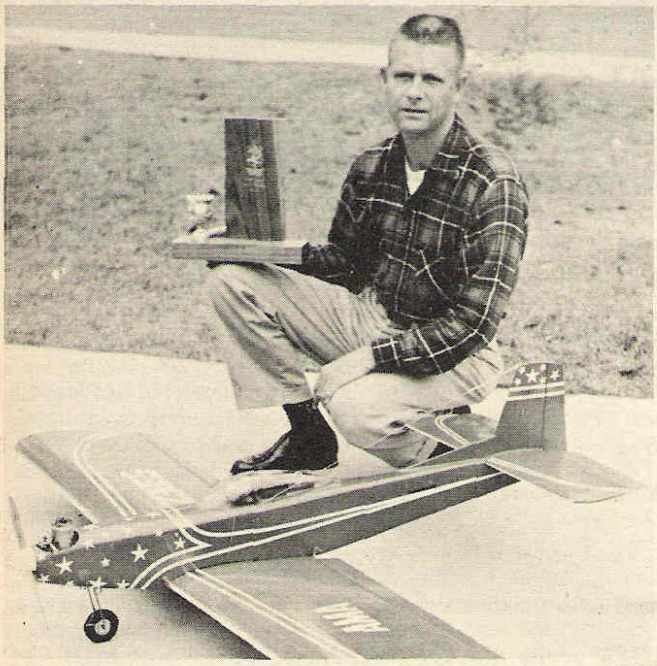
# THE BEACHCOMBER

Author making a touch and go landing approach—plenty motion and Jim calls attention to his attire and notes that "all is not sunshine in Florida."

**by JAMES E. KIRKLAND**

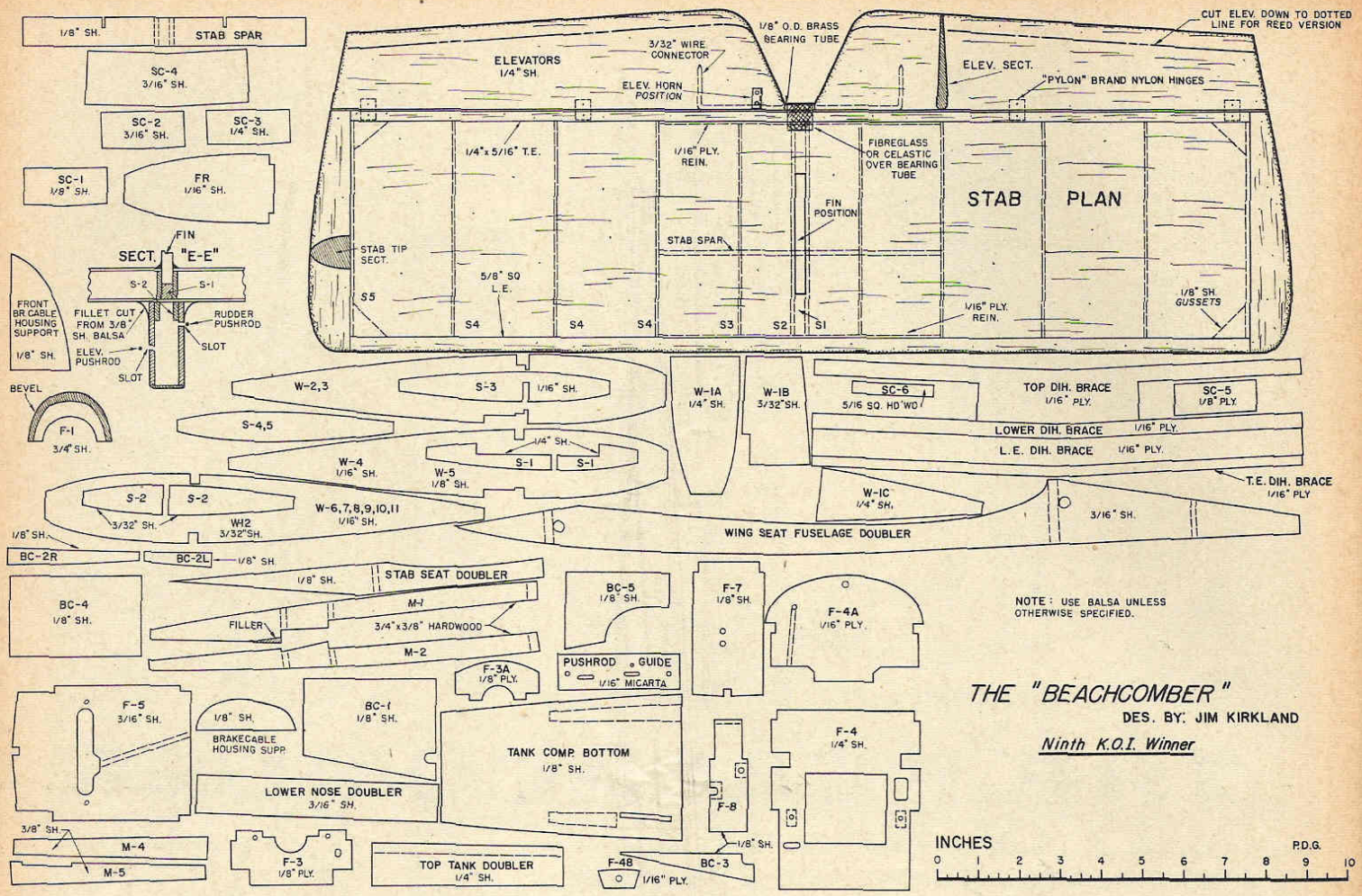
QUADRUPROPORTIONAL R/C MODEL THAT WON FIRST IN MULTI AT THE 9TH ANNUAL KING ORANGE INTERNATS — FLOWN BY THE DESIGNER, IT WON BY A CONVINCING MARGIN.

