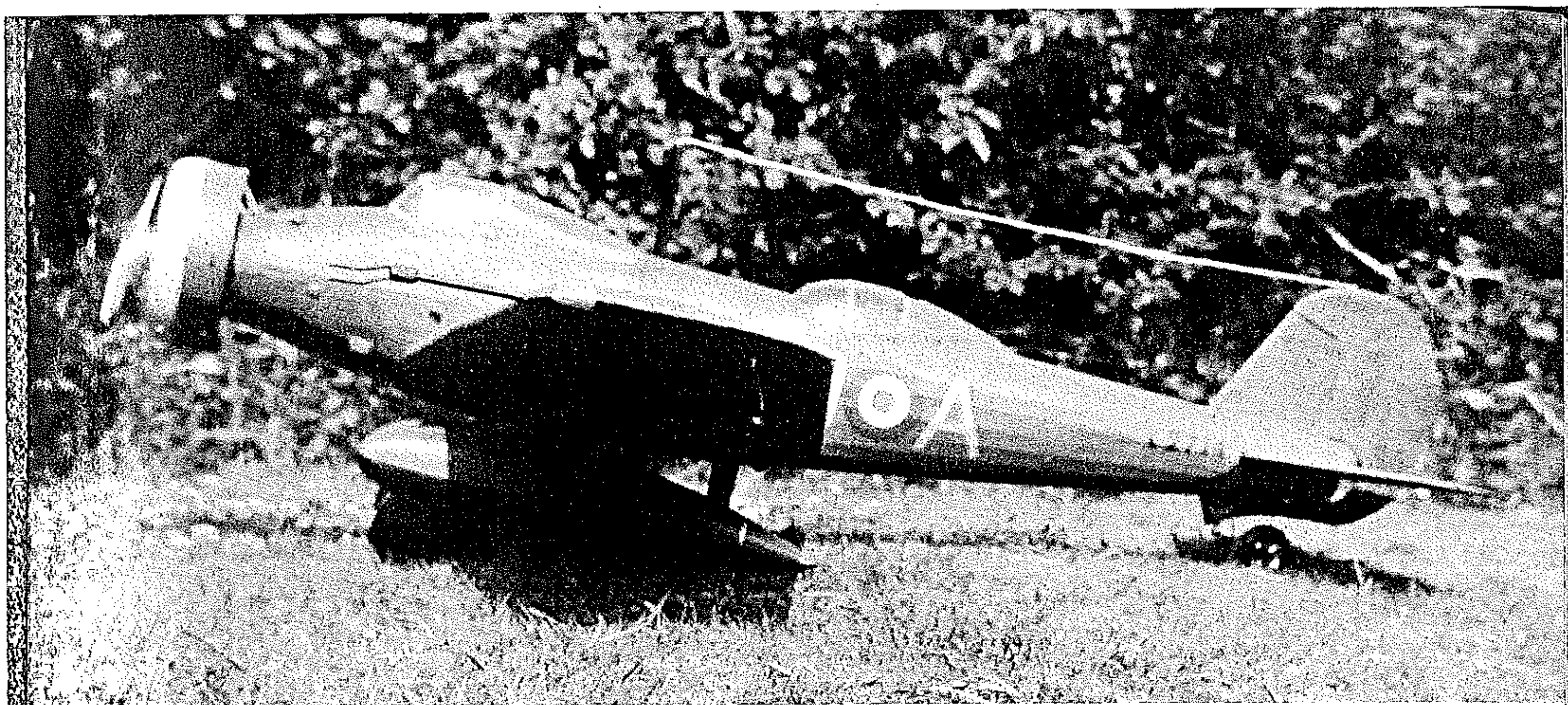
PART OF THE ROMANCE of Scale aeromodeling lies in rescuing obscure, forgotten, or long-lost aircraft from oblivion by giving them a second life. Searching for the details and data necessary to recreate these old aircraft is not only satisfying in itself, but also adds another dimension—the thrill of the hunt—to the rewards and pleasures of acquiring expertise as a model builder.

The Vickers Wellesley is an example of just such a long-forgotten, discarded aircraft. This long-range, single-engine RAF bomber, which I piloted in World War II, had an uncommonly efficient construction and an interesting history well worth knowing about. The brainchild of Sir Barnes Wallis, who later in the war designed airships and the bouncing bomb that destroyed the huge dams in Germany, the Wellesley was flown successfully by day and night over Ethiopia against Mussolini's forces.

Top: It was the extra wingspan and lightweight construction that enabled this long-range RAF bomber to lift much more than its own weight. Above: It's a great thrill to resurrect an old design, but it's particularly exciting to bring this plane back since no full-size version remains.

This remarkable aircraft possessed an exceptional load-carrying capability—even in standard form it could lift much more than its own weight. In 1938 three specially equipped Wellesleys were flown nonstop in over 48 hours from Egypt to Australia—a just-over-7,000-mile trip that overturned the world record for distance held until then by Russia. Fifty years ago, 7,000 unbroken miles was a fairly impressive achievement.

I was privileged to command one of the Wellesley squadrons, having served as second-in-command of another squadron earlier in the war, and found that the aircraft well exceeded my expectations. I also piloted the Douglas A.20, which Bob Wischer has successfully built and test flown as a Flying Scale model; so the Wellesley becomes the second scaled-down version of a



Wellesley

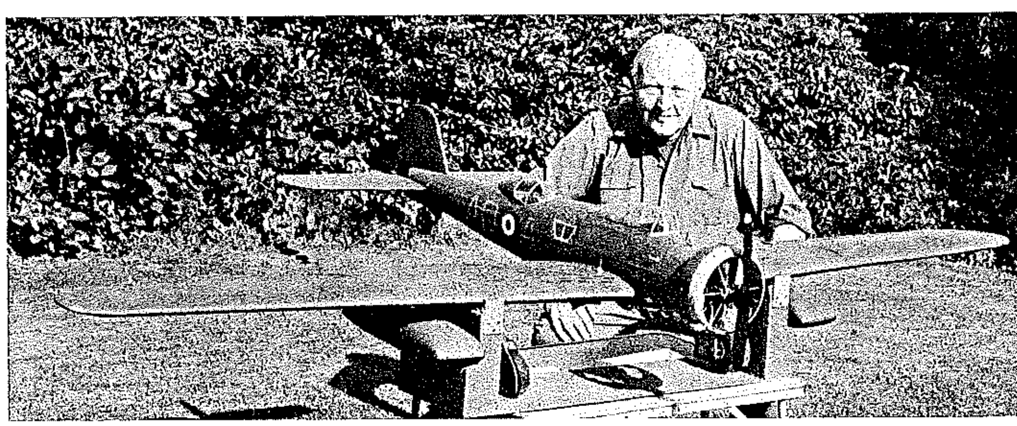
one-time military prototype that I personally flew as an aviator. As full-size aircraft, both the Douglas and the Wellesley did a superlative job in very different wartime circumstances, and both have an equal place in my sentiments.

The salient characteristics of the Wellesley are its very large wingspan (74 ft. in the prototype, which is good news for a model version) and the use of a unique form of airframe construction that Barnes Wallis called *geodetic*, consisting essentially of a double-spiral structure for the fuselage with what might be called *basket weave* in the wing and stabilizer. This geodetic construction gave the Wellesley exceptional lightness and strength, which is the cardinal rule in airplane design. The wing in particular was both extremely light and very strong.

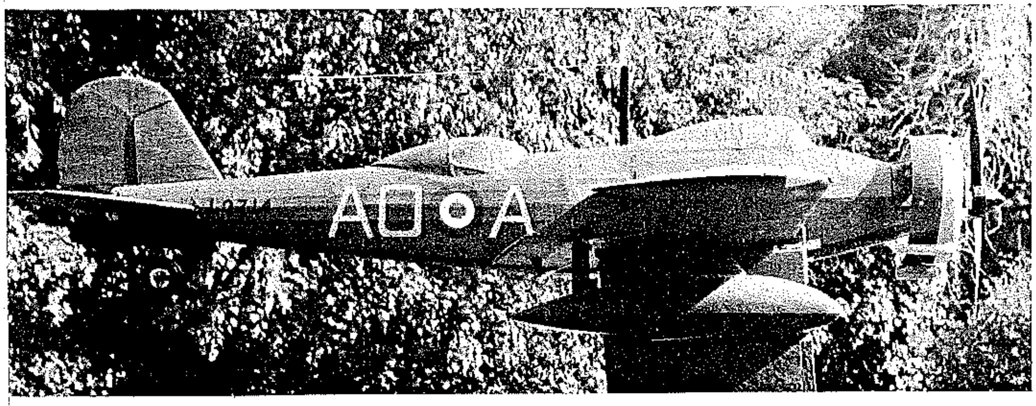
So far as we know, not a single Wellesley specimen has been recovered for posterity; all had been left to their desert fate after the Allied Forces moved into Southern Europe. Thus, in designing a scaled-down version of this worthy aircraft, my research—the aforementioned hunt—would have to be limited to whatever drawings, sketches, and photographs I could obtain. Beaumont Aviation in London, which specializes in keeping records of aviation data from old magazines, books, etc., supplied some valuable material. A fortuitous coincidence also helped me. The Matchbox Model Company had recently produced a 12-in.-span "stick-together" Wellesley kit, and it was the excellent material supplied by this cooperative manufacturer that got me started on the project.

