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Radio Control Data Service GRID LEAKS®

& MODEL AIRCRAFT WORLD

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ED IZZO, CLASS III WINNER LIDS SIXTH ANNUAL CONTEST. ED IS A PIONEER OF THE STYROFOAM WING-CORE, FAVORS HIGH ASPECT RATIOS.

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We are happy to announce that Bev Smith is now associated with World Engines in the role of Product Consultant. Bev called in from San Francisco the other day with this bit of news — — —

He reported that model builders on the West Coast think that our R/C line "CONTROLAIRE" is really an import; that it is only packaged in Cincinnati — in an attempt to fool our customers.

It is easy to understand how a misconception such as this could originate particularly since World Engines is the sole import agent for the famous O. S. and Super Tigre engines. Actually, Controlaire is made right here in Cincinnati and is composed of parts from the very best U. S. sources. We are so proud of these suppliers that we are listing them in the column at left. Jack Port and his lieutenant, Jim Lanterman, are in charge of the electronic end of our R/C business. Craig Asher runs the tool room. Unlike many radio control manufacturers, Controlaire has the facilities to do most of its own sheet metal and printed circuit board work. It really is doing a disservice to Jack and Craig to let the misconception stand — that Controlaire is an import — hence, this advertisement. Want to see for yourself? Then drop into World Engines, Inc. and the Controlaire Division for the twenty-five cent tour.

World Engines, Inc.

8206 BLUE ASH RD. CINCINNATI 36, OHIO

GRID LEAKS

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THE MONITOR

Regular round-up of new and overlooked aspects of the growing R/C field • Shop talk and just talk • A discussion corner.

BOM: "THE SKY IS FALLING!"

■ Discussion of the BOM rule (builder-of-model) so far has been conducted against a back-drop of "dying dragons," "waving of small political flags," "rubber swords," and "rose-tinted glasses." The ruckus evidently began when the *RC Modeler* castigated *MAN* for defending a rule which the former considers detrimental to competitive RC.

It really began when an Air Force officer in the Far East objected to a classified ad in *Model Aviation* for finished models. on the ground they obviously found their way into competition. Some experts took issue, saying it did not matter who flew what airplane, and others, in their turn, lambasted that viewpoint. And we've been at it ever since.

In Editor's Memo, Don Dewey, writing an introduction to a guest editorial by Robert C. Lien, said: ". . . a ruling which has not only served as a tremendous deterrent to this hobby, but one which has severely discouraged many would-be contestants from entering local or national competition." Without for the moment examining the validity of this statement (sense-wise not taken out of context) we find that Don objects to BOM in his following issue on quite different (*Continued on next page*)

READERS WRITE

TAKES ALL KINDS

I am quite an interested follower of GRID LEAKS. I would like to tell you that I look forward to it every two months, and would like to see more articles on ships, cars, tanks, etc., giving some ideas on the type of installation used. I think that more modelers would like to try some other kind of models rather than aircraft. Keep up the good work!

HENRY H. HILL, Halifax, Nova Scotia

GOOD OLD DAYS

I believe that you have the best technical R/C magazine available. Your wide range of articles is very refreshing especially the recent article on the R/C submarine. This was something that every R/C'er has given consideration if only in some far off dream. I have been at R/C nearly 7 years; a buddy and I split the cost of a old Wavemaster receiver and a Commander transmitter, (older tube type) which I put together twice before it worked—this when we were 15 years old. Now I have Orbit 10 for two years, wore out one set of lever switches, hope to get a proportional soon as I make my first million! For two years before I went multi I built a Kraft single transmitter and tube receiver with help of a friend, flew on pulse using a simple multi-vibrator pulser and a Mighty Midget in the plane. Just before I got multi I had refined the system using the same old Kraft transmitter and a Phelps Unijunction pulser in conjunction with a much-modified F & M Saturn, a pulse-rate detector and two M-M's for rudder and motor control, switching off rudder and pulsing motor control between high and low speed. Ever since going multi I have done very little tinkering and a lot of flying. But, still favor the old pulse system, because of instantaneous control, used to be able to take a hot contest design and as soon as it broke ground put it in a near vertical bank two feet off the ground and let it circle around once, straighten out and zoom straight up for about 30 feet, then roll out just before it stalled. Well, that was the good old days!

DON DOWNING, Wichita Falls, Tex.

SHIP AHOY!

I am taking you up on your offer in your March-April GRID LEAKS, and not hesitating to write you concerning the "Fine Art of Sail." I have been radio controlling for several years, starting out with a 10-channel boat (48" Chris Craft by Sterling), then to an aircraft which I gave up because I had too much time in it (being a perfectionist) to see it buried by a two-second mistake! My next project was a little more daring, but back to the water again with an Octura-O&R Hydro of my own design. Having had so much fun and success on water with the minimum risk of kissing good-bye my equipment, I am definitely in the mood for trying a sailing machine for my next project. Would you kindly ask Mr. Hartman and Mr. Reynolds to send me all the information they have with pictures, and if you have a list of any other R/C Sail (*Continued on page* 31)

THE MONITOR continued

grounds. Just one sentence covers it.

"This is the real point in our stand against this ruling," he stated. "If it cannot be enforced—and quite apparently, it cannot—then what use is it?" Thus, we are to consider—as the word "real" indicates—the case against BOM on its practicality as a law, on a moral and social rather than materialistic basis. This is proper.

Why can't we hang BOM for a materialistic crime? For the simple reason the many arguments attempting to show BOM economically damaging are not provable. Removal of those arguments clarifies the ethical issues on which BOM stands or falls.

It was stated in an *RCM* editorial that two of three contests in its author's area are not AMA sanctioned—because of BOM. We may wonder why the few leaders who organized these contests ignore the national good, allegedly justify their policy with the claim that contest activity depends on allowing a privileged minority to enter purchased, finished airplanes without the possibility of embarrassing protests. Sanctioned or not, we can reasonably assume that most of the competitors in those meets—if there were enough to be a criterion—built their own planes. Either they preferred to, or had not the funds to buck the chap with unlimited resources.

It is late indeed if we are to assume that these leaders, who put on the non-sanctioned meets, had no choice! Why would they have no choice? Obviously, an unknown percentage of entrants were not AMA members. And, if they were not members, one supposes them ignorant of the meaning of organized modeling. You can burn up the cost of a membership in a few weeks flying. Surely we are not to believe that the Class III expert can't spare a few bucks—when he supposedly wishes to pay for custom-built planes? If meet management does not require AMA membership, the result will be chaos. Anti-BOM justification is obtuse logic.

Why don't more flyers enter meets? Everyone agrees there is little or no relationship between the sport and contest flyer. The sport flyer is not interested in contests. This is an over-simplification. There was a time when almost anybody who could find transportation, and the means, showed up at a meet. Today in Class III, the only Class that matters now, alas, there is a big-league, more or less professional, aspect to competition. Among the sport flyers are many who stay away simply because "they don't stand a chance." The winning pilots (who are good regardless) are those with ample opportunity to practice for hours on weekends, and often on weekdays. An international champion writes of twice-daily sessions. Friends of ours practice flying the way a concert artist practices the piano.

The consistent winners burn gas by the many gallons. Failures, accidents, and wear-and-tear use up the crates. Guys band together for mass production, using jigs. They tour regional meets like golf stars. If other people won't or can't pay the price, or make the effort, clearly BOM is not at fault. It may seem that way, however, to the super-active, super expert who, with contest fever in his blood, wants to hit as many meets as possible, and suffers ague when he must ration his ammunition.

Of course, shy violets should compete anyway. But the fact they don't is more to blame for our contest situation, than any supposed inability to buy unending finished crates to smash up on the contest trail. Patterns, judging, grow harder as experts grow more skilled. Events are tailored more and more to match increasing skills of a decreasing number of people. To the high cost of equipment, of travel, of time spent in practice, of aircraft, it is now proposed to add another substantial boost—the cost of a finished model, or models. We may yet break the $1000 barrier. How much more advantage can be yielded to the man with substantial funds?

There is a drift toward professionalism. The super-expert is not concerned, or does not risk showing concern, that others do not build their own models, or that Joe or Charlie is a member of a manufacturer's stable of pro pilots who benefit from an endless supply of costly equipment which the true amateur can't match. An editorial asks, if a manufacturer's stable pilot "proves out systems in competition, making the best mark possible to aid in the development and *future sale* (our italics) of the products involved, should this facet of our hobby and sport be considered wrong?"

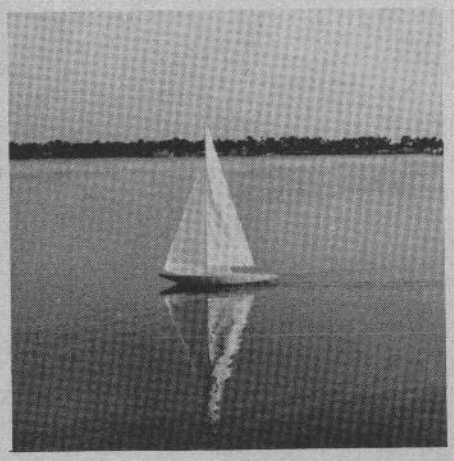
In U-control, the modelers themselves once raised such a stench—because of manufacturer's people flying their own models for sales promotion purposes (you see, the "pros" never refused a trophy!) —that magazines excitedly published articles against commercialism and professionalism, and the *New York Mirror* (newspaper), for one, prepared a list of industrial villains (yours truly included, who never won anything, and Christine Zaic—she never built a model that we know of). Feelings reached such a pitch that one national expert was sabotaged with sand in his tank, and others who had *no* affiliation but always won—and honestly, too —actually gave up modeling. Of course, this is not RC. Graciously, we condone everything. By doing so, we are making a monster out of BOM.

We argue obliquely. There is, for example, the oft-repeated editorial cliche that one does not have to make his own tennis racket, bowling ball, or skis. How many angels can dance on the head of a pin? Why not say that the Girl Scouts should buy A&P cakes in order to win more cooking competitions. Or buy one from the girl next door? Or let Mom cook the thing while Susie is out skating. How many horse-shoes equal how many watermellons? Until we decide that this hobby is no longer model *building*—which it has been for 50 or more years—we have an entirely different frame of reference than, say, tennis, bowling, or sking. Nothing new is being imposed on anybody who has had a right to buy finished planes. This has been an amateur hobby with clearly defined rules. The question now is whether it should be professional or amateur.

Before taking up the ethical or moral aspects of the debate, it should be established who wants the BOM rule removed, and what is a plane that is not built by its competition flyer. Many Class III entrants prefer—and can't afford otherwise—to build their own kit models. They may or may not use foam wings and fiberglass shells, feeling that those excellent assemblies, which do again favor the chap with funds, at least require enough work to maintain a fair status quo. (Though close to a finished model, they are not a finished model.) If, occasionally, they are grounded, or miss a meet, or can fly in only five meets instead of 10 or 20 (which they could do if they had access to products of someone's basement factory), this is part of the game.

It dilutes the advantages of special privilege, economic or otherwise. It works against the ever narrowing limits of competitive Class III, and for maintaining a desperately needed broader base of activity. When some expert cries that he has insufficient time for chain building, the average Joe doesn't bleed for him—he has no time either! It is a common problem which always has tended to keep competition activity reasonably open to all who feel they must have a chance, however remote, if they are to compete. And, as the editorials have said, there is no factory-

(*Continued on page* 32)



Prototype 12-meter model of Defenders of Americas Cup, from the Reynold's Mfg. Co.

Cute radio-controlled biplane for Quarter-A motors was made by Herb Clukey, Fairfax, Va. Both wings knock off, rudder control by escapement or Adams Actuator, etc.

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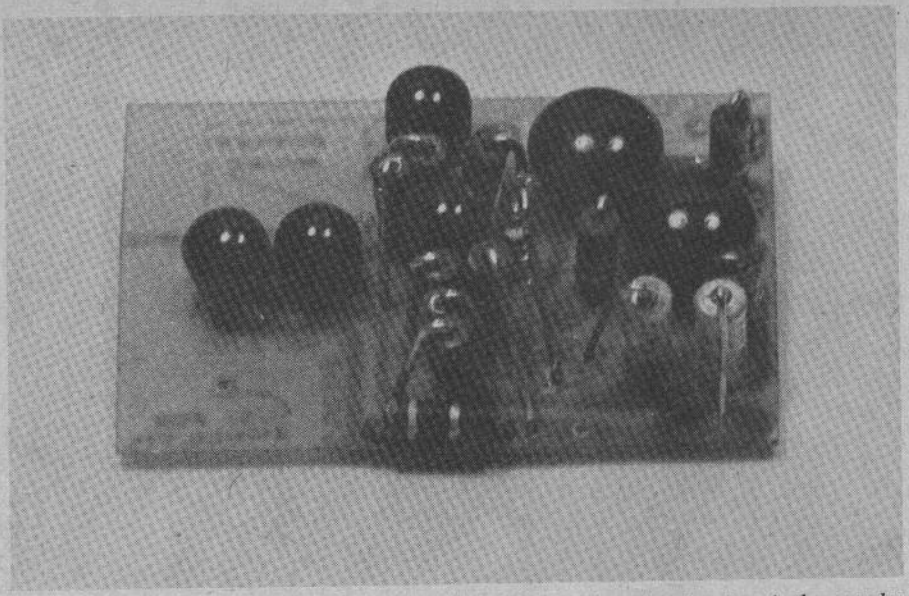
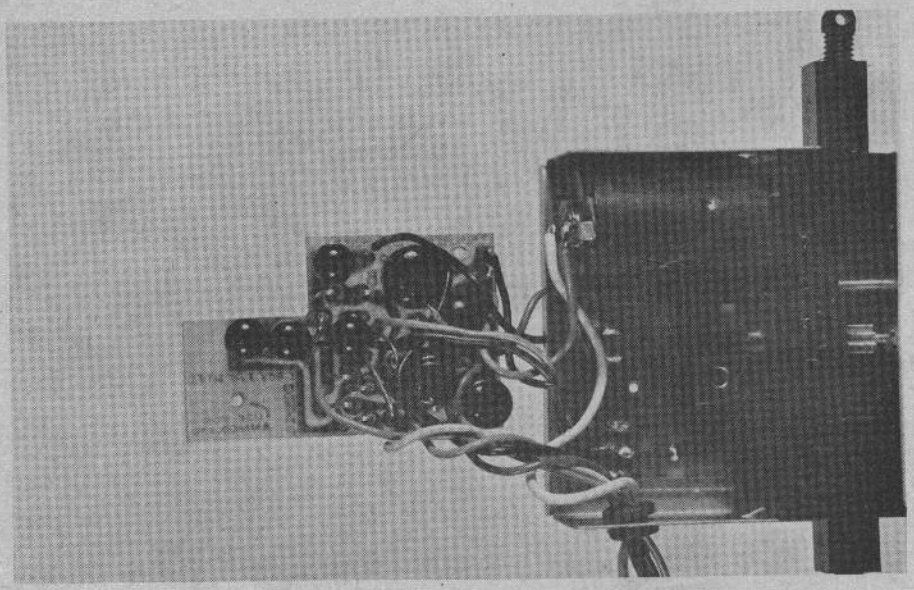
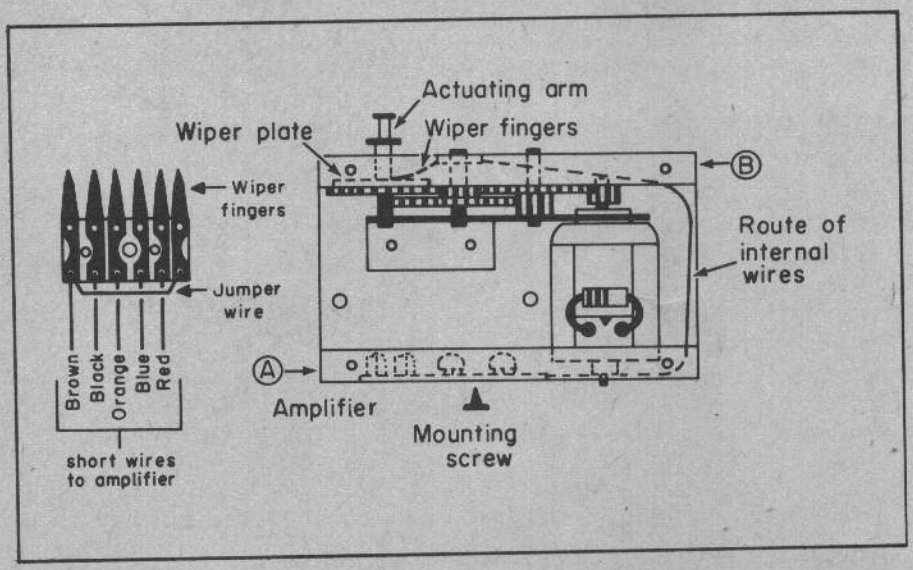


The components assembled on the "universal" printed circuit board which has indications for trimming to suit the popular servos now available from the dealer.



A finished amplifier as trimmed for the Annco. Inasmuch as various arrangements have been tried for the components, it is not recommended to make any changes.



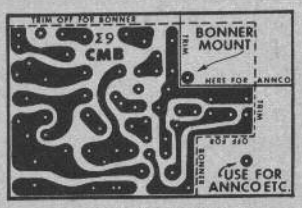
(Citizen-Ship servo: Locate according to mounting holes used.) Power, signal wires led out at A or B by reversing case cover.

The SIGMA 9 Silicon Reed RELAYLESS SERVO AMPLIFIER

... A Step Toward Pulsed Reeds

By CURTIS BROWNLEE

NOT JUST ANOTHER AMPLIFIER! BETTER IN SOME WAYS—EQUAL IN OTHERS—IT OFFERS ADVANTAGES WHICH MAKE IT WORTHWHILE REPLACEMENT TO TRY.