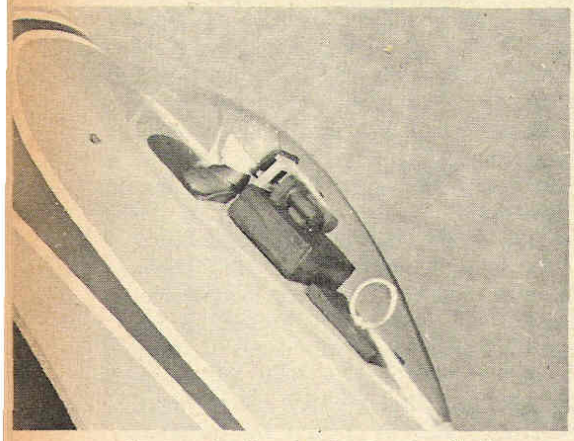


Author with his Beachcomber and KOI trophy — Jim is M/Sgt. in USAF and member of Guided Mites R/C Club Eglin Air Force Base.

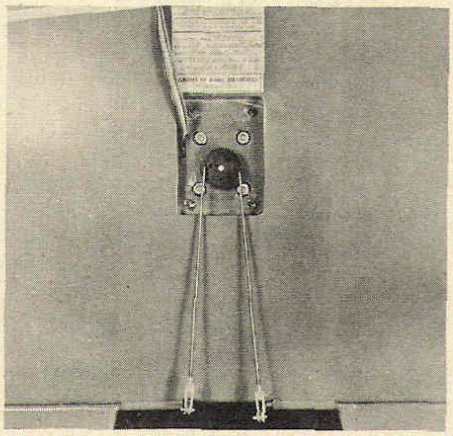
► In early 1962 a decision was made to take a long, hard look at the new quadruproportional control systems for R/C multi competition. These systems seemed to offer unlimited opportunities for smooth and precise flying. At the '62 Nats it was apparent that winning R/C flights not only had to be smooth, but also high points had to be scored on every maneuver in the present AMA pattern. This pattern requires our models to perform some remarkable aerodynamic feats when compared to full scale aircraft performance capabilities. As the top scores at the 1962 Nats would indicate, present day multi designs flown with reed systems do a very creditable job of this. However, these top scores also indicate that there is considerable room for improvement before this present AMA pattern becomes obsolete; which will surely occur at some future date! I flew a reed ship at the '62 Nats and came away more convinced than ever that the new proportional systems could do better than reeds in meeting the demanding requirements of competitive flying.