Construction. Once sufficient data from which to work has been collected, the pivotal step in Scale design is to decide upon a suitable scale and choose the hardware. That determined, all the rest follows—problems and all! For the Wellesley, after doing some figures on the back of an old envelope, I chose 1/10-scale—as I had for the RAF Boston, which was my counterpart of the A.20. That way, I'd get a big wing and keep the wing loading down to reasonable figures—the perennial aim that so often eludes the Scale modeler. The wingspan would be 90 in., and I hoped to get the weight down to around eight pounds.

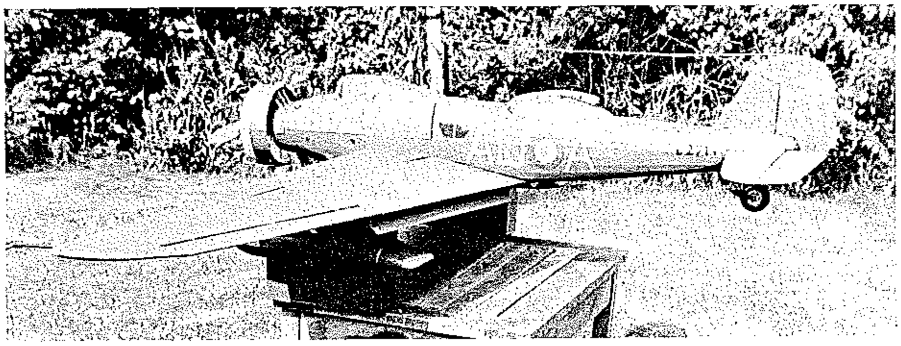
For a power plant, the Enya .40-4C four-stroke seemed promising. I'd successfully fitted a pair of them into the A.20 (RAF Boston, in my case); I also happened to have one of these engines to spare from my good friend Bud Voss. My only uncertainty concerned whether the Enya had sufficient power to get the big Wellesley airborne and



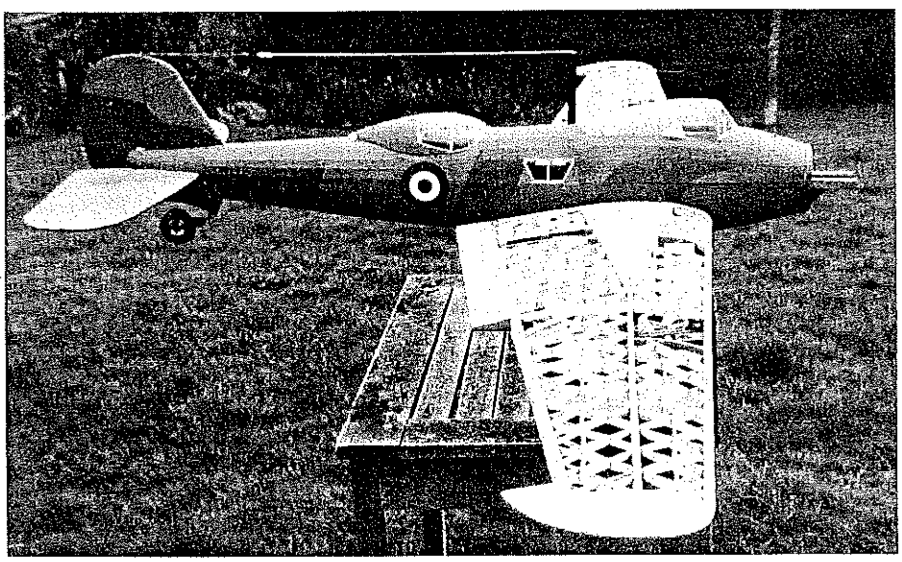
Top: This particular model version is a plane that once flew for the 223rd RAF Squadron. The Wellesley set the distance world record (7,000 continuous miles) in 1938. Above: Our author with his rendition of one of the bombers he piloted (actually serving as squadron commander) during World War II. Even scaled down to one-tenth of the actual size, this is a big model.



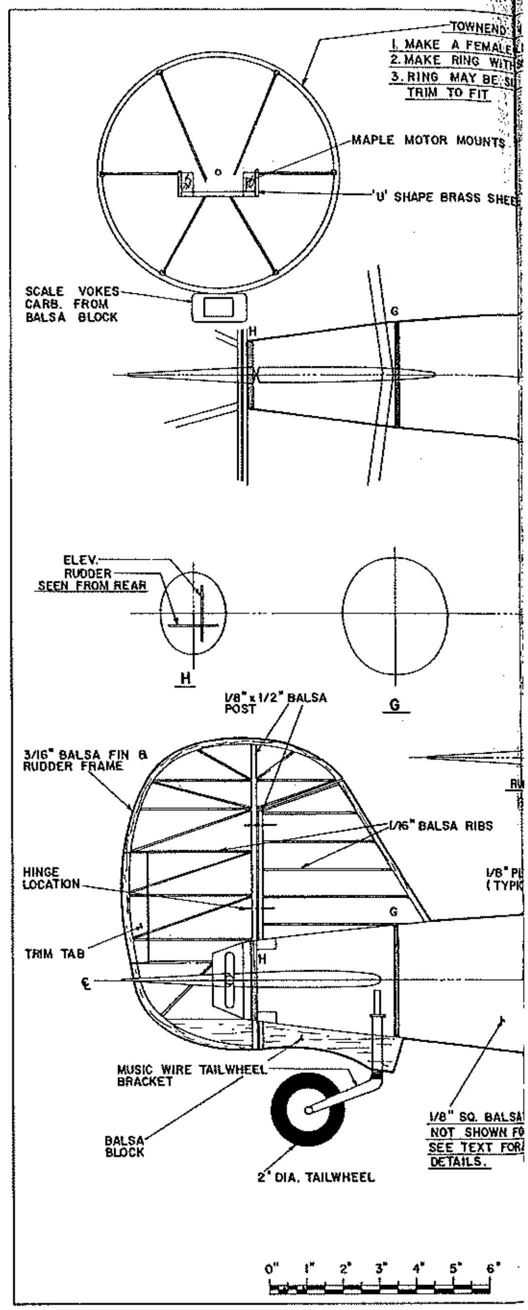
Using a run-up table makes it easier to get everything assembled and to perform the engine adjustments. See the text for details on making the polystyrene external bomb containers.



Operating flaps slow this big model down for floating touchdowns, and add to the realism.



The real beauty of this model lies just below its skin. The unique geodetic construction was used by designer Barnes Wallis to give the Wellesley lots of strength without lots of weight.



flying safely, but the Enya proved equal to the task.

The landing gear was supposed to be a tail-down, retractable job, and I decided to stay with a proven product—the excellent Rom-Air type. As in the Boston (where it gives creditable service even when the very high wing loading sometimes occasions dramatic arrivals on touchdown), it seemed a natural choice to use a known entity.

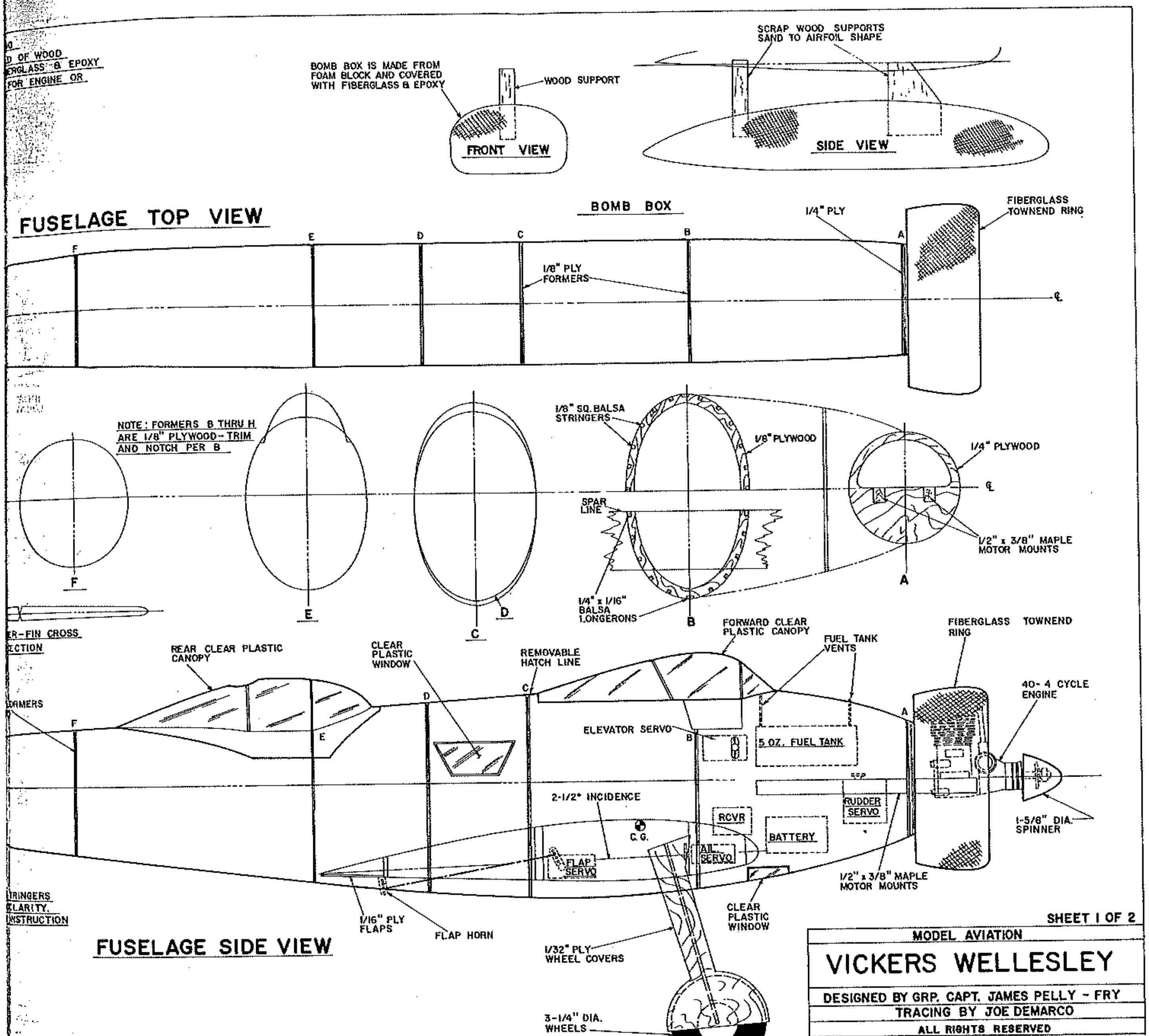
Fuselage. Fairly conventional construction is used here. The geodetic inner framework was omitted for the sake of weight-watching, leaving only four longerons and the stringers (as in the prototype) to establish the correct oval shape in cross section. In practice, with the fabric covering used aft of the pilot's cockpit, there are of course a number of "flats," but a sufficient number of stringers is employed to maintain the general oval shape, even to a critical eye.