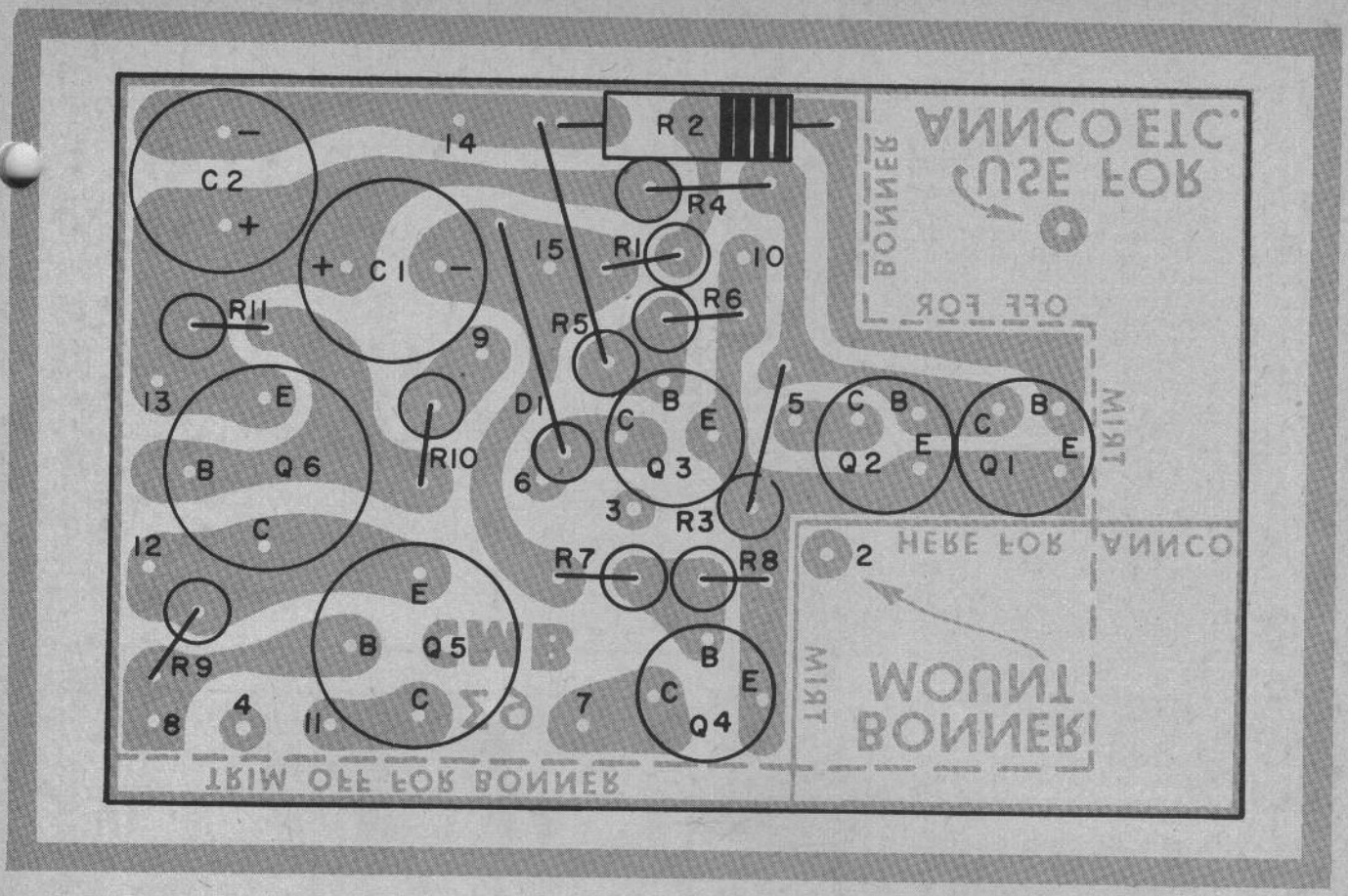
ACTUAL SIZE

► This is an amplifier to convert relay-type servos to relayless operation. While it has some similarities to circuits already commercially available, it has differences in the basic circuitry, and in the goal to be met. It is superior in some respects to any previous circuits, and equal to them in others. As "just another relayless amplifier" it is a worthwhile replacement for what you are using.

Response time is much quicker than that of commercial Germanium amplifiers found in most commercial servos. The servo arm moves at the same speed under no load, at slightly less speed when heavily loaded—as compared with the Germanium amplifier. The amplifier is lighter and more compact than any others, and fits into practically any servo.

In order to achieve this fit into a variety of servos, the amplifier is laid out on a small circuit board. Because this is necessarily crowded, the beginner who hasn't built a few small electronic kits is not ready for this job; it requires some previous printed circuit soldering experience to avoid damaging the PCB. If you have built a few kits, or done the equivalent, you will have no trouble.

It is not necessary to use heat sinks in building this amplifier. The components will stand *normal* soldering temperatures. This means using an iron of no more th 30 Watts; a pencil-point shaped tip is r quired. Ersin Multicore solder No. BS 219 Grade K or equivalent is highly recommended. The .028-inch-diameter (22 swg) size of 60/40 alloy is the best we have found for printed circuit work. If you do



not use too much heat, the work will appear shiny when finished.

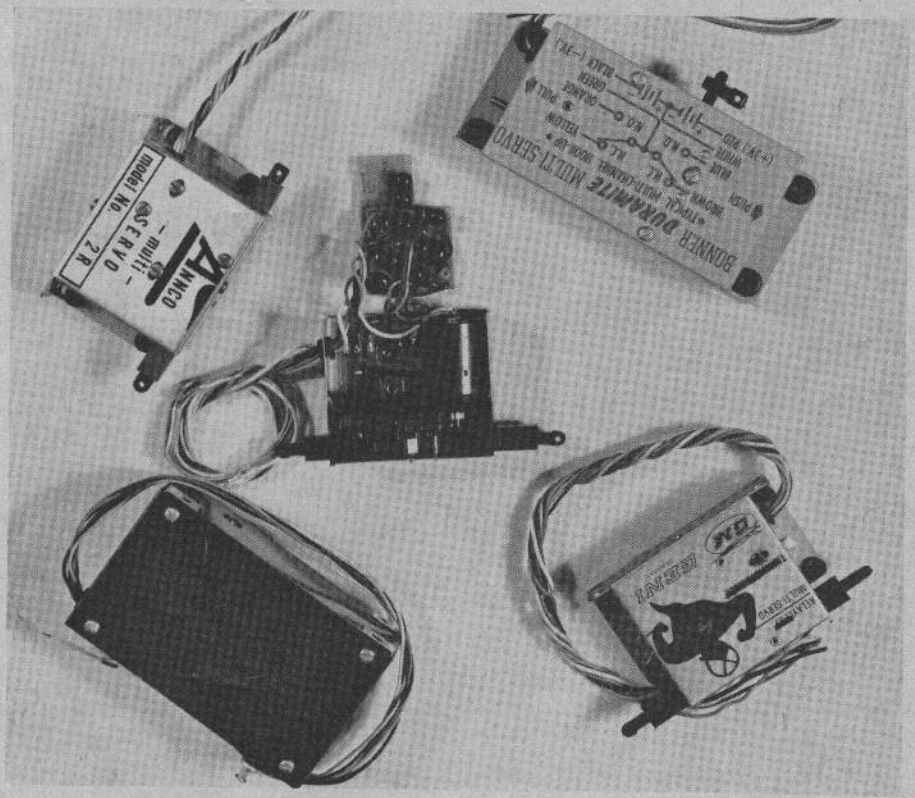
We will not go through the requirements of components in the circuit, except where there is a basic difference between this amplifier and those already published. Looking at the circuit diagram, you will note some differences. One is the voltage divider formed by R3 and R4. The transistor which provides the drive for neutralizing, Q2, is biased "on" by this voltage divider at all times when Q1 is not conducting (no signal). By using a voltage divider of this type, you will find that neutralizing will still exist if the bias battery weakens or goes dead. This amplifier will give controllable action without the bias battery, but will be noticeably slower in one direction. In one of the most popular amplifiers on the market, you lose absolutely all of the centering or neutralizing intelligence should this battery go dead.

Another interesting thing from the laymen's point of view is the transistors used. As manufactured these units are made up on a header and encapsulated in epoxy. They are mechanically strong and immune to vibration. There is no dessicant pellet rattling around inside to cause trouble, and the plastic body, being in intimate contact with all the surfaces of the transistor chip as well as the junctions, serves as one heat sink for all of these.

Some readers are interested in using pulsed reeds for proportional, others in the electronics of this thing. The writer has been working with pulsed reeds for some time, with mostly confusing, some discouraging, and a few fair results. First trials with commercially available servo amplifiers were completely negative. At the 1964 Nats we had a discussion with Ted White of F&M Electronics about the differences between Germanium and Silicon transistors. He gave us four of the little Silicon units—and that's how this started.

Even with Silicon NPN transistors taking the signal from the reeds and feeding it to Germanium output transistors, there was a slight difference in response time or delay. There was another great difference in that these little Silicon units never missed a thumb signal, no matter how slight or how quick. On the pulser, though, there was too much delay in the output stages to get any kind of recognizable proportional control, even with the pulse rate as low as 5 PPS and the mark/space set at 30/70. You either had full rudder or no rudder.

Then we received samples of some new Silicon PNP's (*Continued on next page*)



These are the servos with which this amplifier has been thoroughly tested. In general, response time is greatly improved. Arm speed has proved to be more uniform.

with a low enough collector saturation voltage to be considered for this purpose. When these were inserted, things looked better. We could pulse a little rudder, half rudder, or full rudder. Going back to thumbs again, the response time was very good. Using a variation of this circuit to drive a Hillcrest servo, we found it possible to control the output arm in increments of less than one degree from the transmitter switch. This corresponds to a figure varying between five to 12 degrees using Germanium output transistors. This alone should illustrate how great a difference we are talking about, and how it can be a problem with pulsed reed operation.

Some of the important things we have to cope with when going to pulsed reeds are:

1. Equal electric motor speed in both directions.
   (a) The electric motor itself.
   (b) Transistor matching.
   (c) Load imposed on the servo.
2. Thermal instability of circuit components.
3. Manufacturing tolerances of circuit components.

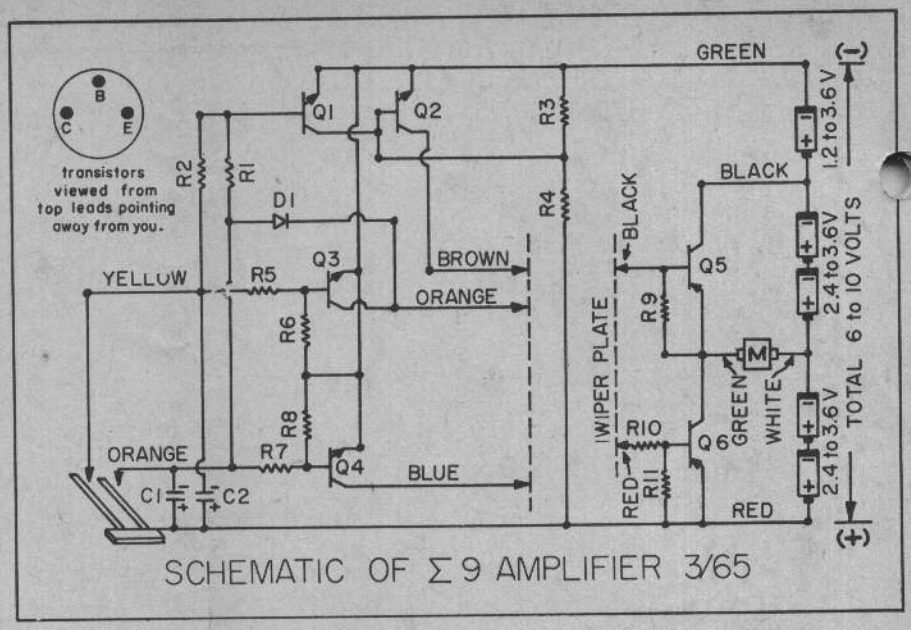
The points enumerated in 1. a,b,c usually can be taken care of by adjusting resistor values if you can spend a lot of time. There is not much we can do about making an electric motor run with exactly the same RPM in each direction as long as the motor is in good shape. We can select closely matched transistors all night; but if the load on the servo is changed, one direction will slow down more than the other direction.

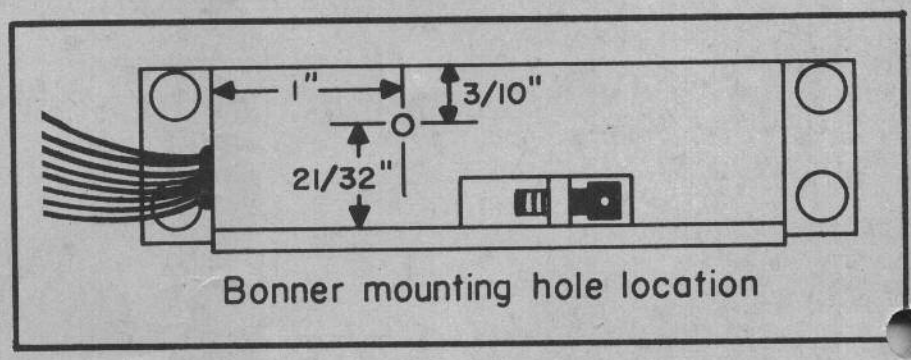
The load is really the key to the problem. If you wish to experiment, R10 is the best place to start. The lower limit here is about 100 Ohms, and the upper limit about 200 Ohms using a five-cell nickel cadmium pack. Under heavy loads, a value of 100 Ohms may be necessary to keep Q6 in saturation. However, the base current of Q6 may be as high as 50 ma. and under moderate loads 25 ma. is plenty of base current to keep Q6 in saturation; we are talking about "forced" saturation.

Under normal loads, then, about 25 ma. of useful collector current which would be passing through the motor, is instead diverted through the base circuit. Let's just saw we "guessed" that 300 ma. of motor current would be required. Going to the curves, we find that 1.1 Volts will be required across the base of Q6. Thus, 11 ma. would go through R11 and 30 ma. would be more than adequate for Q6 base current to force collector saturation. Subtracting the collector saturation voltage of Q4 from the *fully-charged* voltage of the batteries, we find that R10 must drop 5.1 Volts at 41 ma. This leaves a theoretical "exact" value of 124 Ohms for R10. BUT, this is only for 300 ma. of motor current. If the motor current goes to 500 ma., this resistor will have to be smaller. So?

Let's take a better approach. Let's just forget about the motor and matching all those little transistors and picking R10. Just use 100 Ohms for R10 and let the base current of Q6 slow the motor down in the "Orange" direction, then put a 0-5 Ohm pot in the black lead to the batteries and adjust for equal speeds. When you get it right, you may substitute a fixed resistor here if you wish.

Now that we have equal speeds, are we in the pulsed reed proportional business? Not yet, I'm afraid. The transistors and resistors are up to the task, but we still have to put up with the electrolytic capacitors. Using pulsed reeds you want the RC time of C1 and R7, as well as C2 and R5, to be as "quick" as possible, while still providing enough delay to keep Q3 and Q4 in saturation when you want them to be. Most of





the electrolytic capacitors available in a size small enough for our uses have a tolerance of plus or minus 100%. With normal relayless reed operation we can just make this value two or three times its required value and let it go at that, for none of us has thumbs fast enough to know the difference.

Sampling signals from a pulser is quite different, however, and we find we need some quality now at this spot. Some Tantalum 10% types which are very temperature stable will probably make this pulsed reed thing go. We have made some inquiries about them but haven't nailed down a source thus far at a price you would send up in a model airplane. For now, just use 8 to 14 uF here and for normal reed operation you should be very happy.