Most present day reed designs have some necessary compromises "built in" to enable them to perform as smooth as possible by "hiding" the beeped commands. While these compromises make a certain degree of smoothness possible with reeds, they also affect other areas of performance to some degree. To overcome this now "built-in *deficiency*," additional measures must be taken to enable the model to perform the more demanding maneuvers consistently. These additional measures must usually be paid for in some manner; commonly in the areas of time, cost, gadgetry and possibly some sacrifice in overall reliability. I felt that the new proportional systems would eliminate the "compromise" and "deficiency" problems and thus allow us to fly in the same manner as would a pilot flying a full scale aircraft. With these systems we should be able to develop "in the cockpit" capabilities while flying our R/C models. (*Continued on next page*)

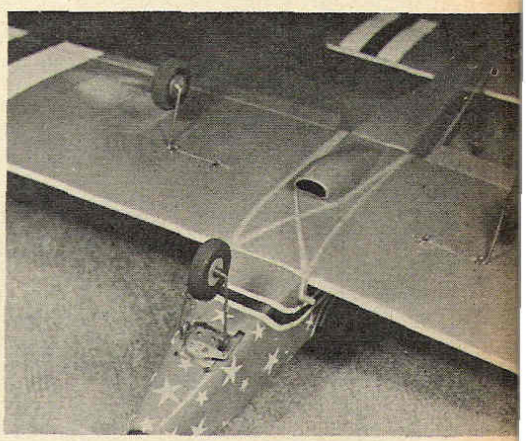


Canopy interior detail — wonder if that ejection seat works, also radio direction finder.



Aileron servo mounting detail — registration indicates 6 pounds, O.S. 49 and 800 sq. in.



Main gear, nosewheel, brake and steering arm detail — simulated air intake for servo clearance.

I had heard much about the controversy as to whether the new proportional systems could match the reed systems for precision maneuvers. My experience as a pilot of full scale aircraft, where emphasis is on smoothness *and* precision, revolted at this supposition. Proportional would offer us, as R/C fliers, the same advantages enjoyed by the pilots of full scale aircraft. What was needed now was a multi design to take full advantage of the new proportional systems.

I had flown most of the more prominent multi designs on reeds, and there seemed to be a little something missing in each as I considered them for proportional. Soon I realized that I was exploring in a relatively unknown area. This was when I first gave serious thought to the designing of the Beachcomber. I wanted a model that would fly as precise as any reed model, yet respond to controls properly in any attitude, or condition of flight. I wanted a model that would fly inverted as well as it would upright, and remain just as stable; and do this with a minimum of trim differential. I wanted a model that would spin reliably with no trim change; one that would tail-slide reliably; one that I could roll slow or fast as required. In short, all the things I had wanted from a reed design but had failed to find for obvious reasons. If I was going to try my hand at this design thing, I might as well go for broke!