The fuselage is made up in two halves, using a datum line straight along the centerline between the top and bottom halves. This method gives a good foundation for construction. The Mosquito employed essentially the same procedure, the only difference being that the "Mossie" fuselage was joined up top-and-bottom, rather like a chocolate Easter egg.

All the ⅛-in.-thick three-ply bulkheads are constructed as in the drawings, appropriately slotted to take the "north-south-east-west" longerons and the intermediate stringers. When completed, each one is cut across the horizontal centerline, using a razor saw that removes the minimum of timber. It is useful to number each bulkhead as you go. The one situated behind the pilot's canopy has to be duplicated to provide the endpiece of the removal hatch. For this reason, make sure that only the lower halves of this twin bulkhead are glued together, and that the top halves are just lightly spot glued for subsequent separation. The double lower bulkhead gives added strength where the rear spar of the wing passes through the fuselage later on.

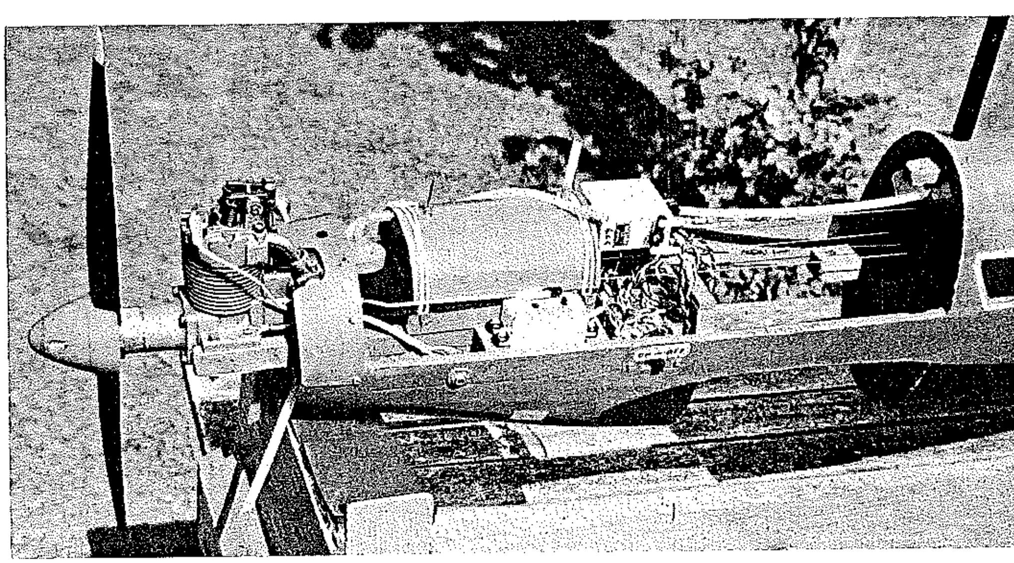
Lay out the full-size drawing (top view) of the fuselage on your building board, and steam to shape the first pair of ¼ x ⅛-in. spruce or obechi sticks so that they lie flat. These are to be joined together with their

Full-Size Plans Available . . . See Page 164



counterparts to form the completed longerons. Having pinned the two sticks down securely—I pin either side of them, not through them—take each top half-bulkhead, or "hoop," in sequence and glue it into its correct location. It's best to do one at a time, as the hoop is pretty unstable with its small base (even when all of the half-bulkhead hoops are glued into position). For quick results, I used epoxy and supported each hoop with anything handy—so long as the hoop remained dead upright during glue setting. The front bulkhead is double thickness ply for strength.

Steam and bend to shape the top longerons, which again are ¼ x ⅛ in. Slot and glue them into all the half-bulkhead hoops. Slot in and glue the ⅛-in.-sq. balsa stringers, fitting them alternately to avoid distortion. With the top half of the fuselage semi-complete and sturdy enough to handle, remove it from the building board and



An Enya .40 four-stroke provided plenty of power for this model. Note the wire for the remote glow plug connector. The fuselage beams may look flimsy, but they're plenty strong enough.

drawing. Place it somewhere level, with weights on the bottom longerons to preserve a true shape, and begin all over again with the construction of the lower half of the fuselage.

In constructing each fuselage half, keep in mind that it's unnecessary for all of the stringers to go all the way to the back (there's not much room, anyway, at the thin back end). So it's a good idea to shorten every other one to suit your eye. In any case, remove all the stringers in the last bay where the tail unit is located. Another important reminder: Take great care that the second half of your fuselage duplicates the first as exactly as possible. This is particularly true for the midpoint longerons, which must be either glued or fitted together at the inspection access hatch location. It's important to take pains with your craftsmanship at this early stage of the project.

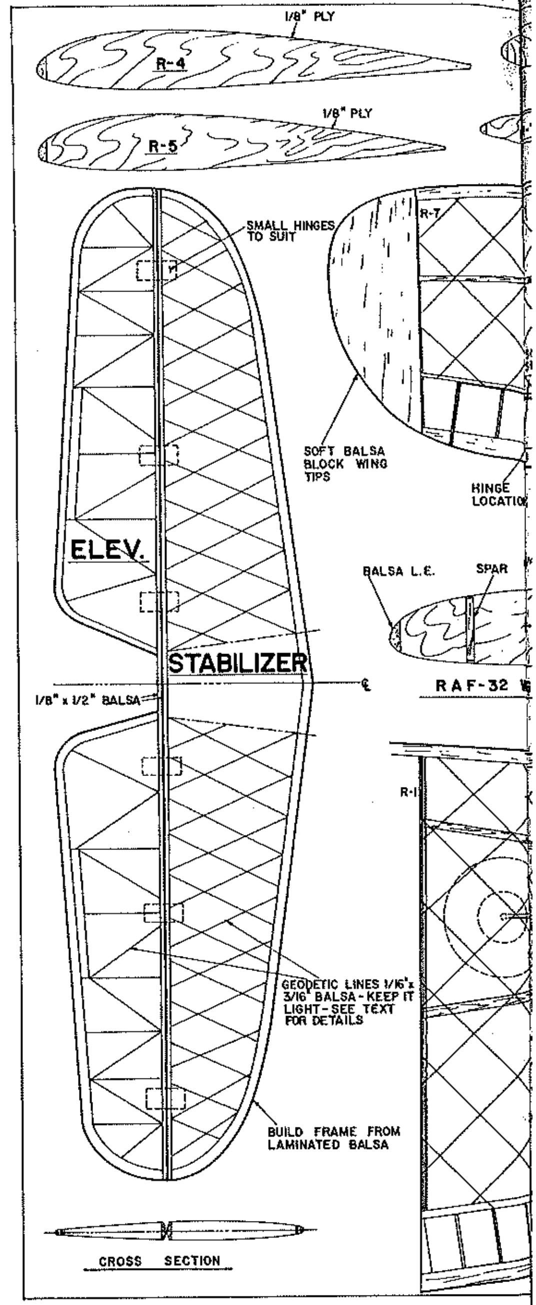
After checking that your two identical fuselage halves join together exactly, apply glue along all the edges—with the important exception of the front half, where the longerons will not be glued but just fitted together (what I call a touching fit) around the inspection hatch area (you'll be separating the hatch with a razor blade later). Bring all faces (both glued and fitted) together, and secure along the entire length with spring-loaded, office-type bulldog clips—very handy, as they grip firmly and can be fitted with one hand.