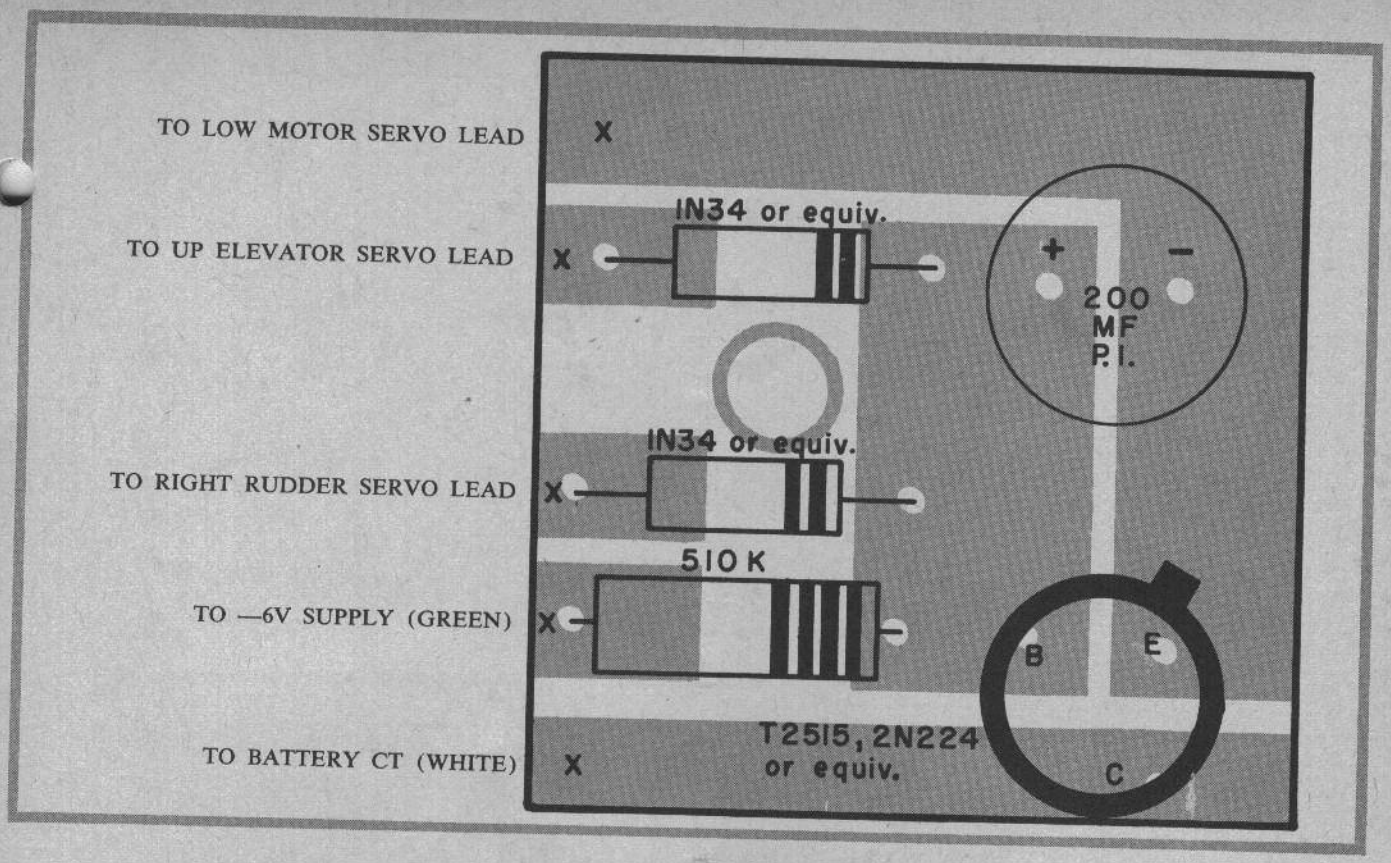
Another thing worth mentioning about the previously referred to voltage divider (R3 and R4) is the versatility it lends to matching this amplifier to various receivers. Using this amplifier, a six- to nine-volt battery pack may be used. You may use the conventional five-cell nickel-cadmium pack if your receiver is a six-volt job, or you may wish to use a nine-volt receiver. If so, just use a seven-cell pack, with 3.6 Volts bias. Another configuration is six of the Eveready E-91 cells using two of them (3 volts) for bias.

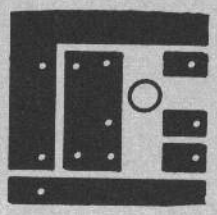
A few final words about the breaks we get with Silicon transistors. If you look again at the circuit, you will note the absence of the shared-emitter resistance common to most circuits. This is usually a 15 to 47 Ohm resistor between the emitters of Q 1,2,3,4 and the negative lead of the bias battery. This was not overlooked, but is left out intentionally. Using Silicon and putting in this resistor is like putting tubes in tubeless tires. One reason is that there is so little leakage with Silicon that for our purposes we will just say they don't leak. The main reason, though, is the higher threshold voltage of the base/emitter "Diode" using Silicon. This is about .7 Volt higher than with Germanium, and this feature acts as a "Squelch" circuit in a radio. The need for a shared-emitter resistance to guard against stray feedback signals such as motor noise firing the "Off" transistor is remote indeed with Silicon here. There is some argument that the resistor is needed to protect the base/emitter junction of Q5. It is true that the major limiting factor for Q5 base current is the bulk resistance of the junction itself. However, we have measured the Q5 base current of many of these amplifiers (Orange lead to switcher plate) and the highest we have measured was 22 ma. on a five-cell pack, and 35 ma. on a seven-cell pack, with 3.6 Volts bias. The junction will stand twice this without damage. In fact, we have driven two Hillcrest servos stalled in parallel from this circuit which is a load of about three amps.

With Q3 and Q5 conducting, they both became very hot, but we left them on for 30 seconds. With Q4 and Q6 conducting, they also became very hot, but the kicker was R10. It blistered my finger. After everything was thoroughly cooked, the circuit just bogged down and wouldn't function. After cooling down for 15 minutes, it worked normally. The base current of Q5 and Q6 must have been in the neighborhood of 150 ma. and we didn't ruin them. Maybe another second would have done it.

So much for that. Let's just say that we do not think this resistor is necessary in this amplifier.

Nothing has (*Continued on page* 26)





ACTUAL SIZE

FAIL-SAFE

FOR REED SERVOS

THIS PARTICULAR DEVICE OFFERS A NUMBER OF ATTRACTIVE FEATURES, AMONG THEM ADJUSTABLE TIME, NO RESETTING TIME DELAY, FAIL-SAFE ON MOTOR ONLY, LEAVING OTHER CONTROLS NEUTRAL.

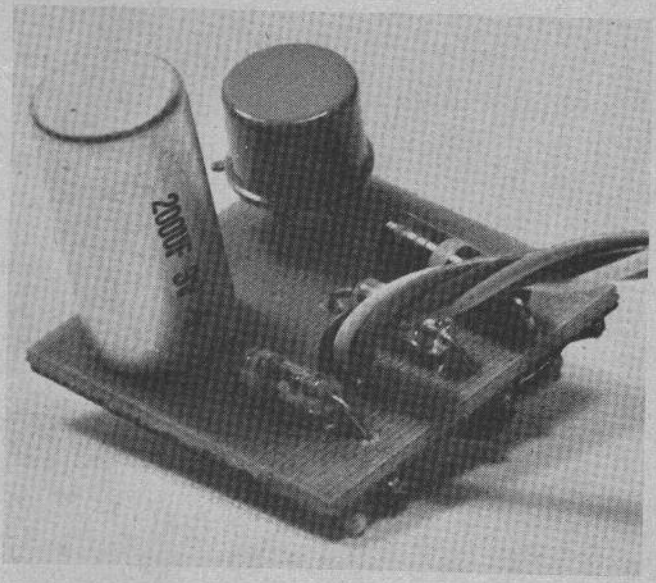
By G. A. JEWELL

► Maybe you have been looking for something like this in a reed fair-safe: Readily available parts; quickly constructed, using five components on a PC base; small and light in weight, measuring 1 x 1 x 1 inches, and ⅛ ounce; adjustable time; no separate batteries required; fail-safe on motor only, leaving other controls in neutral; no resetting time delay.

If you have, then try this simple circuit; it has all of the above features.

Construction is so simple that an explanation is hardly necessary except for this: Twist all leads together and insert through the hole in the PC base before soldering to the points on the lands marked with an "X". The servo leads referred to above are either the yellow or orange wires to the servo itself.

In operation the fail-safe works like this: A positive potential from the up-elevator and/or right-rudder reeds will maintain a charge upon the 200-mf electrolytic capacitor through diodes D1 and D2. This charge maintains transistor T1 in the cut-off state. The diodes isolate the reeds from the fail-safe and from each another. Additional control functions can be wired to the fail-safe by adding yet another diode.

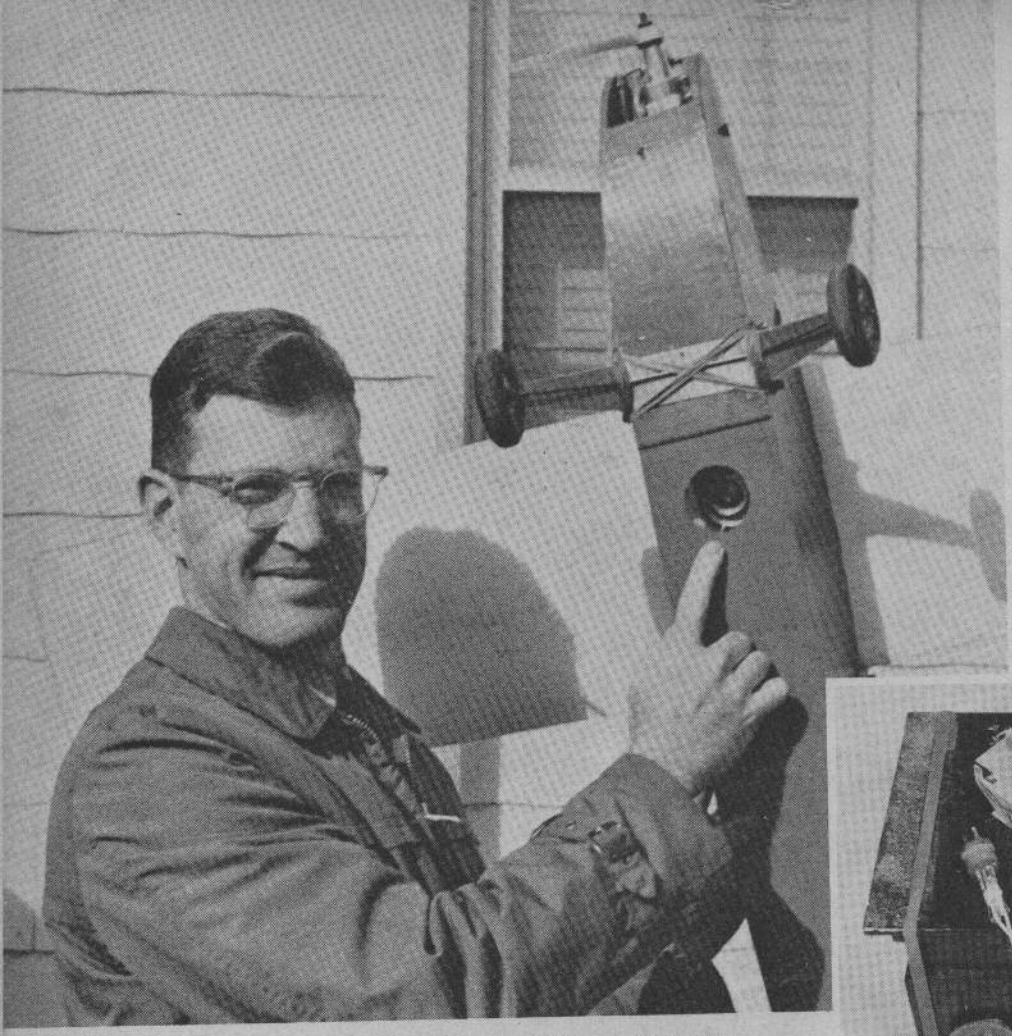


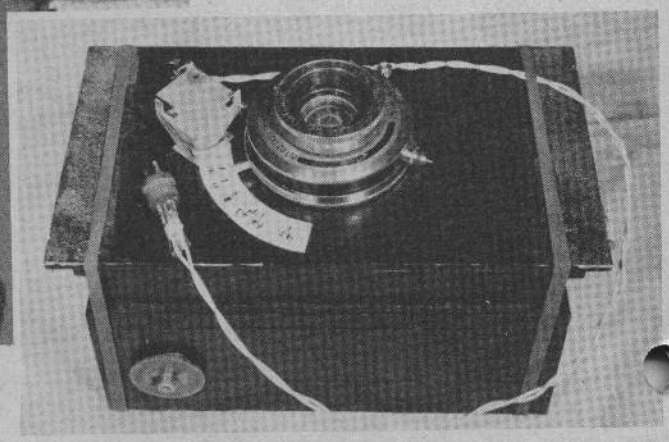
Measuring only 1 in. in any direction, the fail-safe can be quickly made from readily available parts. No separate bats.

Upon an absence of a command to any of the connected control functions, the capacitor will discharge through the 510K resistor. As the capacitor discharges, the base of the transistor becomes negative and the transistor starts conducting. Its output drives the meter conrol servo to its low position.

With the values shown, the discharge time is approximately 25 seconds. This will vary with individual units because of the wide tolerances in electrolytics. Start with the value of RI shown and adjust to the desired time by increasing or decreasing its value in 100K steps. A 100K decrease will produce an approximate one second decrease in the fail-safe time. The value of the final resistor should be between 470K and 1 megohm. ●

YOU TOO ...CAN HAVE A U-2 • PART TWO





Pointing out camera port is author Williams. Right—The camera as modified for an electrically operated shutter. Actuator basically SN escapement minus shaft and rotor.

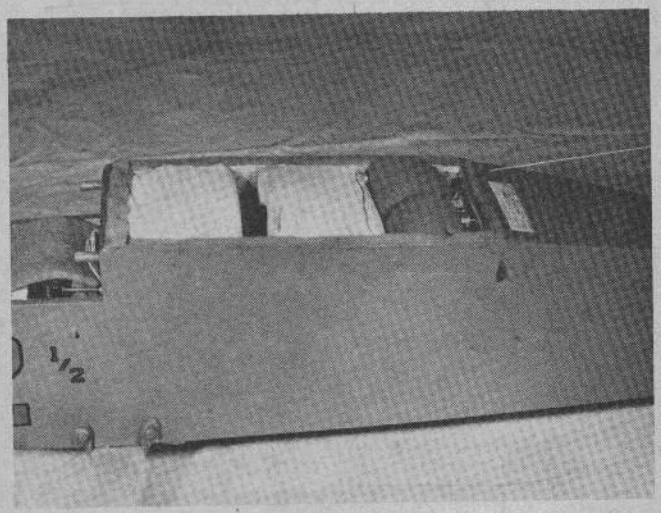
by TORREY WILLIAMS

■ One of the most surprising aspects of my dabbling in the RC aerial photo field has been the interest it generated in modelers and non-modelers alike. When the subject of model airplanes comes up in non-modeling circles, as I am sure most of you already know, a "ho-hum" attitude usually results. However, just mention that the planes are really "camera drones" (a slight, but perhaps permissible exaggeration) and show a few aerial photos and the interest response is noticeably more positive. Photos of the local flying field also draw lots of attention from fellow modelers as they strive to interpret the familiar and unfamiliar patterns in the pictures.

Last month's article discussed how to build a camera; now let's turn to the next problem—getting it aloft.

Of course, you may have the aircraft problem solved already through the use of an available model. If you haven't, however, a good bet is to start your design with a "cabin" big enough to contain your camera and add volume and length as needed to accommodate the other essential parts. Since stability is a must for unblurred photos, a high-wing cabin ship is a natural choice. The "U-2½" which was used to haul aloft the camera described in last month's article was shown then in pictures; other shots appear here. It has a simple "boxy" fuselage built on deBolt's basic design of the middle 1950's, as exemplified by the Livewire Trainer and Cruiser. The wing and stabilizer were left over from a long-since defunct Royal Rudder Bug (620 sq. in. wing).

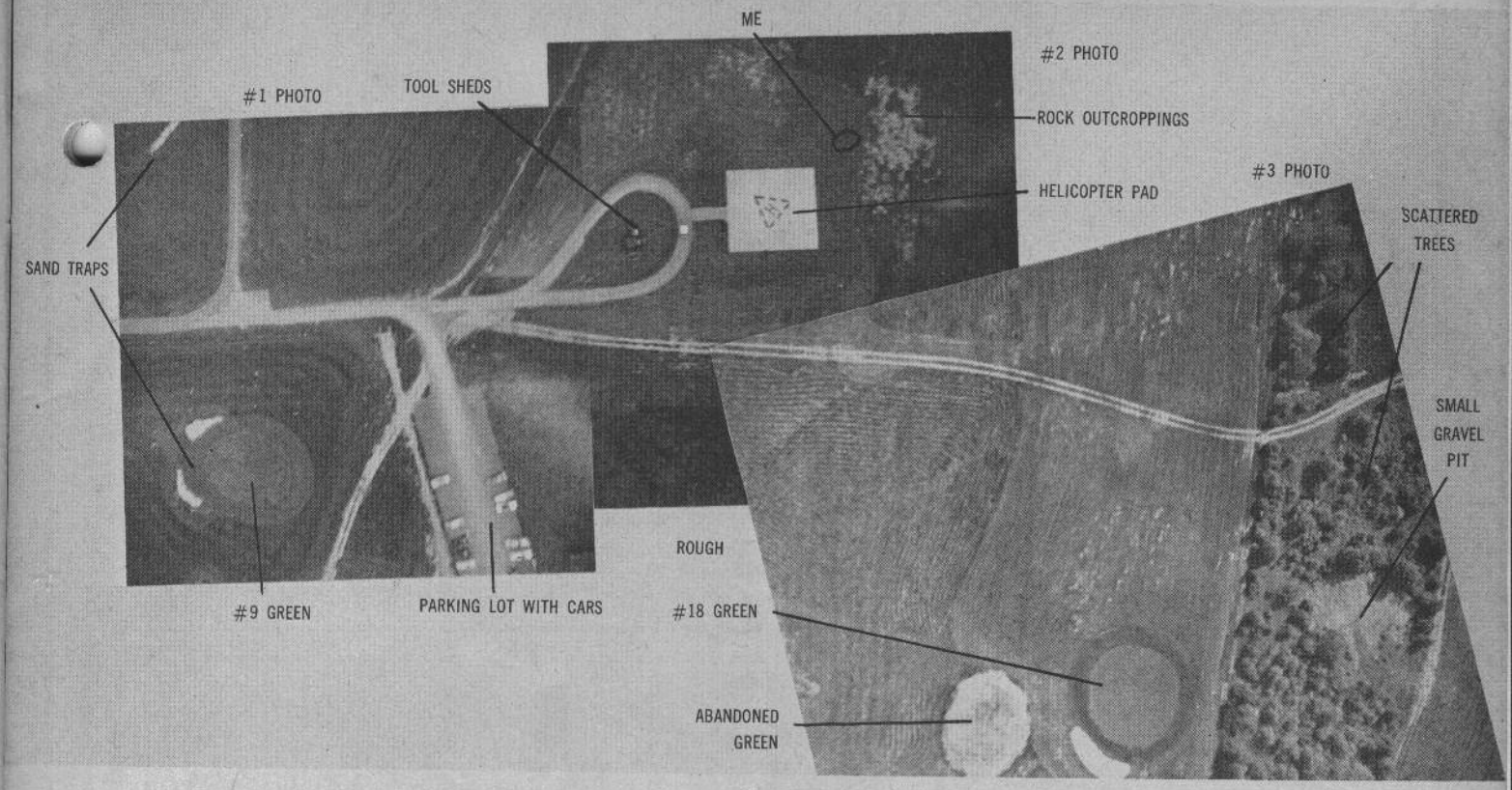
In designing the fuselage, a volume large enough for the camera was reserved around the CG of the aircraft, in the space behind the forward cabin bulkhead. Since this is the area used for the radio equipment in most standard models, room had to be made, fore and aft, for the other necessary gear. In the somewhat-longer-than-usual nose are an Orbit 10-channel receiver, a Justin Micro-Tie board, a motor servo



The fuselage is shown here stuffed with foam rubber and ready for the wing and forward hatch cover. Note sketch at right.