Webster defines the word "beachcomber" as a loafer, a vagrant, a thief! While I don't really claim to be either, I did use all tried and proven practices throughout the design. It is really hard not to! Besides, once I had made up my mind, I did not have much time before the 9th (*Continued on page* 38)

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King Orange Internationals. Anyway, the word "original" appears to have lost its meaning when it comes to multi designs. There are a multitude of ways and means to lay out a design with appealing lines; many ways to vary moments, lateral area distribution, thrust, lift, drag, etc. They all seem to have been used! I, for one, certainly was not so interested in being different that I would be willing to burn midnight oil and build dozens of trial ships just to have something different. I wanted a practical model to fill the need for a proportional design, and I wanted it in a minimum of time! You will recognize lots of construction practices that have been used before. Sure, you will even see some lines that remind you of some other model. So I will claim the "thief" bit in Webster's definition, and let the Beachcomber do the loafing! It does this quite convincingly while performing the present AMA pattern.

Designing for proportional was certainly going to require an open mind. Since I seemed to have reached a conclusion on what features I wanted the model to have, it was now necessary to decide on *how* to get them. Right about here my shortcomings as a designer began to really rare up and shout! Well I had been called "hard-headed" before, so out with the paper and pencil!

The RAF 30 looked like a pretty good symmetrical airfoil, so I "modified" it for the wing! I used a 15% section as I didn't want snap rolls—not even a little bit! I thickened up the leading edge to get a nice round, blunt entry shape to keep the wing from being too sensitive about the pitch axis. I wanted a minimum of bouncing around in rough, gusty air, and the rounded leading edge should help to minimize this.

Then I thinned down the airfoil section aft of the high point. I wanted immediate, sensitive, and linear response from my ailerons. By thinning down to the rear of the high point I reasoned that the slip stream would get back down to the ailerons intact; and with the generous ailerons shown I hoped to get the results I wanted.

Since I was not designing a pylon ship, I used a large wing to keep the airspeed within reason. The final wing loading came out at 18¾ oz. per sq. ft.! Pretty light, but I wanted a model that would do all the maneuvers with ease, and I had to have lift to accomplish this!

While dihedral is an important factor in controlling lateral stability, it was also reasoned to be detrimental in some respects; especially so when present in too large amounts. When a low wing airplane is slowed down for landing in gusty wind, there is a good possibility that the gusts will not be exactly in line with the line of flight. When such is the case, the upwind wing would have an amount of the lower wing surface exposed to this side gust exactly in proportion to the amount of dihedral present. Meanwhile, the opposite wing panel would be partially blanked from the effects of this same gust by the fuselage. This would result in the model tipping, as would a sail boat with too much sail. I have seen low wing models, with too much dihedral, get tipped over by gusts of wind while taxing crosswing. I didn't want this to happen to me! Also, I wanted a minimum of difference in upright and inverted flight turn characteristics, so the 3 degrees was chosen as the minimum and the maximum. This worked out especially well because my jig bed for wing construction is not hinged in the middle, and it was already set up for 3 degrees!

Man, by now I was really beginning to dig this design jazz, so on to the stabilizer! The first thing I wanted here was ease of construction and as much warp resistance as possible. I decided on a sheeted, symmetrical stab to satisfy both of the above requirements. The stab airfoil would control airflow in much the same manner as the wing airfoil. The elevators would be effective, yet linear in response, as I had reasoned the ailerons would be. Maybe if I made them big enough I wouldn't have to use "up" trim to get the model to spin! Man, now I was really reasoning!

I had the "how" of the flying surfaces all worked out. Now it was only necessary to hook them together by some means! I laid out the wing and stab airfoil sections on a zero incidence line, then the engine thrust line in zero. I got all the equipment together, measured it, and drew it in the positions I thought best. I then drew lines around and about all this and had my fuselage! This was getting easier all the time! I added the little scoop effect at the spinner and drew in what resembled a P-51 fin and rudder—in what I considered to be about the right amount of area. Then, by positioning the canopy in the proper location on top of the fuselage, and adding a small scoop to the bottom of the wing, Bingo, P-51 (????) Oh well, maybe just a little, if you stretch the imagination!