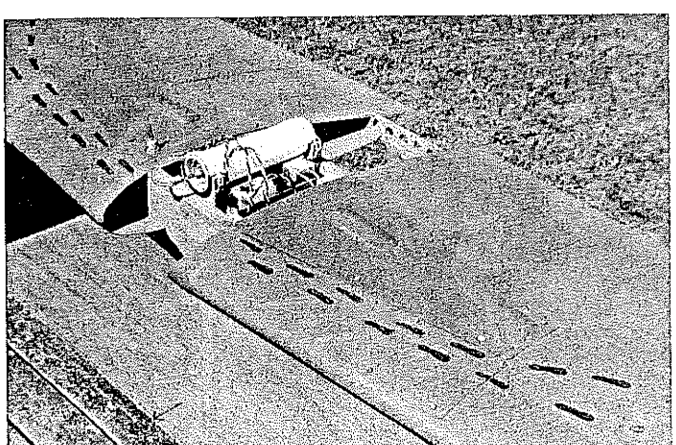
You now have a nicely shaped, fairly stiff fuselage frame. The oval bulkheads have all the rigidity they will ever need—the nylon covering that you add later will support them even more—and for most of the fuselage length the joined-up parts become a good, strong ¼ x ¼-in.-sq. section forming the master longerons along the centerline. Before setting aside your masterpiece (as I'm sure your family and friends will agree!), remove those stringers in the last end bay where the tail unit will be located. They will later be replaced by super-thin three-ply, screwed into place to form the access hatches. The main hatch up front, and the only quick-remove one, can temporarily be left spot glued in place to allow it to get used to its new shape.

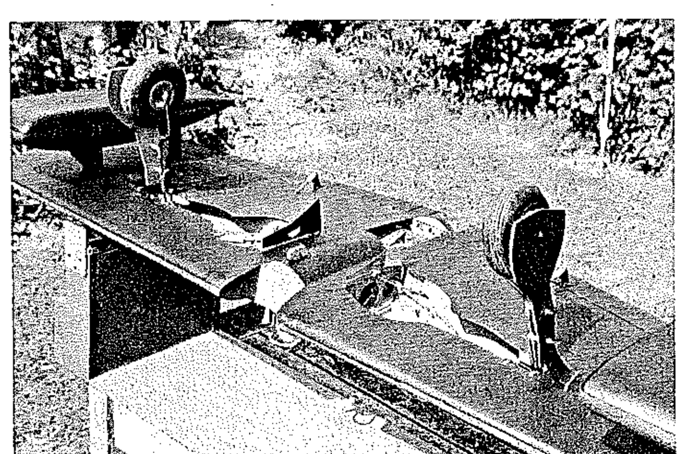
Empennage. The greatest need at the back end is for maximum lightness combined with adequate strength for flight and ground handling. Every fraction of superfluous weight in the tail of the model is roughly equivalent to putting four times as much into the nose. Building light in the tail in order not to exact a weight penalty cannot be stressed too strongly. All too often, particularly with Scale modeling where the basic layout is prescribed by the external shape of the prototype, the builder finds that, after installing essential items like engine, fuel tank, servo, radio battery, etc. well up front, he still needs to add the much-dreaded ballast to correct the balance point. Some Scale models need as much as two pounds of lead squeezed into the nose to offset tail weight, and that's a terrible handicap! Models with short noses present the biggest problems, and thus tend to be avoided.

Because of this requirement for lightness, the materials for the stabilizer, elevators, fin, and rudder were chosen with great care and kept to a judicious minimum. The wood is primarily soft balsa, plus only a small amount of hard balsa and a little 1/64 super birchwood ply made in Finland—the latter to strengthen both sides of the stabilizer main spar and the rudder post. The thin ply is glued to each side separately, keeping it a little oversize and then sanding it down to shape. The spars taper slightly out to the tips. When they're made up, check for any twist during construction; if they're weighted down during gluing and allowed to dry out well, they will remain straight and true. A 2½-in. aluminum tube is used to connect the elevators and attach the homemade control horns.

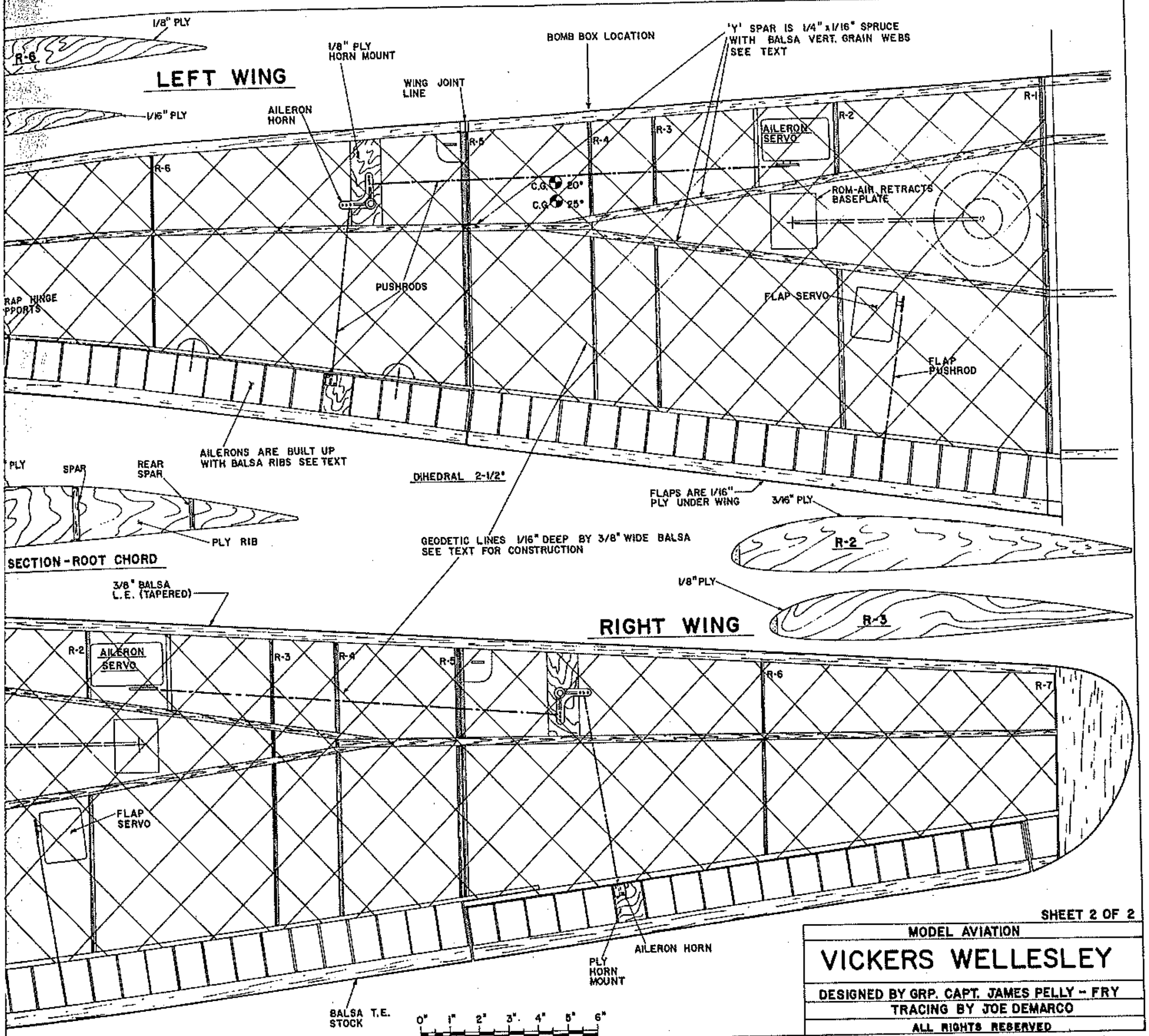
As with the fuselage, make the empennage over the drawings to ensure accurate shape and those subtle curves that give your model its realism. The stabilizer is distinguished by its lattice-work geodetics, while the elevators, with their slightly off-center







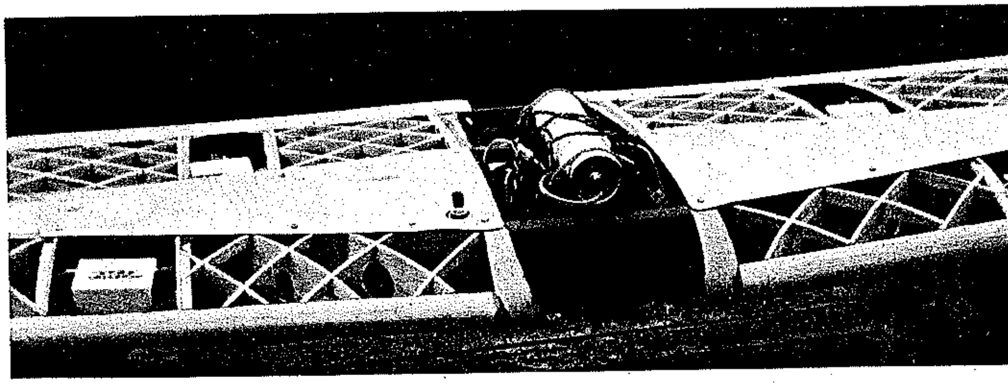
Left: The air tank for the Rom-Air retracts and the servo that operates the valve. The inspection covers are held in place with six self-tapping screws, and the blisters are necessary to accommodate the wheels. Right: Small inner covers for the wheel wells are closed by the wheel itself upon retraction. When the gear is down, weighted arms on the small doors keep them open. Plastic straps cover the hole when the gear is up.