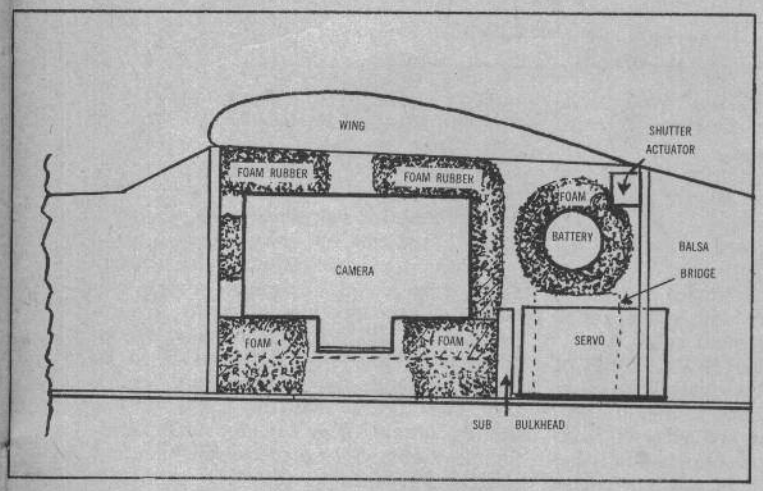
(Annco) and the gas tank. The battery, switches, and rudder and elevator servos (Bonner) are behind the camera. The tail moment was made long enough to compensate for the extended nose and a large rudder was included for directional stability. No detailed plans are included since the camera to be used will dictate the shape and dimensions which must be satisfied, and your tastes in aircraft design will undoubtedly differ from mine.

As will be discussed later, be sure to leave room for sufficient shock padding around the camera. Holes are needed in the cabin floor for the lens, in the fuselage side for the film advance crank and in the center section of the wing for viewing

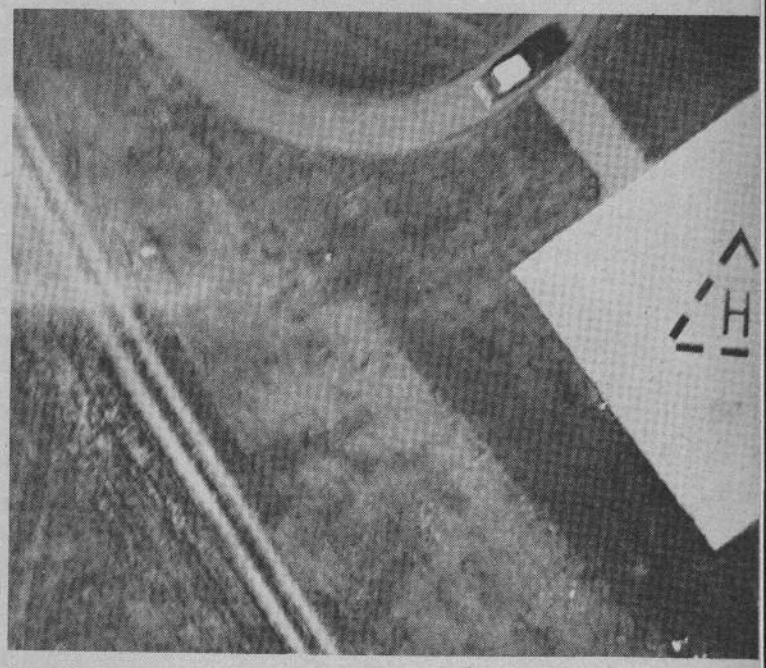


Up on your photo analysis? Matching of photos taken from the same altitude permitted the author to practice interpretation!

Part 1 covered the design and construction of a simple roll-film camera. This concluding article details the mission. Plane, control system, films and filters.



The careful arrangement of foam rubber for shock mounting was found necessary to prevent tripping due to vibration.

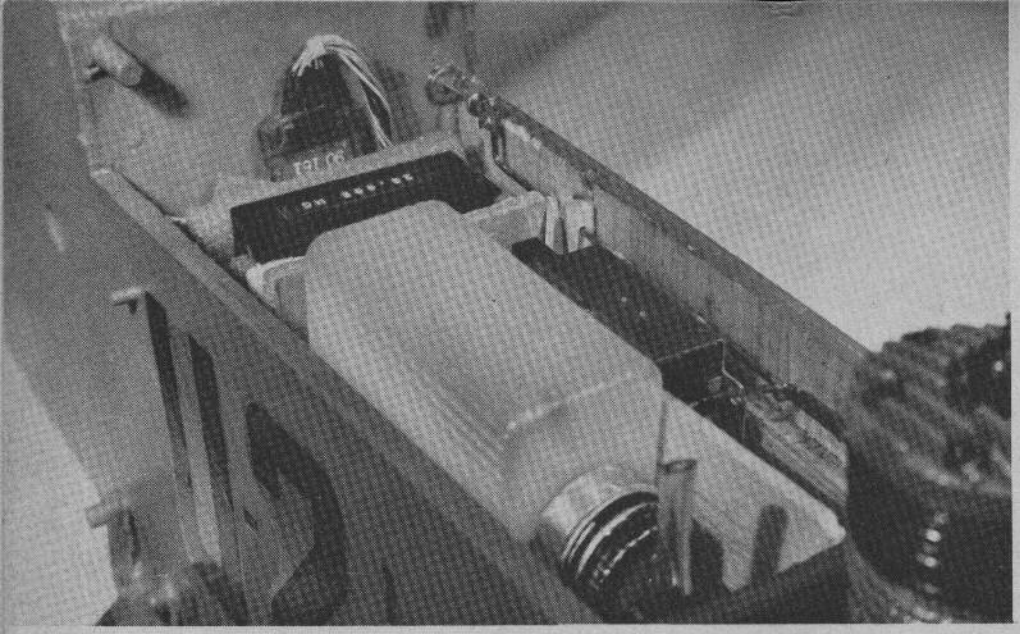


Local helicopter pad from 200 feet, shutter tripped by electromagnetic tripper. Shows marginal quality of 1/200 second shutter when plane too the rear ground—1/500 or 1/1000 better.

the numbers on the film as the roll is advanced. (Otherwise the wing will have to be removed after each flight, a tedious chore.) The hole in the cabin floor should be large enough to permit the shutter to be cocked without removing the camera from its mounting. I would recommend that this hole not be covered with acetate which may cause optical irregularities (reflections or blurring). The hole in the center section of the wing should be covered, however, to keep engine exhaust oil out of the cabin area. The crank hole should preferably be on the opposite side from the exhaust stack.

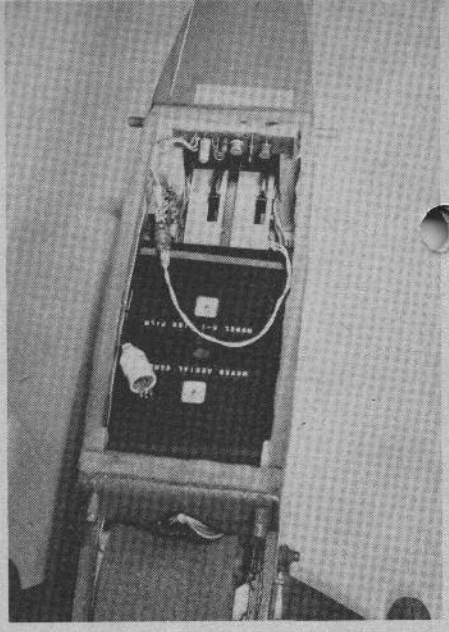
Once the "U-2½" was built, a number of test flights were made to prove out both the pilot and the ship. Since the camera represented a considerable expenditure of effort, it was not placed at risk in these initial flights. A photo shows the substitute ballast, a plywood plate with three small iron transformers bolted thereto, equalling the weight and balance of the camera.

The control system used, as can be deduced from the previous paragraphs, was a standard 6-channel reed set-up. This has worked very well, giving good, positive control of the aircraft. Originally the "U-2½" was fitted with a single-channel pulse rudder with a trimmable engine (*Continued on next page*)

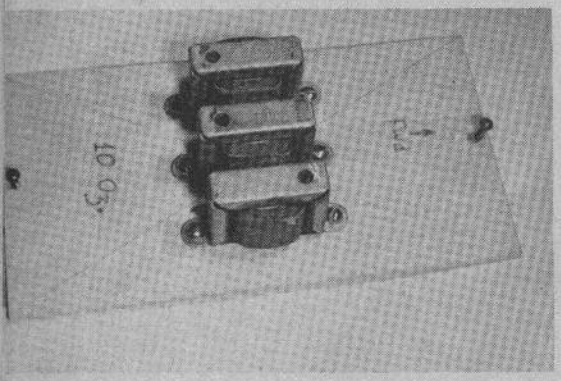


Aft end MC pushrod aligns with plunger on standard shutter release cable. No additional equipment required to trip shutter.

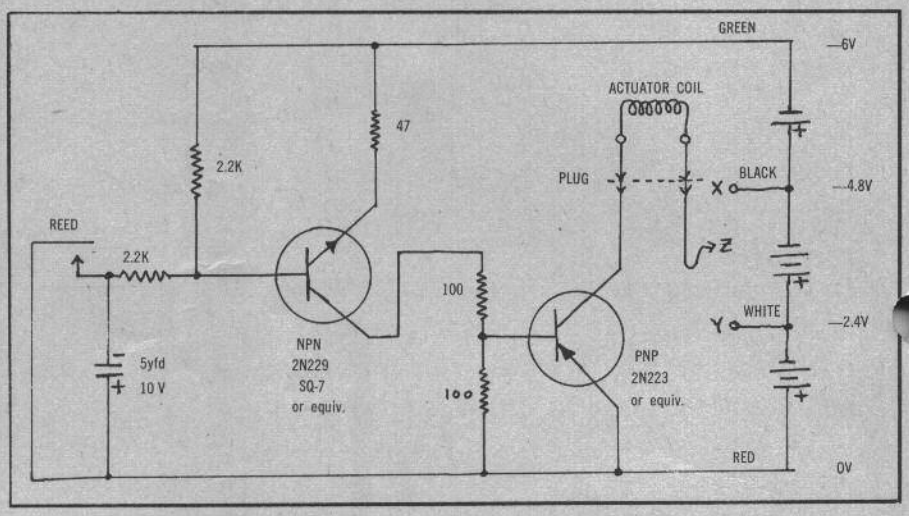
The hole in the fuselage side in cabin area used by crank for advancing films without removing the camera from the aircraft.



Top layers of foam removed to show the servo installation and PC board with shutter actuator amplifier on bulkhead.



Ballast tray used as a substitute for the camera in author's test flying program.



Circuit for shutter actuator from reed-bank (plane's batteries). Connect Z to Y, or X if more current needed. Higher voltage can overload the transistors.

YOU, TOO CAN HAVE A U-2 CONTINUED

servo driven from dual pulse-omission detectors. The system worked well on the bench but the 5¼-pound airplane turned out to be too much for me to feel sure of with the precious camera aboard. The growing need for superhet equipment at my flying site also weighed heavily in the switch to a 6-channel system. The earlier system is only mentioned to show how many different RC hook-ups can be adapted for aerial photo work.

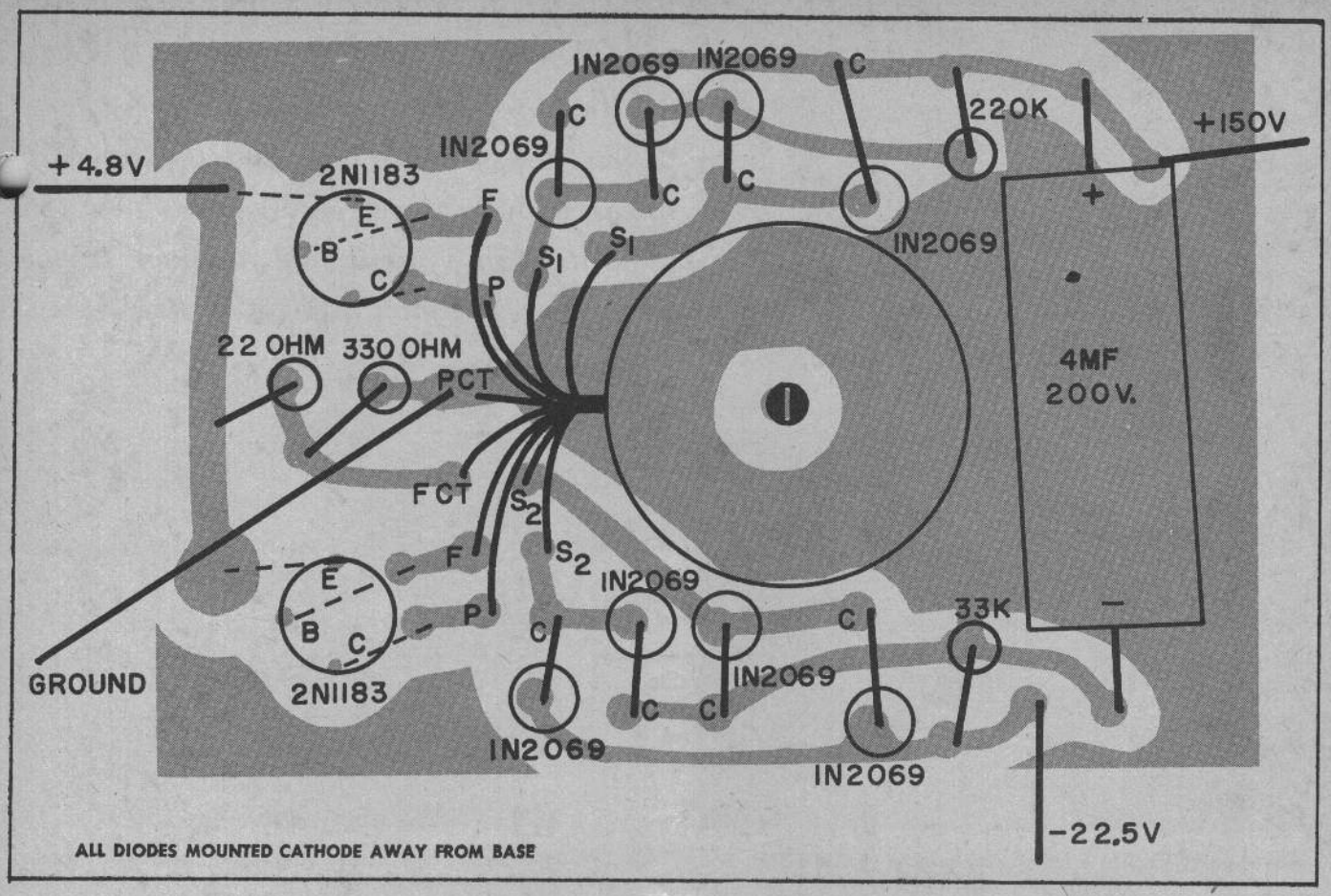
In order to hold the number of servos on board to a minimum, the camera shutter was originally, linked to the engine servo. This arrangement is illustrated. A standard flexible camera shutter release cable was passed through the forward bulkhead and epoxied in place. The plunger was aligned with a cupped push-plate on the rear end of the throttle pushrod. Whenever the throttle was brought to idle, the plunger was forced in and the shutter tripped. This meant that the mission sequence was as follows:

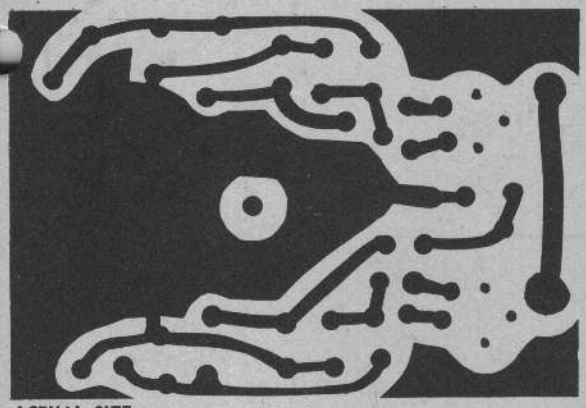
1. Plane fueled and ready for flight.
2. Throttle opened. (Switches off)
3. Film advanced in camera.
4. Shutter speed and lens opening (f/number) set.
5. Shutter cocked.
6. Engine started and adjusted. (Switches on)
7. All controls checked. (Throttle not retarded past half-way)
8. Take-off, climb to altitude.
9. Photo run started with plane aimed upwind to minimize ground speed.
10. Engine throttled back with series of "beeps" spaced several seconds apart until engine was at full idle and shutter tripped.
11. Flight continued and aircraft landed. (Throttle could now be advanced and retarded as desired. There was no danger of double exposures since the shutter was cocked with one lever and tripped with another.)