The lateral area distribution was purposely laid out to utilize 3 degrees of right thrust in the engine. (I must have really gotten bit by this design bug!!) Having flown models with both the zero-zero thrust set-up, and those with right thrust, it had been my opinion that right thrust had more advantages than disadvantages. Anyway you look at it in a zero-zero thrust set-up, torque is sure to be a problem in some attitudes. True, there is a certain range of speed at which torque is balanced out, but below this speed torque does show up. This low speed area does appear frequently in our flight pattern, and this was the reason for the decision to use right thrust. The fear of losing some power as a result of using right thrust was of no concern. Present day engines have power to spare for anything!

A tricycle gear was a foregone conclusion, dreams of a retracting gear came into the picture and the whole layout was adjusted so that it could be used by making a few minor changes here and there for future Beachcombers. However, the original design had to settle for a fixed gear. The brake cable and housing is available from the Victor Stanzel Company of Schulenburg, Texas, as "nylon tubing

and drive cable." Three 48-inch length for $1. This tubing and cable is very easy to work with and install. The small steel cable does not stretch, thus making precise brake adjustments possible.

*Some proportioned closed-loop feedback* servos have the peculiar characteristic of rotating any number of degrees when the receiver is turned on without the transmitter being turned on; sometimes completing 360 degrees of rotation before settling down. This characteristic must be allowed for and probably caused the greatest amount of head-scratching! Finally, two small, easily fabricated devices solved this problem completely.

The first was a small "shock-link" made of telescoping brass tubing and two small *compression springs. This unit is capable* of expanding, or contracting, 3/8" in either direction from its center-loaded position. This gives a total of 3/4" over-ride capability. I used one of these on the throttle linkage. This "shock-link" enables the servo to travel to any position it desires without being effected by the stops on the throttle at the engine. The "shock-link" either expands or contracts, as required, to take up the excess servo movement. I used another "shock-link" between the rudder servo and the nose wheel steering *arm to reduce the side load effects that* could be transmitted from the nose wheel to the rudder servo. The "shock-links" shown on the plans are much easier to construct than the original, but accomplish the same thing. You can probably devise something that would do a comparable job, but whether you use the "shock-links" shown on the plans, or devise your own method—by all means use something to accomplish this vital function. It is definitely necessary!

The second device to solve the servo *cycling problem was a small retainer for* use on the push rod ends where they connect to the servos. Ordinary retainers will not allow a servo of the Space Control type to rotate more than about 300 degrees before stopping it cold! This is hard on transistors! The special retainer shown on the plans is made of .025 music wire and is easily constructed by winding this wire around a 5/64th drill bit shank and bending as shown on the plans. When used with the Perfect eyelet soldered to the push rod, they will allow the servos to *rotate throughout 360 degrees continuous*ly without any stoppage occurring. Of course, with servos equipped with eyelets already mounted on the drive discs, as are the Steeb-Sampey units, ordinary retainers will do fine.

Well I had all the "hows" answered; now to get them all down and in proper perspective with one another. The drawing board was broken out and design work started less than 90 days prior to the KOI contest. I was ridiculed by fellow modelers for attempting such a task in so short a *time. But I made it, and so can you.*

*CONSTRUCTION:* Plans are quite detailed, only special instructions are included here. Wing is most important and must be true. Invest and build yourself a jig. The double D-tube construction is simple, strong, and light in weight. It is a snap to build this wing in a jig. Build your jig fullspan, and with the dihedral angle built into the jig bed. Lay your bottom planking and cap strips in the jig bed, add hardwood landing gear support pieces and bottom spar. Starting with the center *section, lay in webbing and ribs and ply*wood dihedral braces. Add all servo mount parts. Then working toward the tips, add webbing where needed, then a rib, webbing and a rib, etc., until all webbing and ribs are glued in place. Add the top spar and

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⅛" sheet leading and trailing edge full-span webbing. Now sheet the top of the wing, add top cap strips and let wing "cure" in the jig for at least 3 days. Remove wing from jig and add the ¼" sheet to leading and trailing edges after first trimming back the leading and trailing edge planking flush with full-span webbing. Add tips, let dry, then sand entire wing to shape. Be sure to sand leading edge to a constant radii from tip to tip. Make ailerons of ¼" hard balsa. Make the aileron horn assemblies and fasten to the ailerons. Do not hinge the ailerons to the wing until after covering and doping has been completed on both wing and ailerons.