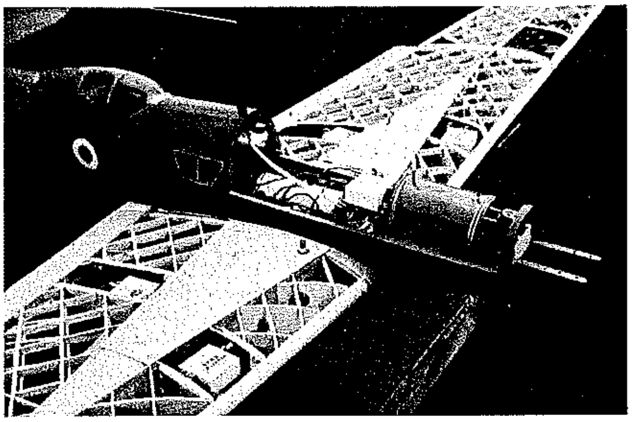
horns to avoid contact with the rudder, are more conventional. Use small plastic hinges, slipped into pre-cut slots at the correct midline points on the frame and glued with a minimum of epoxy. Check for security by pulling gently on each hinge after the epoxy has cured (which may be the next day).

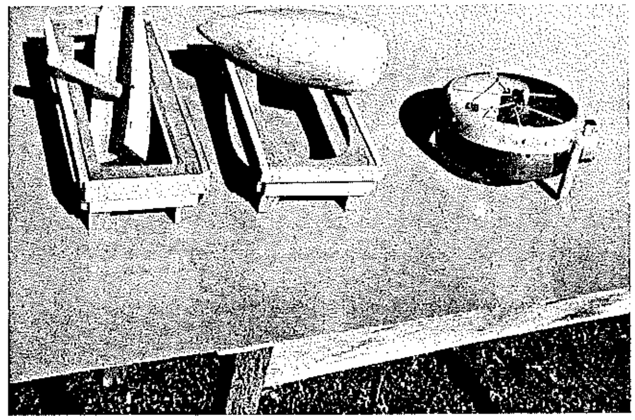
The trick to fitting the stabilizer and elevators into the fuselage is to cut away the leading edge spar sufficiently to enable it to be maneuvered into place. Once that's done, stand the fuselage on its nose on the floor, steady it, and then glue the main spar onto the back of the rearmost bulkhead at the midpoint. There's very little room in this area, so work carefully and accurately, making sure that the stabilizer is dead square to the fuselage when upright. Once the epoxy has set, you can build up the "broken" leading edge with a short piece of hard balsa, which is then glued to the bulkhead alongside, using a filler piece if necessary.

The fin-rudder assembly, completed but not necessarily covered at this stage, is now set up in the fuselage. Make provision at the foot of the spar (the rudder post) for the spar to be standing and glued onto a small block; the rudder, of course, has to move freely, and the double arms (or horns) must have full travel. The latter is influenced by the shape of the inboard part of the elevators where they sweep into the stabilizer spar. In practice, the Wellesley does not need much application of rudder in normal flight, since the ailerons do most of the work. In my model the ailerons are coupled



Detail of the geodetic wing construction and the locations of the aileron and flap servos.





Left: Band-sawing a soup can in half and then soldering tin across the flat bottom resulted in this nice looking custom fuel tank. Right: The molding tools and beds used to make the canopies (see the text for details). On the right is the aerodynamically clean Townend cowl.

to the rudder, at least for the time being; I may change to separate controls later. Once again, rehearse your final assembly and gluing by making sure everything is true and accurate beforehand.

Replace the stringers that you cut away earlier from the last end bay of the fuselage with four shaped pieces of 1/64 ply. This will provide access to the moving parts in the tail (elevator, rudder, steerable tail wheel). (If the builder prefers, the stringers can be left out in the first place, since the chance of fuselage twist is slight.) The four small, very light panels are secured into the bulkheads with very small self-tap screws. To spare weight, put in just enough of them and no more. For a little visual embellishment that adds almost nothing to the weight, a quarter-section of a ping pong ball can be fitted and glued, edge on, to the top half of the rear bulkhead.

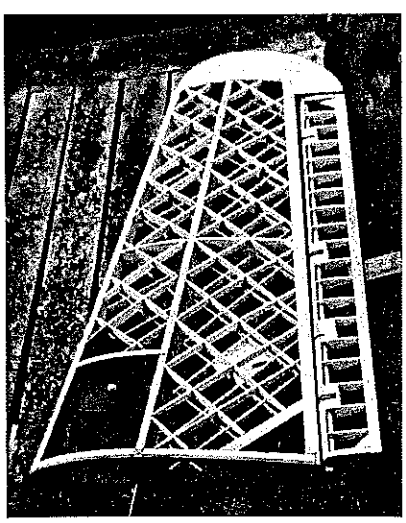
The elevator and rudder controls are the closed-loop type. Closed-loop systems work fine and save weight. I used very lightweight fishing trace wire, nylon covered; it should be no more that 10-lb. breaking strength. When assembling the servo and coupling up the wires, use miniature fishing tackle swivels at the servo end; fishing gear ferrules trap the wire for coupling up, with a nip or two from wire cutters. The advantage of the swivels is that you can adjust for correct tension without removing the clevis or, worse, twisting the wire. Allow enough slack in the wires so that you can move them sideways, at about midpoint end-to-end, approximately ½ in. Overly tight wires are bad for servos.

The steerable tail wheel (2¼-in. dia. and as light as you can find) is mounted in a made-up fork of piano wire—about 16-gauge is just stiff enough for the job. Bind the ends with thin wire, solder lightly, then slide it into a piece of aluminum tube and glue with epoxy. Trim the wire ends. The unit then fits into another tube—you want a nice, sliding fit—which is epoxied into a built-up unit in the fuselage; use balsa pieces to give rigidity. Test for smooth movement.

Make up your own crank (or horn), and carefully epoxy it to a collar of the type used for landing wheels. Locked with a grub screw, this collar traps the inner tube at the top where it projects above the bearing, and its horn connects to one arm of the rudder horn. You now have a good, steerable tail wheel which is adjustable for correct tracking when taking off and taxiing, and which is also removable when necessary. In my book, neat taxiing and straight, down-the-dotted-line takeoffs add to the realism of model flight.

At this point, we backtrack to the front end of the fuselage, where a few major jobs have to be done before proceeding with other work. These are: (a) make the access cover removable; (b) cut away part of the fuselage to form the air-gunner/radio man's position, and make the pilot's and gunner's canopies; and (c) cut away part of the fuselage underside to accommodate the wing root double spars.

To make the hatch access cover removable, begin by slipping a razor blade between the centerline longerons to break the spot gluing. This will free the cover nicely. To help retain its shape after removing the cover, fit a small strut across the back of the hatch. (Do not fit it in the front, as to do so would prevent your putting on or taking off the cover.) With the cover off, glue in place a double-thickness front bulkhead, gluing the bottom half only. Your hatch cover now has no forward movement. Prevent sideways movement by fitting little feet to the hatch cover; these slip inside the longerons. Make small adjustments so that the hatch fits snugly. When in position, secure it with nylon bolts; small platforms glued to bulkheads inside the fuselage can take the captive nuts. Recessed bolts help appearances.



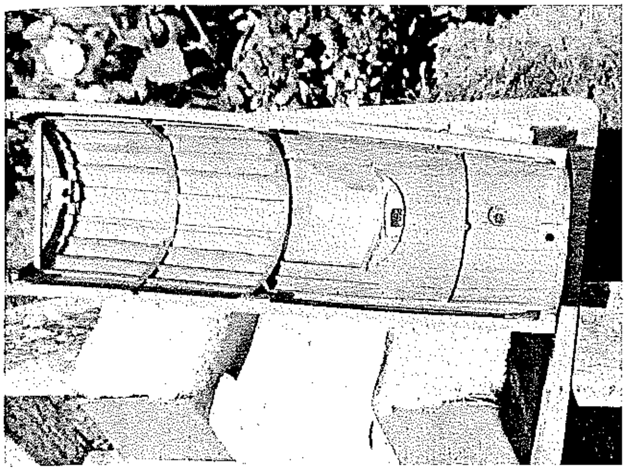
It seems a shame to hide structural work like this underneath covering. But this is a Scale model, and full-size bombers have never been known for having see-through wings.

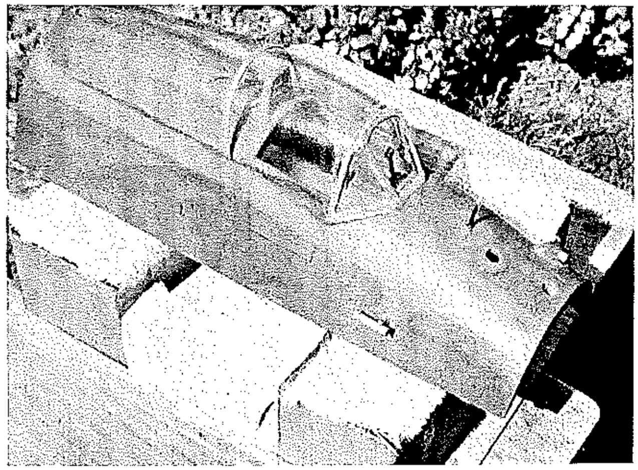
Making the pilot's and gunner's canopies was a first for me, and I had to think about it for awhile. Since the chance of finding anything ready-made that approximates the right size and shape is nil, you have no option but to make them yourself. The method I chose was to heat-mold them in the oven, using a molding tool and finding a way to position the clear acetate sheet securely. My newly found expertise in this area is welcome!