The procedure in Step 10 turned out to be necessary to minimize picture blurring with the 1/200-second shutter available. With the "U-2½", if the engine servo was driven from full advance to full idle by a single command, the plane changed speed rapidly enough to cause a sharp forward pitching motion. This change in aircraft pitch meant that the camera was, in effect, rotating with respect to the ground at the instant the shutter was open. By allowing the plane to assume a stable glide angle before the shutter was opened, the blurring was minimized. A little ground practice helped in making this a smooth and natural procedure.

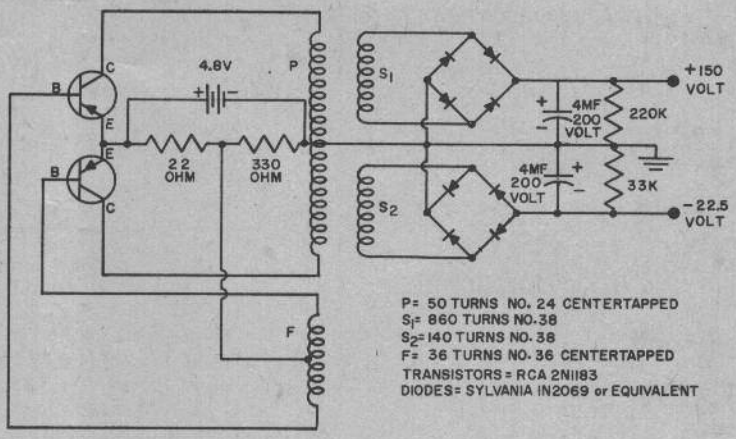
As an alternative solution, particularly since extra control channels were available, my next step was to go to an electromagnetic shutter tripper activated on command. This allowed the plane to be put on a stable, level course with engine near idle and to snap the picture at the desired instant. The actuator was simply an old 8-ohm SN escapement without its shaft and escapement rotor. The armature was bent slightly to provide more throw on activation and the device was bolted to the plywood base of the camera in such a way that the armature pressed directly on the shutter trip lever (see illustration). The circuit used is illustrated. It is, essentially, one of the drive-channel circuits of a standard Transmite servo.

One caution: When the aircraft switches are first turned on, a surge of transient current goes through the actuator coil sufficient to trip the shutter. Thus the flight sequence listed above must be changed so that the film is advanced, the aircraft switches (*Continued on page* 25)





ACTUAL SIZE



By NORMAN L. BEELER

B & D POWER CONVERTER

■ THIS CONVERTER'S (FOR THE B & D) CLAIM TO UNIQUENESS IS A DUAL HIGH-VOLTAGE OUTPUT, SUPPLYING 150 VOLTS FOR AN RF SECTION AND —22.5 VOLTS FOR THE PULSER-MODULATOR. Specifically, it was developed to supply the voltage needs of the B & D proportional transmitter, as featured in the July 1964 issue of *Model Airplane News*. It is developed from the Ace 1-inch cup core form.

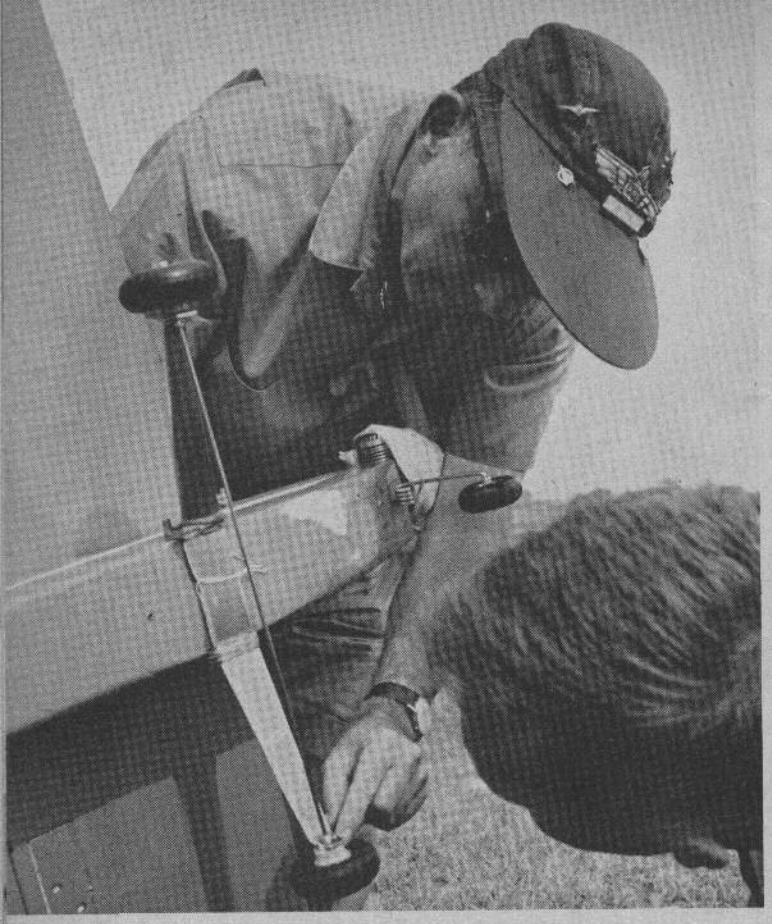
Voltage input of 4.8 volts was used to keep the individual cell drain to a reasonable value, and give a little better operating efficiency. While it was developed for the B and D system, it is also a natural companion for the newly introduced Phelps pulser when used with tube transmitters. The 150-volts high voltage output will pep up the transmitted RF output.

No special construction techniques are needed to build this converter, other than a few extra fingers to keep straight the wires from the cup core. Small pieces of numbered adhesive tape will make the chore a little easier. The cup core does not have much winding room to spare, so neatness in winding the primary is very important, since it takes nearly one-half the available winding space. The primary consisting of 50 turns of #24 center-tapped is wound first, followed by the high voltage secondary of 860 turns of #38, the low voltage secondary of 140 turns of #38, and the feedback coil of 36 turns of #36 center-tapped, in that order. The secondary coils are most easily wound by chucking the bobbin in a hand drill held in a vise. Also, you need not spend too much time trying to center tap the #36 feedback coil. Just wind on 18 turns, run a loop out and back, and wind the remaining 18 turns.

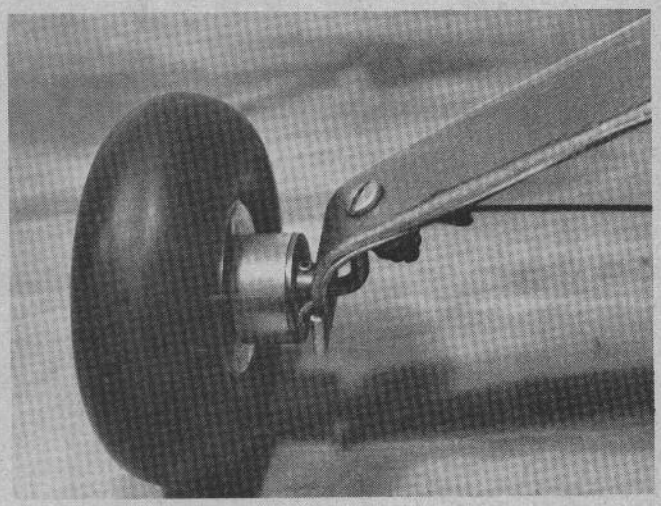
The printed circuit board and parts layout does not show a filter capacitor for the —22.5-volt secondary, as the B and D pulser-modulator has a capacitor incor- (*Continued on page* 32)

By WALT GOOD

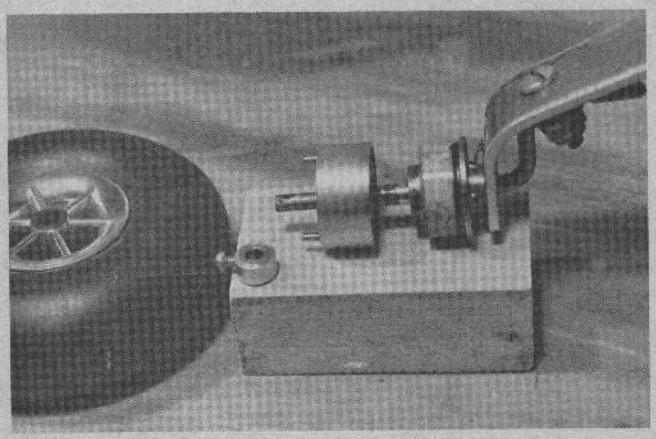
Reliable brakes less Rube Goldberg gadgets! They won't lock and the action is as smooth as velvet. Requires two pencells—won't limit the weaker servos. In fact, the man thought of everything!



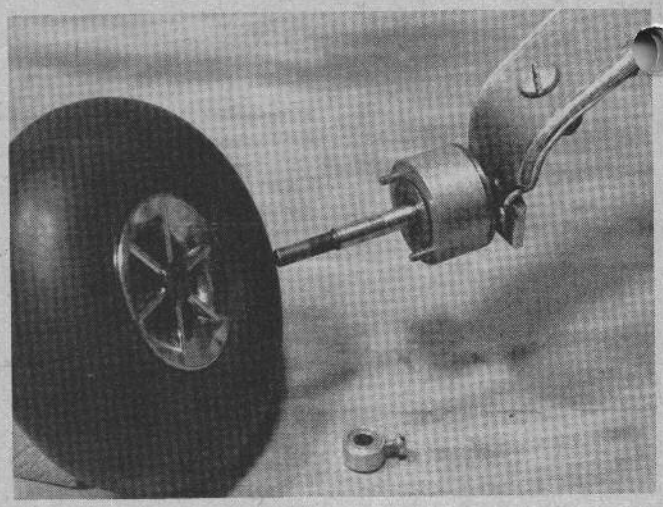
The author points to a set of experimental brakes installed on the rear landing gear strut of his Acro-Bug in October 1964.



The brake and wheel assembled to sheet aluminum landing gear strut. Designed for 5/32-in. shaft, large DuBro hub.



Inside the electric brake, coil-wound spool, right, and outside sleeve. Instructions cover modifications 1/8-, 3/16-in shafts.



ELECTROMAGNETIC WHEEL BRAKES

■ Here's the easy way to put reliable brakes on your RC model. No strings! No adjustments! Just slip electric brakes on the landing gear. Use the gear for one connection, a wire for the other and then connect a microswitch to the down elevator servo. Add two pencells and you are ready to use your electro-magnetic brakes for a smooth stop or an easy release. These brakes can't lock up and the braking action is like velvet. And furthermore, they don't limit the motion of the less vigorous proportional servos which can be a nuisance.

PRINCIPLE OF OPERATION: The electric brake is an old-fashioned electromagnet gone modern. It consists of two parts made of special magnetic iron alloy and a many-turn coil. Current through the coil magnetizes the iron parts and pulls them together. The semi-disc brake action applies a drag torque up to the 10 inch ounces per brake. This is shown in Fig. 1 where (A) is the fixed core which is secured to the shaft with a set screw. The rotating sleeve is part (B). When coil (C) is energized the magnetic gap (D) is closed and a very high magnetic force causes a drag action at (D). Note that there are no adjustments and even a slight wear at (D) causes no changes in the magnetic circuit and hence no change in drag.

The actual brake is ¾" in diameter by about ½" long and weighs about ½ oz. The 15-ohm coil can operate on 2 to 6 volts DC depending on the degree of braking required. One coil connection is the frame of the brake (A) and the other connection is the lug (E). The polarity is not important.

HOW TO USE: A typical circuit for the electric brake is shown in Fig. 2-a. Here one wire is soldered to the nose gear and the other is soldered to the brake lug.

FIGURE 2 ELECTRIC BRAKE CIRCUIT

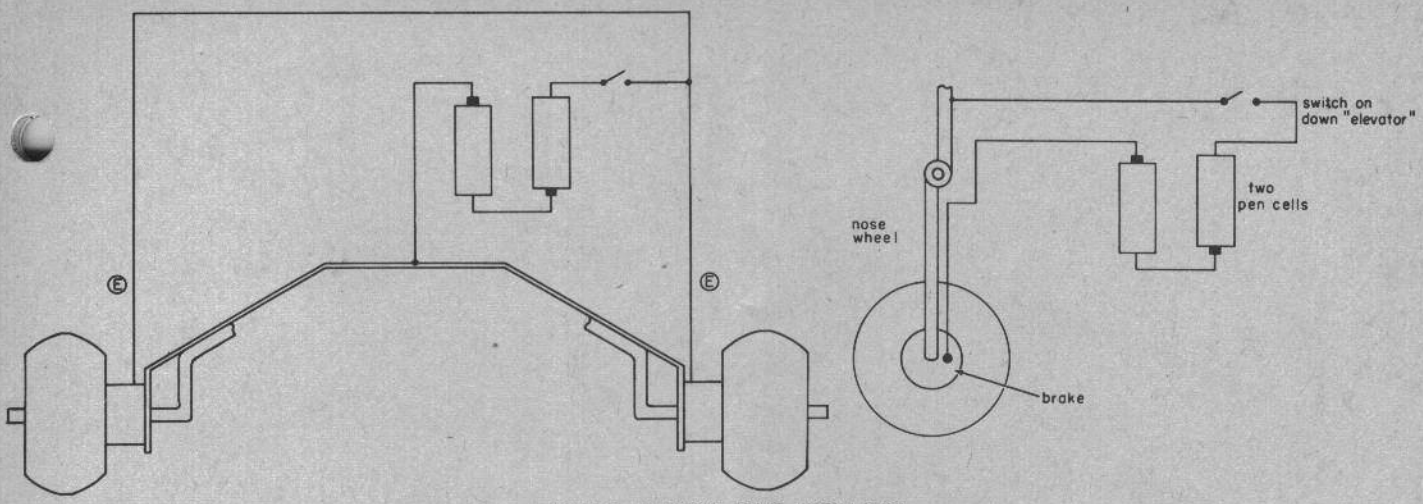


FIGURE 1 ELECTROMAGNETIC BRAKE OPERATION

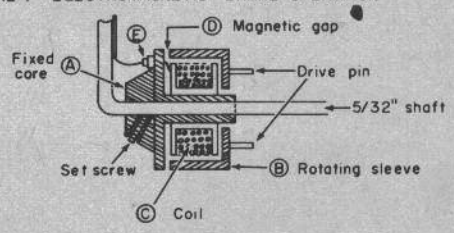
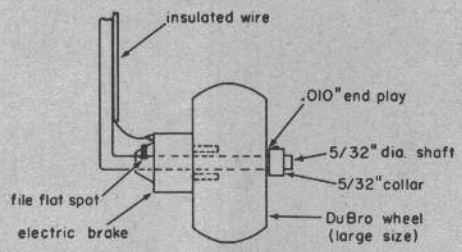


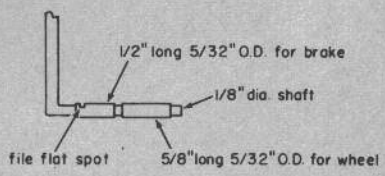
FIGURE 3 ELECTRIC BRAKE INSTALLATION

(a) for 5/32" shaft



(b) for 1/8" shaft

Same as for 5/32" shaft except that two pieces of 5/32" O.D. brass tubing are slipped onto the 1/8" shaft.



These two insulated wires are led to two series pencells and a normally open microswitch which is actuated by the movement of the elevator servo to the down position. The photo shows a microswitch fastened next to the Bellamatic elevator servo. This arrangement gives 5 in. oz. of drag and draws about 160 ma. At this rate of drain and considering the amount of usage, the pencells will last most of the season.

Many variations are possible. More braking action is obtained by using up to 6 volts, of course with increased current. For nose wheel braking, it is recommended that you start with 4.8 volts and then increase or lower the voltage as needed. The flight batteries may be used for this purpose and hence eliminate the added cells. The switch does not have to be a microswitch but could be two small pieces of spring brass epoxied to a piece of plywood and then mounted on the elevator servo.

For maximum braking action it is suggested that two brakes be used on the main gear as shown in Fig. 2-b. Although wire (E) from the lugs is shown schematically, a neat physical arrangement is to epoxy the wire to the rear edge of the landing gear. Connections into the plane can be through a plug or through pressure contacts on the bottom of the fuselage. With 2.4 volts and the coils in parallel, the current is 320 ma. and the drag torque is 10 in. oz. Here again stronger brake action up to 20 in. oz. will result when using up to 6 volts. Over 6 volts does not increase the drag because of the saturation effect in the magnetic material. Typically, 2.4 volts on both brakes will give normal drag. Any small difference in brake drag is easily overcome by a slight amount of opposite steering in the nose wheel.

HOW TO INSTALL: The brake is designed for a 5/32" dia. shaft and the large size DuBro hub. A shaft length of 1½" is required to hold the brake, wheel and retaining collar. Here are the steps for installation as shown in Fig. 3-a.

A. *For 5/32" shaft:*

1. File a flat spot on the shaft where the brake set-screw bears. This insures no brake hub rotation.
2. Slide on brake and tighten set-screw.
3. Slide on wheel, placing brake pins between spokes.
4. Fasten collar in place allowing about .010" end-play of wheel.
5. Solder insulated wire to brake lug.
6. Solder or connect wire to landing gear.
7. Lead the two wires to the switch and battery according to Fig. 2.