Original fuselage was made with all-sheet construction and built in a special jig. The fuselage shown on plans can be easily built without a jig and is no different in shape or weight from the original. First, build up your motor mount assembly as shown. Also, build up F-5 as shown, with the micarta push rod guide bolted in place, and the radiused rear brake cable housing support glued in place on the back side. Cut other formers and fuselage sides from balsa as indicated on the parts patterns. Glue the ¼" by ⅛" longerons, also the wing and stab seat doublers to the fuselage sides. Be sure you have both a right and left side. Top of fuselage sides are straight to enable you to build the fuselage inverted. Tack glue the motor mount assembly and all formers to top view of plan in an inverted position and at their proper stations. Wet the outer sides of fuselage side pieces and glue to formers and motor mount assembly that have already been glued to the plan. Basic fuselage is now assembled inverted on the top view of the fuselage drawing and after drying will retain its proper alignment. After letting this assembly dry for at least 24 hours, remove and finish fuselage as shown.

The 1/16" sheet covered stab is easily constructed using balsa strips of proper thickness laid spanwise under the 1/16" planking to form a jig. Be sure the bottom planking contacts the bottom of the ribs properly. Use soft blocks for the tips. The elevators, fin and rudder are cut from ¼" hard balsa. Now, sand all the tail group parts to shape. Join elevator halves, but do not hinge elevator or rudder until after covering and doping.

When all major components have been completed, align and glue stab to fuselage. When dry, glue the fin in the slot in stab and dorsal fin to fuselage and the main fin. Be sure these surfaces are aligned properly, or your model will not fly as it should. Add stabilizer fillets cut from ⅜" sheet balsa to the fuselage under the stab for added "seat" area. Now complete all final sanding and pre-dope the wood in preparation for covering.

Next step is to cover and dope entire model. I used Silkspan tissue on ailerons, elevators, fin, and rudder in order to minimize warping of these surfaces which are made of hard balsa and the strength of this wood is sufficient. All other parts were covered with silk. Before you apply the last two coats of dope, hinge all surfaces, using Pylon Brand nylon hinge material as shown. Use light weight fiberglass cloth and dope to fasten the aileron and elevator bearing tubes to the wing and stab. Finish off these clothed areas to match finish you have on remainder of model. Apply the final two coats of dope, add markings, etc., and you are ready to assemble all components.

Before you rush out to the flying field, take plenty of care to ensure that all parts are properly aligned and in neutral when the servos are neutral. Elevator trim should be equal on either side of neutral, as should aileron trim. Total movement should not exceed that shown on the plans. This is very important, as with too much movement you will really have a bear by the tail! Check balance point with tank empty; model should balance as shown on the plans. If not, either shift equipment, or add ballast until it does. Next, with everything installed and the model ready to fly and sitting on a level surface, measure the distance from the tip of the spinner and the bottom of the rudder hinge line to the level surface. These two measurements should be exactly the same. This is also very important, as it will determine to some extent, how the Beachcomber will handle on takeoffs and landings.