Choose a piece of balsa big enough for the task. Using the drawings (and perhaps photographs), carve and sand a pretend canopy that will sit in place on the fuselage. This is the "inside" part. When it sits nicely, and either before or after cutting away the unwanted part of the fuselage, begin to carve it to the shape of the canopy itself. Balsa is easy to work on for this type of job, since a lot of the so-called carving is in reality coarse sanding rather than actual shaping with a carver's tool. When the solid balsa canopy appears just right to the eye, make a hole in the underpart of your creation to accept a handle of your choice; I used a 4-in. length of ½-in. doweling. Be sure you epoxy the handle well; it has work to do.

This canopy-and-handle unit serves as your molding tool. Give it a good, hard varnish. Next, make a wood bed, a little bigger than the plan size of your tool, and supported by feet high enough that the tool can go through the matching hole in the mattress, leaving a bit of space, say ¼ in., all around. When you can move the tool in and out nicely, take a piece of thin acetate sheet and pin it all the way around, close to the hole; push pins work fine here.

Now comes the fun part! When things are





Left: Inside structure details of the cockpit hatch. Right: The one-piece removable cockpit and hatch give total access to the inner workings.

quiet in the kitchen (and mama is out shopping!), turn on the electric oven to maximum heat. When the oven has preheated to as high as it will go, put your bed on a metal tray and into the oven, leaving the main door open but the inner glass door shut. Watch what happens closely. After about a minute, you will see the acetate beginning to ripple, meaning that it has softened with the heat. Before it collapses, take out the bed on its tray, grab your tool pronto, and push it firmly into the "hole in the bed." If the acetate has softened correctly, your tool will force it to accept its shape. If you have been lucky, the tool will now be below mattress level, and will soon cool.

When it's cool enough to handle, gently wiggle the tool back and forth until it separates from the acetate, which now has just the shape you intended. Remove it from the bed, trim off the frilly part of the skirt, and it's all set to be fitted to the fuselage. Don't expect good results the first time you attempt this heat-mold procedure; it's a bit of a knack to get it right, and you may need more than one try before you're successful.

The pilot's canopy (after final trimming for a nice fit) can be edge glued into place. Use short lengths of masking tape to hold it in position during setting. The gunner's canopy, in the prototype, is quite cleverly hinged so that when it's opened the back half becomes a windshield while the front part disappears inside the fuselage (all the Wellesley gunners kept the canopy open almost all the time, there being very little air turbulence and generally warm air over Africa). Making the model's canopy swivel, though, would have been complicated, and also impractical from the standpoint that the canopy will not be stiff when using thin acetate sheet; so mine is permanently closed. If you want the realism of the swivel canopy, no harm in trying. If you make the gunner's canopy permanently closed, don't forget to make up a lifelike Lewis gun, mount it, and cut a slot (a fixed metal compartment in the prototype) in the rear of the canopy for stowage of the gun.

The task of cutting away part of the fuselage underside to accommodate the wing spars may be done now, or left until after the main part of the wing has been constructed, at the modeler's discretion. The latter sequence may be the better one; but either way the method is the same. After marking the unwanted areas—the main spar and the thin rear spar—cut them out with a fretsaw and knife, building up the ends of the big cutaway with ply to shape. The upper line of each cutout must coincide with the root wing ribs, the idea being that the fuselage fits onto the wing and not the other way around. With a low-slung wing, it makes sense to have it supporting the fuselage at all times. Don't be dismayed by the small amount of fuselage material that remains after the the big cutout for accommodating the wing has been made, and with the hatch removed. This isn't cause for concern. Suitably strengthened with balsa planks and my favorite 1⁄64 ply on each side of its frame, the fuselage is tougher than it appears—ready for the perils of the flying life, crashes and all!

Once these three jobs are done, the rest of the fuselage construction is basically conventional (spiced with a few specific adaptations). Two beechwood engine bearers, 5¾ in. long and ½ x ⅜ in. in cross section, are slotted into the bulkheads. They also provide the platform for the special fuel tank which is slightly offset to make room for the engine servo—a snug fit in the space available. It's remarkable how much design work has to be done in certain areas to accommodate essential items.

Once the engine bearers have been fitted, supplementary platforms for radio gear, servos, etc. can be provided to suit individual preference. I do, however, recommend that you locate everything along the lines of my Wellesley. That way, you'll at least know that everything works together in a logical fashion, and that you have good access to all the parts. The space behind my Enya .40-4C engine and the front bulkhead is filled in by an aluminum sheet cowl on the top half (shaped to a paper pattern made earlier), screwed into the thick front bulkhead. The bottom half is thin ply glued into place.

The pilot's cockpit is also part of the fuselage construction. After cutting out the small cockpit area from the hatch cover, make a wooden replica of the windshield framework. You will probably have noticed that in order to simulate the solid front section of the fuselage, going back as far as the cockpit, balsa sticks have to be sandwiched in between the longerons and stringers. This solid structure (nicely sanded down) assists in making a neat job of the cockpit surround.

If the windshield frame is made to match the drawing (which applies equally to the canopy), only minor trimming of the can-

Vickers Wellesley, Mk 1

Single-engined RAF light bomber.

Model to scale of 1/10th, based on L.2714, wartime identity letters AO-A of No. 223 Squadron, RAF.

Dimensions:

Wingspan	89.5 in.
Wing area	6.298 sq. ft. (907 sq. in.)
Wing section	RAF 32
Root chord	15 in.
Tip chord (not incl. balsa tip)	6.5 in.
Aspect ratio	8.8
Fuselage length	47 in.
Wing dihedral	2½°
Wing washout—outers	3°

Engine:

Enya .40-4C four-stroke of 6.5cc	½ hp
Propeller	Tornado, reinforced nylon; 12½ x 5 in.
Maximum rpm, ground run	8,500

Weights:

Fuselage, tail unit, motor, fuel tank	43 oz.
Wing, complete with Rom-Air gear	58 oz.
Radio—8 servos, 6 channels	18 oz.
Bomb containers	4 oz.
Fuel—5 fluid oz.	4 oz.
Total	127 oz. (7 lb. 15 oz.)
(Nominal 2 oz. ballast added to damp down elevator response, as necessary.)	
Wing loading, at 8 lb. wt.	20 oz./sq. ft.

Control throws—at trailing edge:

Elevator	¾ in. each way
Rudder	1 in. each way
Ailerons	⅝ in. up, ⅜ in. down
Flaps	1½ in. full down (approx. 40°)

opy will be needed before a final test fit and gluing. Make certain, however, that everything is in position before you glue, since afterwards you'll have no further access to the cockpit except from the inside with the hatch removed.

The simulated glass windshield panels are made of clear Plexiglass, cut thick enough to look good. A little care in shaping each panel before gluing will give a realistic appearance. Don't forget that the human eye tends to look at things in some kind of priority; in the case of a Scale model it's the cockpit area that attracts.

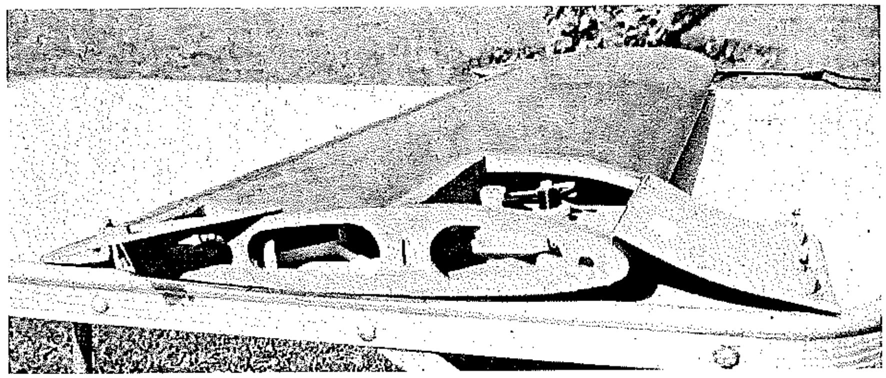
Wing. In the Wellesley, somewhat more than in any other airplane with which I'm familiar, constructing the wing is the key, crucial step. For this model, my priority consideration was to get as near to the geodetic construction of the prototype as possible. Almost as important was the decision to use the well-proven system of removable outer wings, as I had in the Boston. The radio setup was dictated by the fact that the fuselage would sit on the wing, with just four bolts to keep it there. I decided to mount the aileron and flap servos, together with the Rom-Air unit, on the wing, while accommodating all the other components within the fuselage. This makes preflight assembly—and post-flight disassembly—as simple and foolproof as possible.

As in the prototype, the starting point for wing construction is the Y-shaped main spar. This design gives great strength where it's most needed and also accommodates the landing gear nicely. The spar is fashioned primarily of top and bottom sticks of ¼ x ⅛ spruce, supplemented with vertical grain balsa webs and beefed up with ply facing near the wing roots. Even before assembly, the spars are very sturdy.

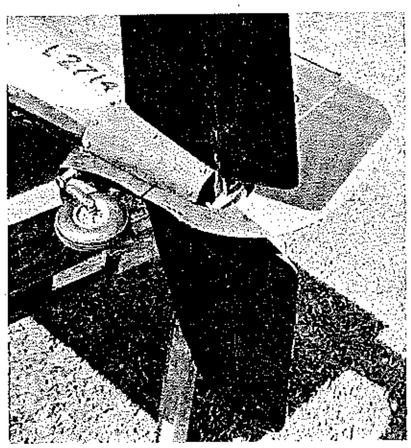
In the initial stages of construction, the wing structure consists of four master ply ribs distributed along the inner wing assembly as shown in the drawings. These are cut, trimmed, and glued in position. Cut small, narrow, vertical slots in the outboard master ribs for accommodating the wing joiners (refer to the plans). Port and starboard wings are constructed separately, with the spruce spars projecting two inches beyond the wing root ribs to form the structure for the center section.