B. *For ⅛" shaft (Fig. 3-b):*

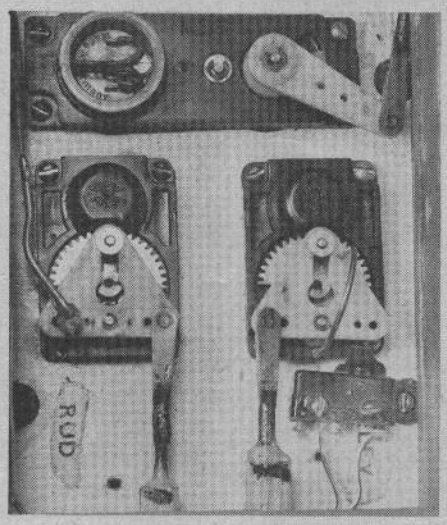
1. Same steps as for 5/32" shaft except that a ⅛" inside diameter brass tube ½" long is slipped over the ⅛" shaft to match the 5/32" hole in the brake. This is standard model shop telescopic tubing. Bear down on set-screw so that the brass tube is idented into the flat spot on the shaft.
2. Slip another piece of ⅛" I.D. tubing ⅝" long to accept the 5/32" hole in the wheel. The photo shows a main gear installation using an ⅛" shaft.

C. *For 3/16" shaft:*

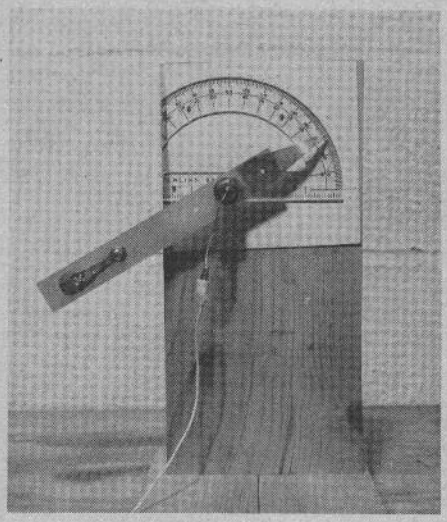
1. The brake hole may be drilled up to 3/16" diameter without affecting the magnetic drag characteristics. It is suggested that the hole be enlarged a small amount at a time. This may be done by using one number drill step at a time.

D. *For other wheels:*

If the brake (*Continued on page* 22)

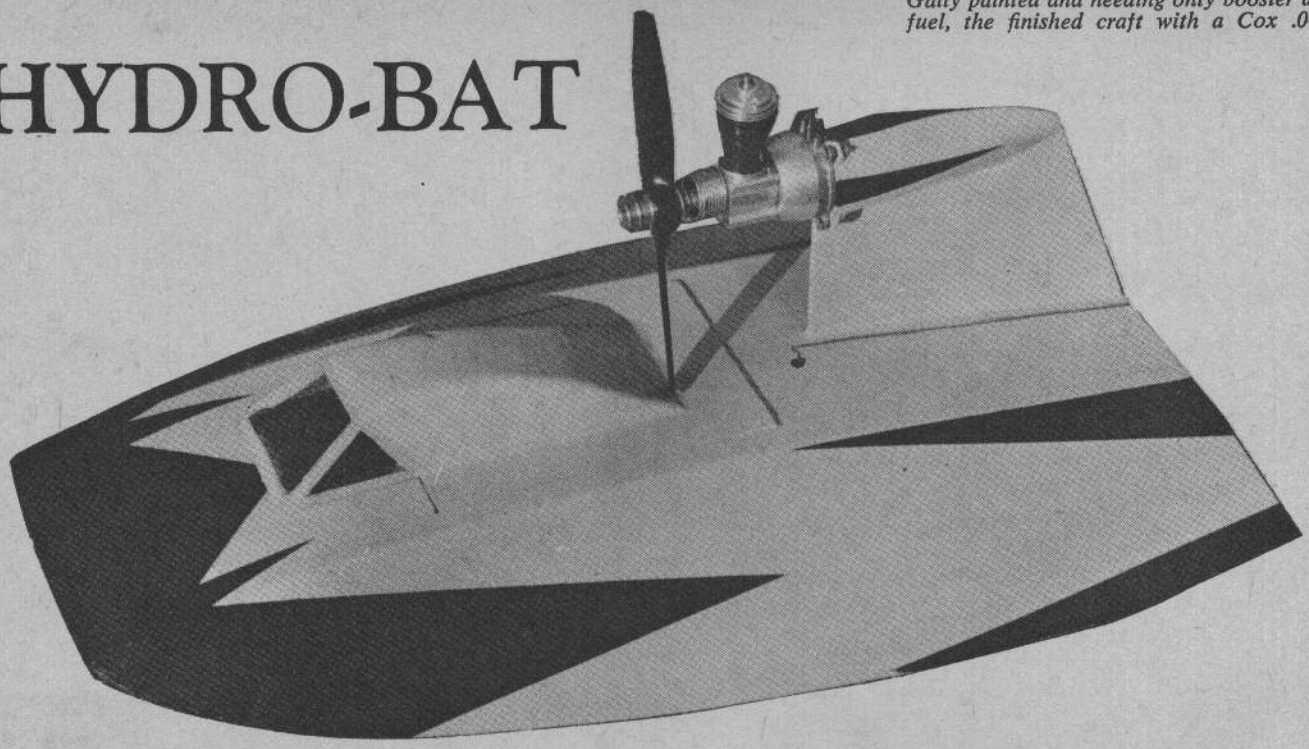


Microswitch installed on down-elevator servo of DeeBee system in the Acro-Bug.



Torque tester, electric brake, center, reads about 9 in/oz. Photos by Fremont Davis.

HYDRO-BAT



Gaily painted and needing only booster and fuel, the finished craft with a Cox .049.

The air boat undoubtedly is the simplest of all RC exciting action projects. This one needs no flywheel, prop shaft, water cooling. You do have to start an engine!

By VIC SMEED

► There is no doubt that the simplest form of boat is the airscrew-driven hydroplane—no prop shaft, flywheel, water-cooling, or other complications of that nature, and a performance that can be quite sparkling. Tethered hydros, built for speed only, reach speeds of 80 mph. without too much difficulty, but for radio running something stable in itself and not quite so fast must be used. Even 10 mph. is a high enough speed for a small model of this type under radio control. The design presented here will comfortably achieve this speed, and in action looks as though it is doing a great deal more.

Motors of .049-.09 capacity are suitable, and we have shown the Babe Bee as being one of the popular motors which is easiest to mount. Modification to beam mounting is quite straightforward, either by using a metal bracket conversion or cementing beams to the pylon, with suitable packing pieces. Alternatively, the motor may be mounted sidewinder fashion in a cut-out in the ply pylon. For different motors, keep the prop in the same position as on the drawing, and adjust the mounting appropriately.

The one drawback of air prop boats is the unprotected airscrew, in the sense that a bystander being helpful and catching the model can damage his fingers. Shrouds or ducts, etc. have proved impractical, apart from the loss of simplicity which is one of the attractions of this type of model, so that operators must use common sense in their choice of water.

Construction: The hull is built egg-box fashion using three bulkheads and two fore-and-aft members, all cut from ⅛-in. medium balsa. Cut and cement these pieces together, ensuring that the assembly is square and true. Cut the pylon from ⅛-in. ply and cement into the hull between B2 and B3; cement scraps of ⅛-in. sheet along each side, between and level with the tops of the two bulkheads. The motor mount plate (firewall) or other form of mounting may be added at this time, or left until later if preferred.

Sheet the hull bottom with medium ⅛ in. in short pieces, grain across, lodging the edges of the sheet on the fore-and-aft members only half-way, i.e. 1/16 in. The remaining 1/16 in. provides a seat for the outer panels of the underside, which are cut to the outline shown, grain lengthways. Cement these to the straight part of the hull, and when dry bend the forward ends to fit, cementing and pinning as you go. It will be necessary to cut a chamfer on the inside edges as work proceeds to ensure a snug fit. If the sheet is reluctant to bend easily at the bow, score and crack the underside, filling the cracks with cement and sanding to a smooth curve later. Sand the edges.

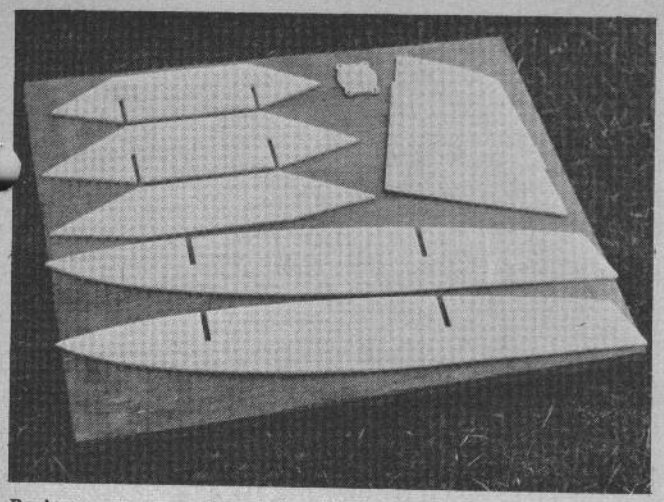
Sheet the center top in the same way as the bottom, leaving a 1/16 inch step for the side sheeting as before. The sides are, however, planked in short pieces, grain across. This combination of grain directions gives a very rigid and tough but light structure.

Sand the hull, then mark and cut the hatch. Cement strips under the edges of the hatch opening, then replace the hatch and build on the cabin. You may prefer to use a bubble canopy, but in any event the front overhang must be sealed with a piece of sheet underneath. The cabin keeps the hatch in shape, so no other structure is needed, especially as the hatch is sealed in place with surgical adhesive tape.

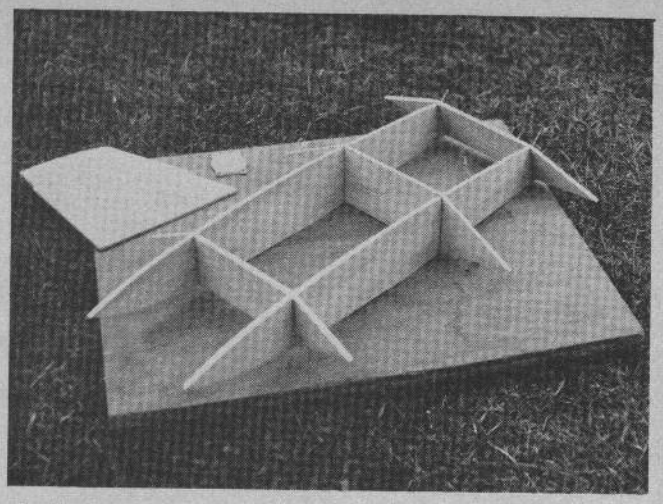
A fuel tank may be mounted on one side of the pylon and the other streamlined in with soft block. Fit the rudder tube, which is simply cemented on the back with a piece of silk or gauze bandage, also the lower fin, then give everything a final sanding and dope on tissue over all woodwork. Finish and dope or paint in the usual way.

Any small single-channel R/C equipment using an electric or clockwork actuator can be fitted, the actuator needing connection only to a crank passing through a rubber grommet trimmed and glued where shown. A pushrod connects this crank to the rudder horn. Only a small amount of rudder movement is necessary, but the degree will depend on the speed of the model. For an .049 engine 25 degrees each way is about maximum. Control is best when optional rudder can be selected without going through a sequence, and the lightest way of doing this is usually pulse control, using a Bellamatic or similar servo. Radio and battery weight should be as small as possible—with a maximum of, say, 8 or 9 ounces.

Trimming for maximum performance may entail moving the batteries forward or backward, but it is not too critical and the boat is divided into nine separate compartments, giving a very high safety margin in the event of a mishap. To keep it all watertight, tape the hatch as mentioned and bring out two wires through the deck (cement around them) to a switch mounted on the pylon. Then, even if the model flips, only the motor and switch will need drying out. ●

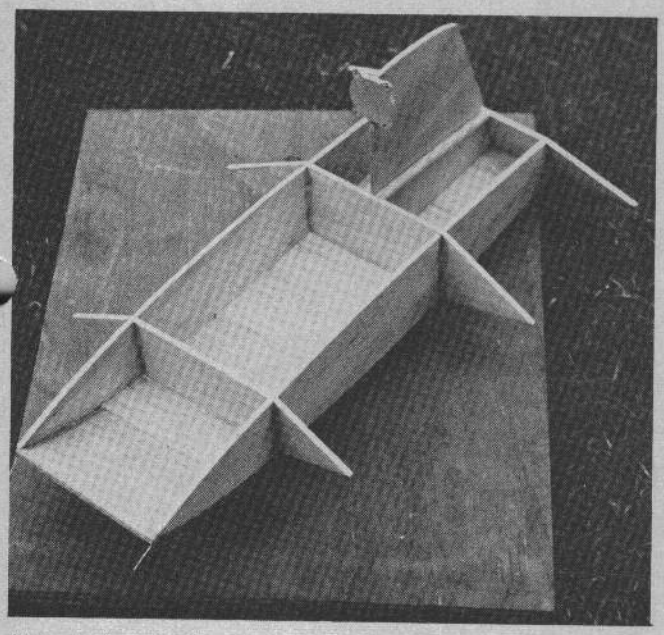


Basic structure consists of just these seven parts. The pylon and "firewall" are made from plywood; the others are sheet balsa.

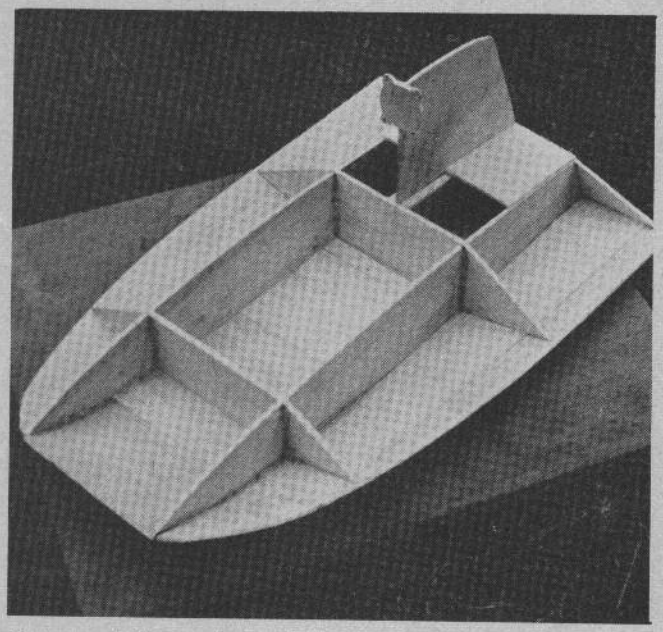


The basic "egg-box" is assembled in rapid-fire order and the transom B-3 is pinned in position until the cement is dried.

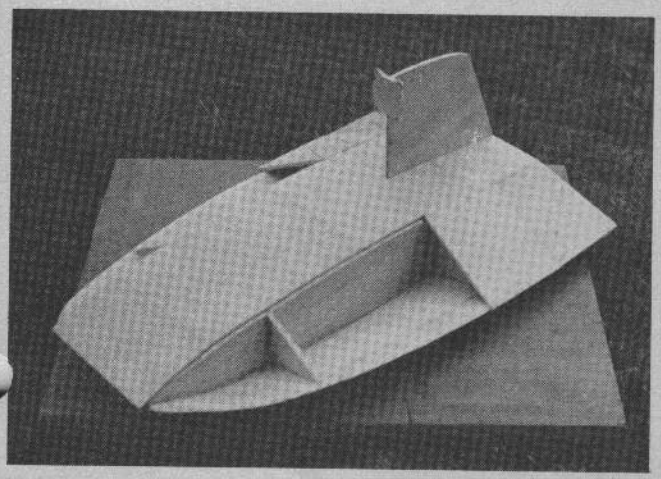
THE FULL-SIZE PLANS OF THE HYDRO-BAT ON THE FOLLOWING TWO PAGES.



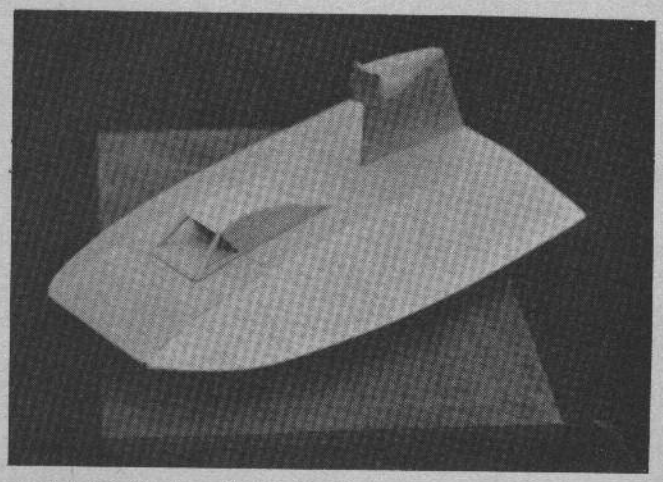
Bottom then is sheeted; pylon, motor-mounting plate fitted. Note scrap balsa parts alongside the pylon at the deck level.