*FLYING AND TRIMMING:* The Beachcomber does not fly like the conventional R/C model, it flies better! Its performance characteristics are a *mixture* of present R/C designs *and* full-scale aircraft. The large ailerons give instantaneous, yet smooth control laterally. With the prescribed degree of movement they are effective at *any flying* speed. Elevators have the same characteristics about the pitch axis. The rudder may be used in conjunction with the ailerons for a variety of effects, but I prefer to use it in the same manner as I did when flying reeds. You will pick up some extra motions and uses for the rudder as you fly more. In flying the Beachcomber on proportional, you fly through most of the maneuvers as you would in a full-scale aircraft, yet the model is groovy enough so that you can rely on some of the features you have become accustomed to while flying reed designs. The model will retain any attitude you put it in. It banks beautifully using ailerons and elevator, four point rolls come easy without resorting to the use of rudder; inverted is as easy as upright; it loafs through the vertical 8; spin entry is as pretty as a drawn picture with a clean, sharp stall preceeding the entry, recovery takes exactly 180°. Going up for a tail slide it looks like it gets in a groove, stalls and comes back down the same groove. Immelmann, rolls, and all loop maneuvers are too easy to even bother describing! The model seems to be reading your mind and flies accordingly!

Takeoffs are a snap, just pour on the coal, and when she is really rolling, come back gently on the stick until she breaks ground. Easy now, just aim the spinner where you want her to go, take her up to altitude and level her out. Trim for level, hands off flight, in an upright attitude. Once you have satisfied this requirement, roll her inverted. Only a touch of down

on the control stick as you roll inverted is all that is needed to keep it level. Now add just a touch of down with the trim control and the Beachcomber is as at home in the inverted attitude as it was upright.

Once inverted look for any turn tendency. You'll trim for this after landing. Do not try to correct for this with aileron trim at this time. If it turned left when inverted, but flew straight upright, then add right rudder; add left rudder if it turned right when inverted. Of course aileron trim will be used to compensate for this added rudder in order to retain a straight and level attitude in upright flight. If your rudder is adjusted very far to either side of neutral when you are properly trimmed for upright and inverted flights, your fin must not be aligned properly, or else you have some severe warps. Too much misalignment, or warps, will cut heavily into the model's overall performance. If you built properly, the model should perform in the groove at all speeds and attitudes with the flying surfaces perfectly streamlined with their respective major surfaces.

Once you have trimmed for hands off straight and level flight in both upright and inverted attitudes, your Beachcomber is ready for any maneuver listed.

Good landings with the Beachcomber are dependent on approach and touchdown speed. This model lands slow due to the low wing loading. In fact, it lands as light and gentle as a feather! However, it is completely stable all the way down to, and including, touchdown. I haven't decided yet whether it is the proportional control, or some hidden blessing in the design, but I have not noticed any tendency of the model to lose any of its lateral stability when slowed down in approaches to landings. Exercising normal caution and attention to the approach, the Beachcomber has consistently made touch and go landings in gusty, shifting winds. Evidently the rounded leading edge is relatively insensitive to the small, abrupt changes in angles of attack caused by the gusts. Also, low dihedral angle doesn't give the gusts too much to work on to upset the lateral attitude. Oh well, beginner's luck!

One last word. Don't let anything that you have read so far in this article about flying proportional, or comparing the Beachcomber's flight characteristics to those of real aircraft throw you. If you can fly reeds, you can fly the Beachcomber on proportional. You will find it to have a really smooth and linear control response about both the lateral and pitch axis. The feel of the spring-loaded control stick in your hand and the visual flight characteristics and control response of the model will give you an eerie feeling of "sitting in the cockpit!" After 2 or 3 flights with proportional in this model you will be wondering why you waited so long to come to a decision. The Beachcomber on proportional is capable of winning at any major contest, and will certainly open a new area of flying enjoyment for you. If you are an avid reed fan, you will find special notes on the plans to modify your Beachcomber for flying on reed systems.