Place the wing skeleton on the wing plan drawing, add the balsa shaped leading edge spar, and then the rear spar. The latter is built up from ⅛-in. strip balsa (medium hard) with 1/64 ply facings. Glue each face separately, the ply being a little oversize, and sand it down afterwards; you will get a light and stiff spar for your trouble.

When all three spars are glued integrally with the four master ribs, and before beginning the geodetic construction phase, install the balsa platforms for the flap and aileron servos according to the drawing. Their location seems to work out fine, given the design factors involved. All access panels (very thin ply) can be secured with very small self-tap screws into suitably positioned, small hardwood blocks, as there is no need for quick access on the field.



Left: The left wing's outer panel. Du-Bro quarter-turn latches secure the inspection hatch.



The twin bellcrank for the elevator is connected to the servo by cables. Note that the lower edge of the rudder projects forward all the way to the aft end of the tail wheel mount.

You're now ready to turn your two half-wing skeletons into geodetic ones. Using the geodetic lines on the drawing (which roughly correspond to the prototype), prepare a large quantity of balsa sticks from 1/16 soft sheet balsa, about ⅜ in. wide. Working all along each panel in the upper part of the frame, cut and fit sticks, edge up, in a herringbone pattern. Run the same pattern in the opposite direction, cutting and fitting the sticks to slot into the original ones. This creates an arrangement of diamond shapes (not squares), somewhat resembling an egg-crate. An important point to remember is that all the sticks are positioned a little higher than the wing contour.

Next, make a sanding stick. Cover a straight batten, about 1½ in. x 1¼ in. and just a little longer than the span of your half-wing, with sandpaper—coarse on one side and fine on the other. With the half-wing on your lap, begin sanding evenly across the span of the structure, working with the grain of the balsa sticks wherever possible. Soon, the wing contours begin to show. When you have sanded down almost to the point of touching the master ribs, use the fine sandpaper to finish off.

You now have a nicely shaped, accurate, tapered wing of geodetic construction. This wing has strength to spare, and you could in fact build an acceptably strong one using less material. But when a wing this generously built is still as light as it needs to be, why hold back? The RAF 32 airfoil duplicates the one in the prototype, but this particular airfoil is not a must; you can substitute a nice-looking NACA biconvex version that's a minimum of two inches deep at the root chord.

Once the first wing half is looking good on the topside, turn it over and create those same airy, basket weave contours on the underside. Repeat the process with both sides of the other wing half. If the routine is beginning to stale, at least you know that the end product justifies the means. The Wellesley's geodetic wing is singularly twist-free and light.

Now, you're ready to join the wing panels together. The first step is to make jigs to support the wings when positioned on the drawings. The jigs must provide a secure base, and give the necessary 2½° of dihedral as in the prototype. Equally important, each wing half must have precisely identical rigging angles, fore and aft. It pays to work carefully and accurately in this process.

With your wings carefully positioned over the drawing and ballasted as necessary to keep them steady on the jigs, all angles correct and the whole business symmetrical, connect the spruce spars that project into the fuselage bay with more spruce, cut to shape. I like epoxy for this job; it's quick drying and strong. When the main spar is connected, repeat with the rear spar. The shaped front balsa spars do not have to be joined, since the main spar with its doubled 'Y' configuration provides strength enough.

Remove the inner wing from the jigs, and beef up the spar assembly with vertical grain balsa where the join has taken place. Check by eye that it all looks good. Add three-ply faces to each spar. Not only do these make for an extremely serviceable center section job, they have a specific use as well: They provide a location for the brackets which accept the nylon bolts that attach the fuselage to the wing.

Trial fit the fuselage in the main part of the wing, making the usual adjustments and alterations to get it right. The wing root ribs should bed nicely into the cutaway part of the fuselage. The wing must be dead square with the fuselage centerline.

Continued on page 138

RC Helicopters/Jolly

Continued from page 135

as possible, we had to go to a flybarless rotor head. I've been flying GMP's heads flybarless for several years now and have had excellent results by modifying them in the following way: The center yoke is bandsawed off even with the top of the machined portion of the head. The head is then assembled normally, except that the dampening must be as tight as possible. With the Rangers I ran GMP blades cut to a rotor diameter of 58 in., and each blade was ballasted so that they were center-of-gravity-corrected and the weight was 190 grams. Set up this way, the ships were superb to fly.

Because I use no mixer on the head—just two links direct from the swashplate—I must cut down the collective cyclic throws, as they can be quite excessive. If you do try one of these heads flybarless, just make sure that the dampening is tight and the throws are reduced so that the head gets normal pitch changes. If you do this, you'll really like flying flybarless.

Also, with 190-gram blades, the autorotations are a dream. In fact, one night I was flying one of the Rangers, and I had just set down on the ground. Being cute, I hit the throttle hold and pulled up on the collective. The head has so much inertia that the Helicopter lifted higher than my head, and then settled slowly back to the ground. I thought sure I would run out of blade speed and bend the bird up, but an honest soft touchdown was achieved.

So we finished the three Rangers in time and shipped them ahead to Globe, AZ where the filming would take place. I arrived two days later and uncrated my beauties, finding minimal damage inflicted by air freight.

I kind of winced when I found out we would be flying at an elevation of 4,000 ft. Believe me, nothing gets a director more excited than watching a flying bomb winding up and not wanting to lift off! But even loaded to 13 lb., the Cobra/Rangers flew excellently—even at that altitude.

Frankly, after building three Helicopters and shipping them to location in the span of a month, the flying was anticlimactic. The director picked out a rock face, locked off two high-speed cameras, panned with two more, and I hit the spot. This was the first time I'd used real explosives like potassium nitrate and primer cord. It was weird to have the machine strike the wall, see a flash, and then observe the total disintegration of the fuselage with the mechanics falling to the ground.

As I loaded up after destroying the third ship, I was thinking how grateful I was that I could depend on the various model companies to provide me with quality equipment capable of doing the job safely. Anyway, if you see *Midnight Run*, look for the small part model aviation played to give them a believable explosion.

New GMP machine coming! Gorham Model Products has just given me permission to announce their new aerobatic Helicopter, the Legend. I have flown the prototype and can tell you that the Legend is quite capable of the most daring aerobatic maneuvers. GMP will be showing the ship at Toledo, so if you made the show, you saw it on public display for the first time.

Anyway, the Legend is still a cooperative effort between Gorham and Hirobo, but this one is a lot more Gorham. The Legend features a flybarless rotor head, toothed-belt tail rotor drive, extremely light weight, and as John says ". . . is made of mostly two new space age materials called aluminum and steel." As soon as I can get some pictures, I'll give you a preview.

BCNU

Wellesley/Pelly-Fry

Continued from page 60

The thin three-ply flaps are of the split type, and are hinged to the rear spar at three points on each side. The flaps are lightly braced fore and aft along the inside of the span to make them rigid. Small cutaways under the wing to accommodate them will give a snug fit. The flap bellcrank is fitted to coincide with the servo location. Using one servo for each flap is merely convenient, rather than a technical necessity. It's easy to harmonize the two servos by adjustments of the clevises.

The method for constructing the wing outers is the same as for the main inner wing, the ailerons having a recessed hinge. Set up the port and starboard wings on their specially made jigs, making provision for the three degrees of washout; then cut and sand the soft balsa wing tips to shape, and glue in place. Finish by covering the outers with nylon.

Before constructing the ailerons, provide access to the aileron bellcranks using Du-Bro quarter-turn latches. As shown in the drawing, each aileron consists basically of a number of balsa ribs with half-round leading edges, an aluminum tube spar located at the fat point of the rib section, a trailing edge spar, and, finally, three brackets made of Phenolic G-10 (or similar reinforced plastic such as used for circuit boards) which are glued to the wing rear spar in front and to bearings around the tube inside the aileron. When assembling the aileron, by sliding the ribs onto the tube and epoxying each one in turn, remember to slide on the supporting brackets and the aileron horn at the right time.

When all the ribs are epoxied in place, check that the brackets are swiveling freely and that the well-glued horn points down vertically when the aileron is level. Wrap very thin balsa sheet around the leading edge of the aileron, and glue in place. This serves the dual purpose of beefing up the aileron against twist and giving the correct semicircular shape to make a neat job. When completed and checked for trueness, the aileron can be nylon covered and doped.

The aileron is now ready for attaching (by the three brackets) to the rear spar. First, using a wide-mouthed bench vise, position the outer wing upright on the workbench, with the nose down and the rear spar level. When the wing is secure, offer up the nose-down aileron to the wing spar, and by sanding down or filing ensure that all three supporting brackets touch the spar exactly. Mark the points of contact. The gap between spar and aileron should be just enough for the aileron to move freely after attachment.

If it all looks good, you're ready to epoxy. Scratch the point of adhesion at each marked place on the wing spar, do the same on the ends of the brackets, and test again that you have a true fit. Put just a smear of epoxy on all points of attachment. Carefully lower the aileron brackets onto the spar, check for correct alignment, and use short pieces of masking tape to keep the aileron bolt upright. At this point, there's nothing left to do but tiptoe away and have yourself a cup of coffee.