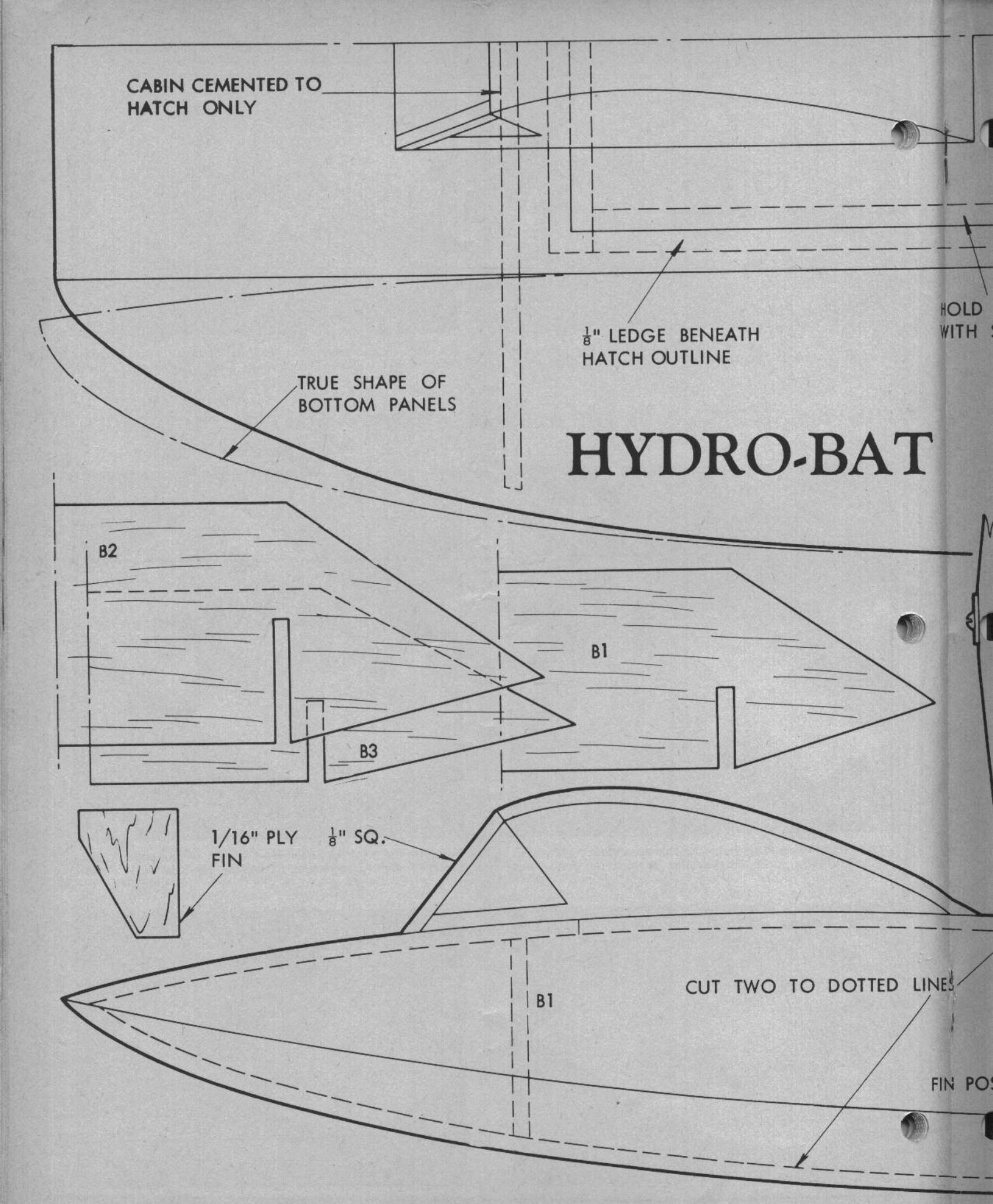
Bottom outside panels attached—the top sheeting started. Side-mounted engine permissable by making modification to mount.

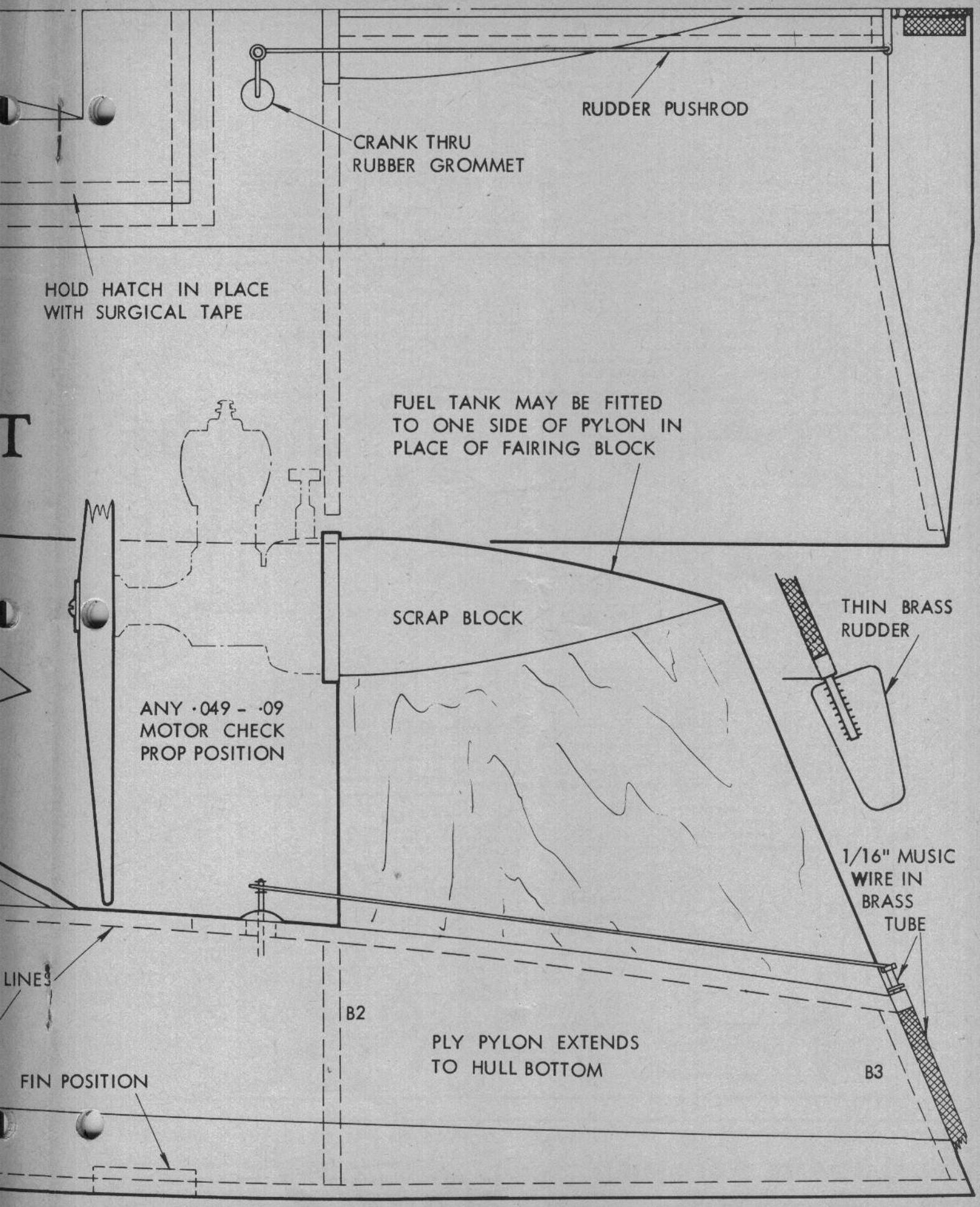


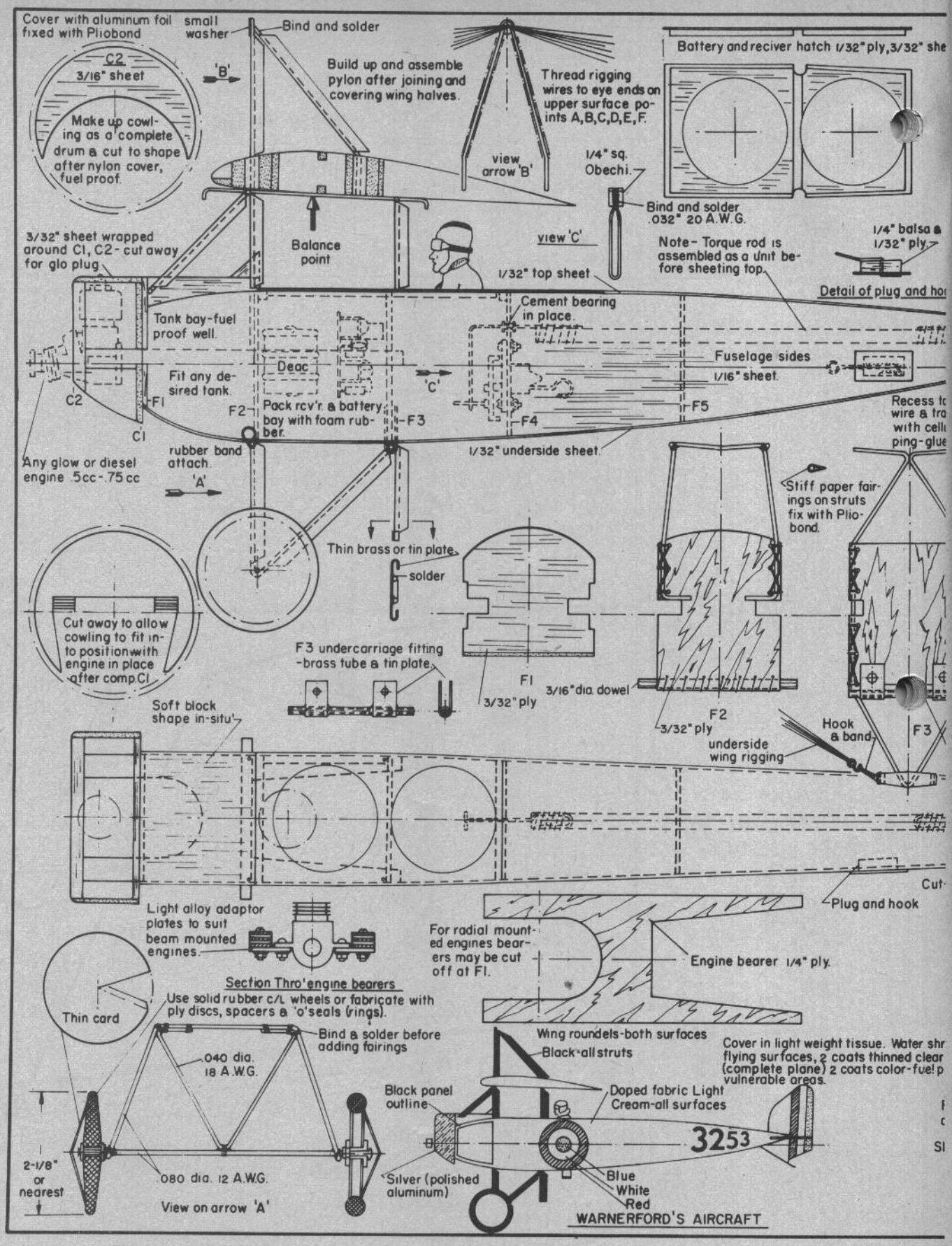
The top center sheeting is completed and the sides begun. Note step along edge of center sheet takes side pieces for gluing.



Completed "in the white." Hatch is cut out and the cabin is built. Sanding sealer first step necessary to a sterling finish.


CABIN CEMENTED TO HATCH ONLY
1/8" LEDGE BENEATH HATCH OUTLINE
HOLD WITH
TRUE SHAPE OF BOTTOM PANELS
HYDRO-BAT
B2
B1
B3
1/16" PLY FIN
1/8" SQ.
B1
CUT TWO TO DOTTED LINES
FIN POS


RUDDER PUSHROD
CRANK THRU
RUBBER GROMMET
HOLD HATCH IN PLACE
WITH SURGICAL TAPE
FUEL TANK MAY BE FITTED
TO ONE SIDE OF PYLON IN
PLACE OF FAIRING BLOCK
SCRAP BLOCK
THIN BRASS
RUDDER
ANY ·049 - ·09
MOTOR CHECK
PROP POSITION
1/16" MUSIC
WIRE IN
BRASS
TUBE
LINES
B2
PLY PYLON EXTENDS
TO HULL BOTTOM
B3
FIN POSITION



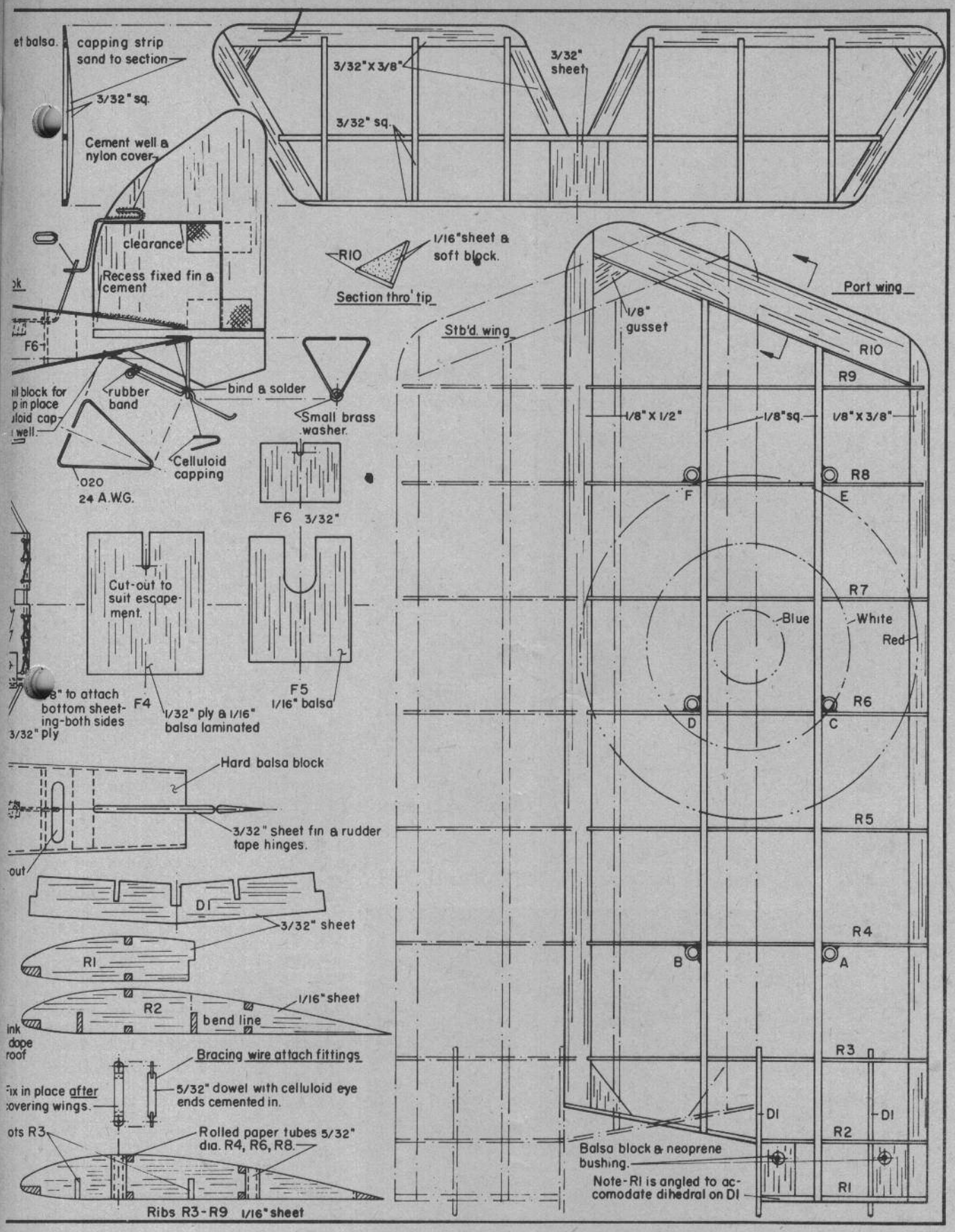
WORLD WAR I NOSTALGIA IN THIS SMALL-FIELD AIRPLANE WILL PLEASE THE "RUDDER-ONLY" FAN

MORANE SAULNIER TYPE L

By D. RATTLE

► The Morane Saulnier, Type L, was a French designed and built aircraft of World War I, powered by an 80 hp. Le-Rhone engine. It had a span of 34 feet and length of 20 feet 9 inches.

The model is of 1-inch-to-1-foot scale, differences from true scale being increased tailplane and rudder area and the



YEARNS FOR REALISM. AND IT'S DETAILED.

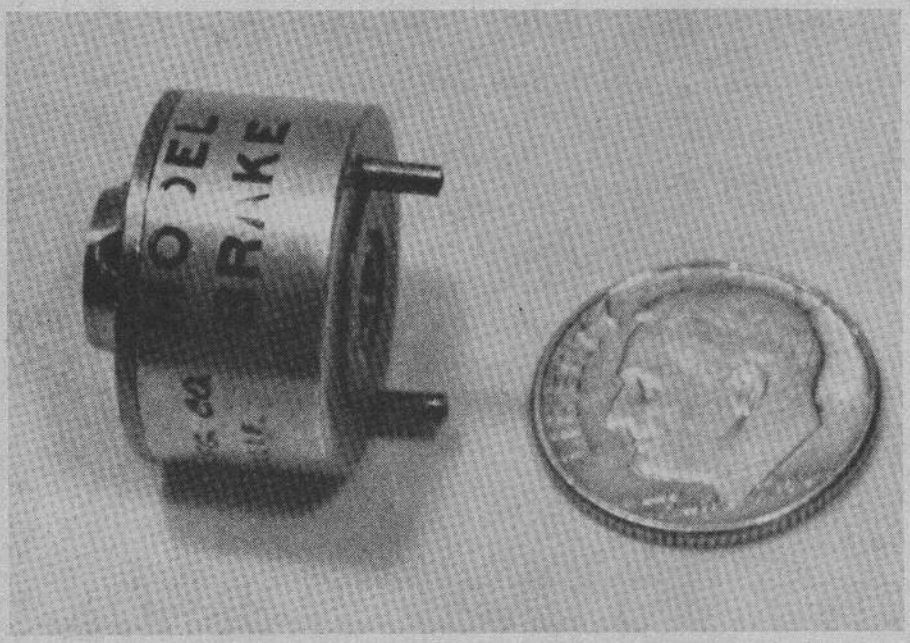
inclusion of dihedral on the wings, these changes being made for stability reasons.