## Belgium's Famous Criterium

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Africa. Britain again topped the overall results with wins in 2.5 speed (Wright) and stunt (Ridgway) plus 2nd places in 5 c.c. and 10 c.c. speed. These latter were won, respectively, by Dr. Millet of France and Guido Battistella of Italy, both fresh from their success in the *Giornate Ambro-*

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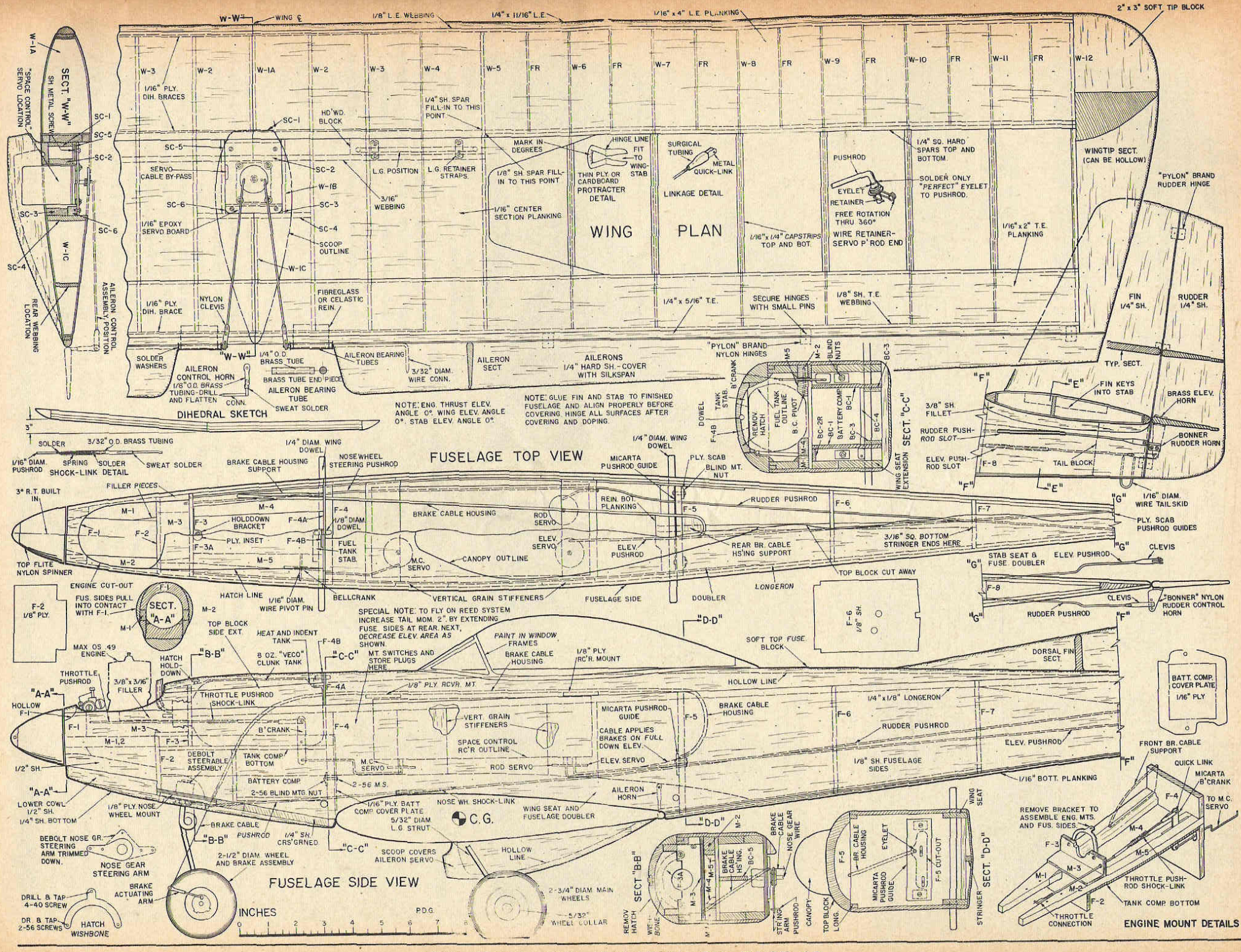


FULL SIZE PLANS AVAILABLE—SEE PAGE 63