When you return to your workbench (say, 15 minutes later), your aileron brackets will be permanently glued into place. Remove the masking tape strips, and check for free movement. Leave overnight for the epoxy to cure.

Construct the other aileron and attach it to the rear wing spar using exactly the same method. If you make accuracy the watchword—no guessing!—the result will be a pair of outer wings that are precisely matched and have an equal amount of washout. The butt joints, in my case anyway, hold firm; no doubt yours will, too.

The wing joining system consists of a brass box, or sleeve, fitted with a sliding steel strip. My material comes from West Germany, but something similar should be available from your local hobby shop. For each wing, take an 8-in. length, remove the joiner, and cut the box accurately into two halves. One half is fitted and glued into the spar of the main inner wing, the other into the outer wing. Support it with extra pieces of wood as necessary, and check that it is secure. The steel strip should be a close fit inside the box, eliminating any sloppy movement. When the strip is being positioned at the time of gluing, a piece of thin polyethylene with a slit in it for the joiner isolates one part from the other, preventing the epoxy from gluing everything together at the face-to-face contact of the two master ribs.

With careful work, the outer wing will slide into position nicely during assembly. The wing outer is held securely in place at two points by small rubberbands on wire hooks—one inside the main wing, and one inside the outer wing. In flight, there is a friction brake effect inside the box, so that the rubberbands just add a fail-safe factor. To prevent the wing outers from twisting around the joiner, fit pegs into the main wing, cutting the matching holes in the outer ribs.

In my Wellesley, the bomb containers are slung under the wing. They're made of polystyrene, proofed, and covered in thin glass cloth. The struts are tube mounted in the wing, so they're removable.

The remainder of the airframe construction and miscellaneous installations follow conventional procedures. The Rom-Air gear, for example, sits nicely on a ply platform at the narrow fork of the V-shaped main spar. The platform should be set up so that the leg, when extended, puts the wheel about one inch further forward, as seen in the side view. The leg should be shaped as in the drawing. For masking the wheel when the gear is retracted, thin ply covers are supported by two metal pegs which are fitted onto the legs. With some adjustments, these covers will do the job nicely and cause no problems in operation.

In my model the Rom-Air tank sits on a padded cradle between the main spars in the wing center section, and the nearby operating valve gear sits in a box together with its servo. Thus, no connecting up is required prior to flight, except to plug in the servo lead to the receiver.

Stringers will have to be cut away at the midpoint of the servo for installing the two windows located there (see plans). The windows are made from thin acetate sheet.

Finishing and covering. With the exception of the front part of the fuselage back to the pilot's cockpit which, as mentioned before, is solid skinned and so requires balsa fill-ins between stringers, the airframe is covered in fine-quality nylon. Apply the covering damp, and attach by brushing on a water-soluble adhesive, well diluted so that it's nice and runny. (Some builders use dope, but I find that dries too fast, preventing you from working the cloth properly.) Once the nylon is adhered just the way you want it, bring it up taut with thinned-out dope. Surprisingly, the geodetic crisscross design retains the wing curvature pretty well.

The finishing job involves a brushed-on desert camouflage treatment on top, with matte black sprayed on the undersurfaces. Apply the dark green and sand camouflage colors with a wavy pattern to suit your taste. Add fuel-resistant varnish (or epoxy) in the engine areas. Finally, don't forget the RAF insignia.

Engine cowling and final checkout. The cowling is called a Townend Ring after its designer, who, according to the encyclopedic Bob Wischer, worked for the Boeing Company in the Thirties. This cowling has better-than-negative drag, rather like something for nothing: Tested in a wind tunnel when hanging freely, it actually moves forward! The Townend Ring is supported on 12 bicycle-wire spokes arranged radially in two rows of six. They in turn are soldered to a brass 'U' plate that fits snugly underneath the engine bearers, and then secured to the bearers with self-tap screws. This arrangement permits removal of the ring for engine maintenance.

A balsa imitation of the Vokes tropical air filter for the carburetor is epoxied into place underneath the cowling ring. The dummy exhaust pipe, made of a piece of dowel drilled out for effect, is glued to the lower right side of the Townend Ring (which carries the integral exhaust collector ring) and is shaped appropriately at the joining point. The real exhaust pipe (a copper one) exits discreetly almost out of sight. A small length of silicone tubing is attached to the pipe at the end.

Do a thorough checkout of all vital items, such as the radio gear; the freedom and accuracy of all flight controls; the engine security; and the landing gear retraction. Equally important, make sure the balance point is as indicated on the drawing (25% aft of the aerodynamic mean chord from the leading edge, which equals 4 in. back from the wing root). After that, take it out to the yard and practice assembly of the wing-fuselage-controls-radio connections, etc. Get the bugs out of your airplane while you're under no time constraints, and before that first flight when everybody's watching.

One useful and time-saving trick is to fit the glow plug with a built-in wiring system, using a miniature jack plug like those used in radios. Fit the socket at a convenient spot on the fuselage, wired up to the plug and the engine (it's handy to have one wire connected to a bolt holding the engine to the bearers), and just plug in from the ground battery to energize the glow plug. This system eliminates having to fool around with those spring clip gadgets that tend to fall off anyway, once the engine fires.

Another suggestion is to build two cradle stands, as I did, one for the wing and another for the fuselage, that make working on the model much more convenient. I use them at home and take them to the flying field, too. Each stand is easily crafted from polystyrene beds on a ply base. When going to the field, I take along a small folding picnic table and place the wing cradle on it so that my preparation work is done at a comfortable height. The stands also give handy protection during transportation.

Test flying. You can approach this several ways. I personally advocate some taxiing to begin with (to check proper tracking of the tail wheel and good rudder control of steering), followed by one or two fast runs and a short liftoff. If she proves her mettle, you can taxi back to the starting point, line her up into the wind, apply power gently, and let her pierce the skies. The Wellesley flies majestically after an easy and realistic takeoff, and when up to a safe height she'll cruise about on no more than 50% power with the Enya .40-4C.

My original weight guesstimation for the Wellesley proved right on the mark. Fully loaded with fuel, the model comes out at one ounce under the eight pounds I was aiming at. A token two ounces has been put in underneath the fuel tank, in order to dampen *down* elevator response.

My fuel tank, by the way, is a very expedient little job by Heinz. I made it from a tomato soup can from the pantry, cut vertically down the centerline. The 5-oz. (150cc) capacity is perfect. Of course, the tank is rounded on top to fit the limited space. Due to its unusual shape, air vents are fitted at each end of the tank as a precaution. One by-product of twin air vents is that fueling is easy. It's best to have brass pipes for fuel supply to the carburetor and an optional brass one for draining surplus fuel after flying. Metal pipes stay put and need no maintenance.

There's just one thing left to say. I'd like to wish you happy building hours, safe and satisfying flying—and applause from all the club members!

CL Aerobatics/Fancher

Continued from page 62

seem to have a real feeling for what modelers would like to see when they step up to the victory stand. I don't know about the rest of you guys, but I'm a big fan of wall plaques. They're much more attractive than most of the trophies you see; plus, I've got a whole lot more wall space than I do empty shelves!

It seems that *Windy* ("Mr. Pro Stunt") *Urtnowski* has entered the specialty Stunt products field with a couple of very desirable items. He has for several months been producing his handmade and finished control handle and has recently supplanted that with duplicates of his handmade, four-inch Delrin bellcrank.

The handle, which sports a handsome, concours-level clear finish on natural light-grained wood, comes in both large and small sizes and features adjustable line spacing. My sample is the small version and fits my hand very comfortably . . . very much like a good, old, out-of-production EZ-Just Hot Rock. Unlike the Hot Rock, line spacing can be changed from 3⅞ in. (again identical to a stock Hot Rock) up to a full five inches, large enough to make even the most recalcitrant bow-wow sit up and do as it is told. Neutral adjustment is via a screw clamp in the back of the handle on a 1/16-in. aircraft stainless steel cable.

The only remotely negative feature is the need to cut off one end of the cable and rethread it through the desired new holes. The cutoff end must, of course, be recrimped. This somewhat inconvenient feature is counterbalanced by the knowledge that there is no way the adjustment can slip—as it can with many of the easily adjusted types.

Typical of Windy, the bellcrank is very innovative. Although conventional in its T-shaped format, the ¼-in. Delrin crank actually pivots on a 3/32-in. music wire axis as opposed to the more common steel 8-32 bolt. The crank is held in place by two brass eyelets soldered above and below it in the middle of the ½-in.-long music wire pivot. Very unconventional but somewhat lighter than the usual bolt. Also, although appearing somewhat spindly, because it is music wire it is very strong for its weight.

The one drawback I see is that there is only one location for the pushrod, located ¾ in. from the pivot. While this is undoubtedly adequate for the vast majority of applications, it would be nice to have a choice of at least three locations for those who desire different sensitivity. Contact Windy at 9 Union Ave., Little Ferry, NJ 07643 for prices and details. His phone is (201) 440-0905.

Drop a line to Ron Prentice, *Vintage Control Line Kits* (Address: The Mill, Ash Priors, Bishops Lydeard, Taunton, Somerset, TA4 3NQ, England) if you're interested in some good-looking, European-style Old-Time Stunt kits. Ron is marketing such oldies but goodies as the Mercury Monitor, Marlin, and deBolt Bipe. These are moderate-size (200-300-sq.-in.) models of the late Forties and early Fifties era.

Excerpts from an ad in the April 1950 *Aeromodeller* magazine for the Mercury Musketeer alerts