The particular aircraft depicted, No. 3253, was that in which Flight Lieutenant Warneford of the Royal Naval Air Service destroyed the German Zeppelin LZ37 on June 7, 1915—for which he was awarded the V.C. (*Continued on page* 22)

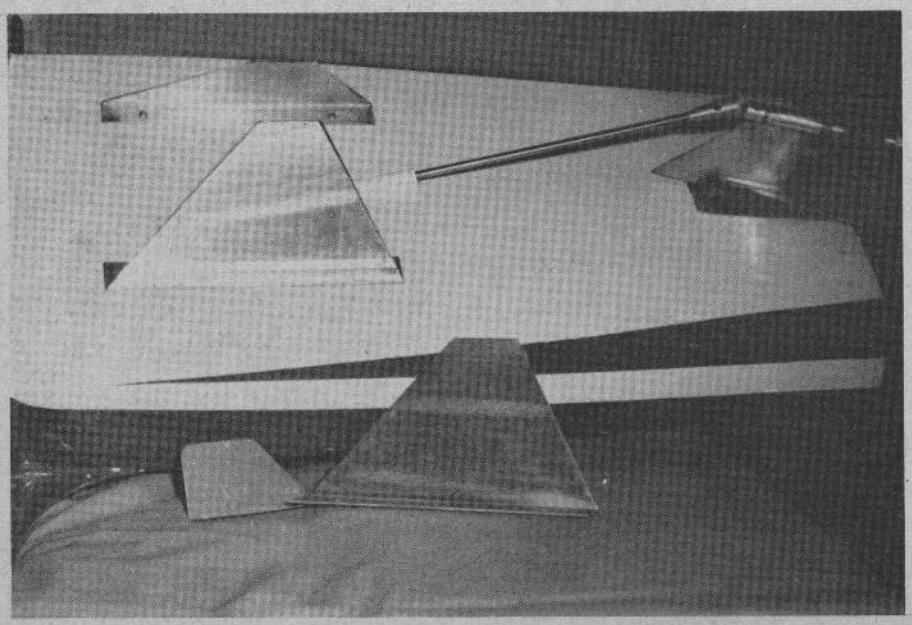
BITS AND.. PIECES..

A useful selecion of new products and ideas of special interest to active plane and boat users.

New 33-in.-long polyethylene floats by the Gee Bee Line, take 8 pounds gross.



Electro-magnetic wheel brakes, designed by Walt Good—article on pages 12-13.



New sizes of stainless-steel fins for racing hydroplanes, by G.E.M. Models.

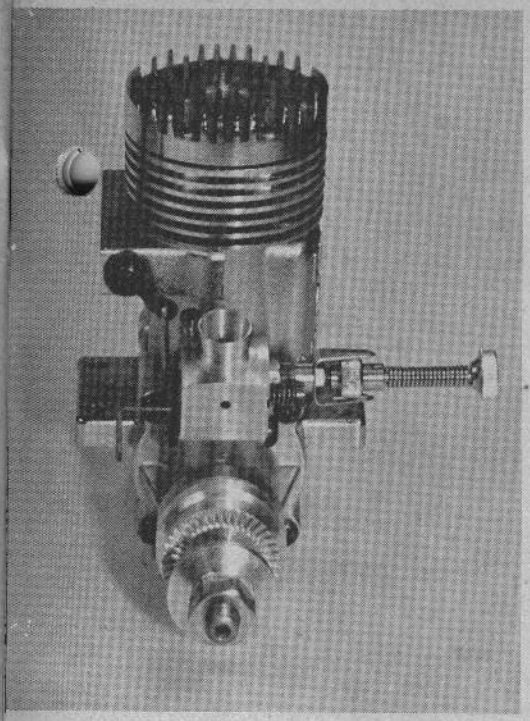
■ Among recently announced products the new 33-in. floats by The Gee Bee Line (Box 347, Forest Park Station, Springfield, Mass.) are a particularly distinctive "better mousetrap" item. Made of polyethylene by the blow moulding process, they are light in weight and, it is stated, have proved virtually indestructible—except for a thrown prop blade. The floats are finished, ready for attachment (hardware included) to the landplane instead of wheeled gear. Independent mounting prevents damage from hard landings on rough terrain. These large-size floats—two smaller sizes measure 19½ and 28 in.—are suited to ships of up to eight pounds gross. $12.95

Electric Brakes: Developed by Dr. Walter A. Good, these ¾-in. diameter electromagnetic brakes deliver up to 8-in./oz. torque drag on 2.4 volts at a drain of 160 mils. Can be used on 2 to 6 volts; coil resistance 15 ohms. No shoes. Special alloy reduces residual magnetism to almost nothing. Ace Radio Control, $6.95.

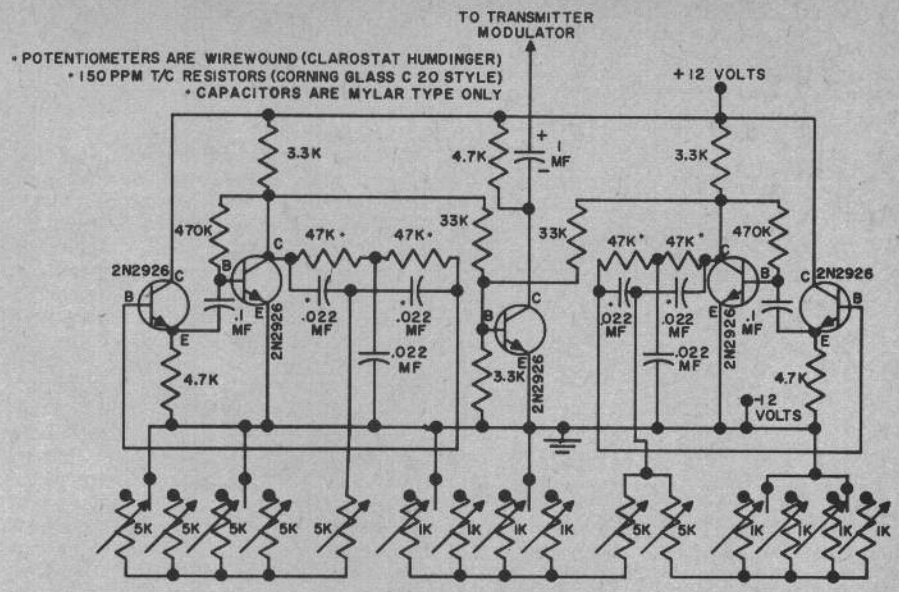
Stainless-Steel Boat Fins: Having thin profile and smooth surface, these fins are rugged enough to take any abuse. The two sizes being added to the G.E.M. Models line are 24-36" ($1.00) for most hydroplanes and ski boats; and 36-48" ($2.95, or $5.00 a pair). The pair of large fins are designed for racing and tighter turns with the G.E.M. Super Challenger but easily adapt for 3- to 4-ft. long boats. Principle is to keep the inboard step of hydroplane from lifting off the water during high speed turns.

G.E.M. also has Locktite plastic gasket, replacing all soft gaskets and O-rings—seals water, fuel, chemicals, gasses, lubricants, hydraulic liquids—$1.75 the tube; Locktite liquid washer for set screws, nuts, bolts, etc., $.85; Molykote Type U pressure lubricant for stuffing boxes and bearings, $.95. Catalogue of fibre-glass boat kits, hardware and engines, $.25. G.E.M. Models, 48 W. Le Moyne, Lombard, Ill. 60148.

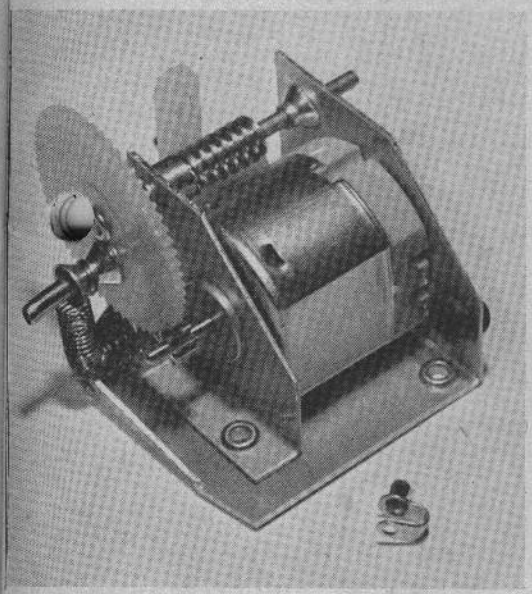
Go-Ac: For single-channel pulse proportional—rudder-only with engine, or Galloping Ghost (rudder, elevator, MC), new unit is smaller, lighter, more dependable, draws less current. Features include encapsulated design, noise-eliminating Zytel-to-brass gear train. Maximum di-



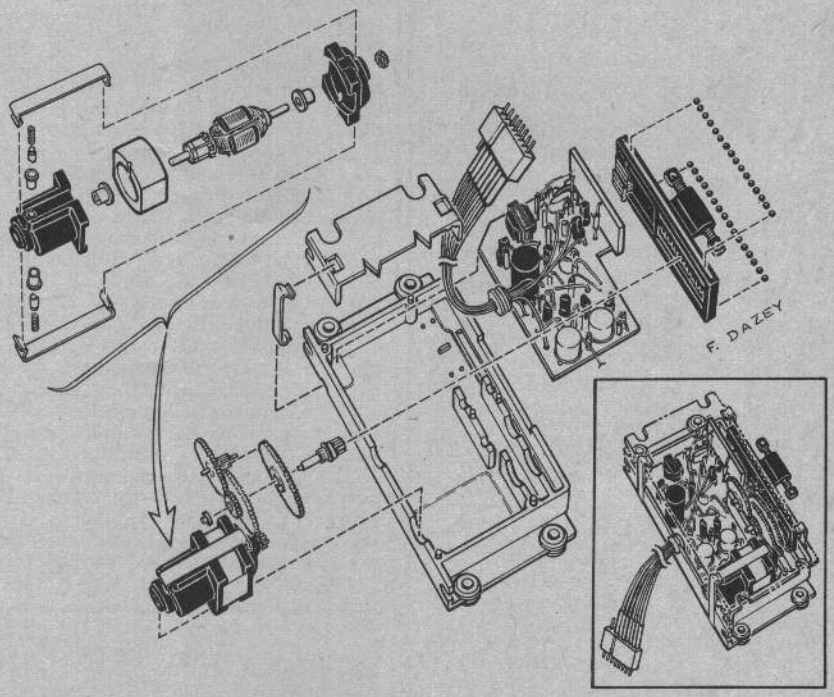
Enya's new double ball-bearing RC .60.



Circuitry by John Phelps, Applications Engr., G.E., Syracuse, ties in with May-June '65, "A Modular All-Silicon Transmitter." Rock-stable tone, silicon transistors throughout. requires no toroid stabilization. Specific type temperature compensating resistor and mylar capacitors required. Same 12V supply as RF portion. Only Tx RF module required. For basing on 2N2926 refer May-June. Circuit could be non-simultaneous for 4 channels up.



Special Edition Plans' new GO-AC.



New Bonner closed-loop servo for Digimite (digital) systems, features ball-bearing output arm, rack-drive action, non-screw, -rivet, -bolt assembly.

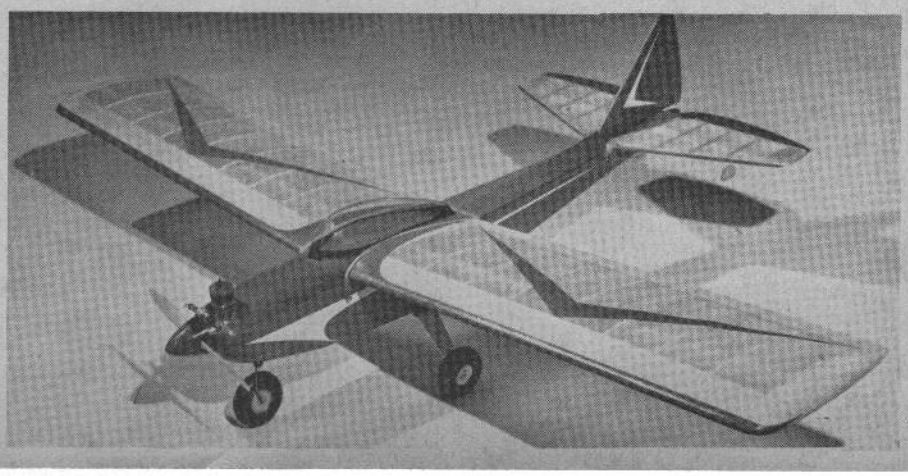
mension, 2 in.; wgt., 1.7 oz.; voltage, 2.4—3.6; drain, full cycle unattached, 80 ma. Special Edition Plans, P.O. Box 2555, Schenectady, N.Y. 12309. $14.95.

Scorpion: Also from Special Edition Plans ($14.95—plans only, $1.50), a 56-in. shoulder-wing for miscellaneous control systems on from .15 to .35 power. One-piece, no-splice sides, ply doublers, dural main gear, coiled nose-gear.

Digimite: Advertising and publicity have familiarized hobbyists with this proportional system by Bonner Specialties, Inc., 9522 W. Jefferson Blvd., Culver City, Calif. ($615.00 list, with 4 servos, 27 mc; $635.00 on 6-meters.) Servo illustration shown, with ball-bearing output arm, is indicative of system's design. The two-stick transmitter has an unusual control arrangement allowing use of as many as eight servos.

In addition to (*Continued on page* 30)

Scorpion, 56-in. span, .15 to .35. Special Edition Plans.



Morane Saulnier Type L

(*Continued from page* 19)

No. 22 of the "Leach Heritage of the Air" advertisements published in *Aviation Weekly*, November 12, 1962, illustrates and describes this action.

Building: Wings and tailplane are built over the plan in the usual manner, care being taken to avoid warps. The wing halves are joined by dihedral keepers before covering. The king-post structure on the center-section and the rigging eyes on outer panels are added after covering.

Fuselage construction is commenced with a sub-assembly of engine bearer and formers F1, F2 and F3, these formers being complete with their "wire-work." Use a good hard-wood glue on this sub-assembly. It is assumed that the builder has decided upon the escapement that he favors and also the engine. Former F4 will be modified to mount the escapement and engine bearer and F1 to suit engine mounting. The 1/16-in. sheet fuselage sides are now added to this sub-assembly, other formers and the tail block finish the basic fuselage, which is then completed as per drawing. Note that top sheeting aft of cockpits is not done until the torque-rod assembly has been completed and operation of escapement checked.

The design is sufficiently versatile to allow any suitable miniature receiver, DEAC cells or pencells to be fitted at the discretion of the builder. In any case, foam rubber packing should suffice.

The cowling presents no difficulty if built like a drum and then finished to shape. More experienced modellers may prefer to make it from aluminum or fiberglass. It is an advantage on a cowled engine to use an extension compression screw for a diesel motor (such motors are popular in England, where our model was built—Editor) or for a glow motor to make two permanent wire connections, one to the plug, the other to the crankcase. These leads run to a miniature socket mounted in any convenient place on the fuselage side. In this way the cowling line is not spoiled by large holes for clips and damage from their use.

Your choice of engine should lean toward reliability rather than high power because the model is basically a sport type.

The rigging on the top surface is permanent, while that from the undersurface is attached by hook and rubber band to the vee-member from F3. On the full-size machine the wings were warped for control purposes by means of these wires, warping taking the place of ailerons (a common practice in the early days).

The undercarriage is hinged on the rear legs at F3 and is strapped to the dowel on F2 by rubber bands.

Examination of World War 1 aircraft indicates that finish was rough—whether a judge appreciates this fact is another matter. The standard of finish therefore is up to the individual. The cream color is intended to represent a fabric which has been doped, varnished and aged.

The fully finished model should balance where indicated and initial gliding trials are recommended to correct the CG position prior to power flight. Wing loading is fairly light and the complete model should weigh about 12 ozs.

Lightweight tissue was used for covering, with two coats of thinned clear, and two of thinned color dope.

Electromagnetic Wheel Brakes

(*Continued from page* 13)

pins don't fit between the spokes or if there are no spokes, then it will be necessary to drill two ⅛" holes in the wheel hub to receive the pins from the brake. *It is important that the hub floats freely on the pins.* Any binding of the brake-sleeve-pin assembly may prevent proper brake operation by preventing the magnetic gap from closing.

EXPERIENCE: Early in 1964 over fifty of the prototypes for the electric brake were put through the pendulum tester shown in the photograph. That's a two-ounce lead sinker on a 5" radius. Hence, when horizontal, the torque produced by the brake (mounted on the center shaft) is 10 in. oz. With a 2" diameter wheel the drag on the model would be 10 oz. for one brake and 20 oz. for two brakes. This is more drag than normally needed for ground taxi maneuvers and would require 6 volts. A larger wheel diameter, say 4", would give one-half the drag of a 2" wheel. So if it's high drag you want, use the smallest diameter wheel.

The fifty prototype brakes were used by many helpful modelers on trike ships, either nose gear or on the main gear, and also on two-wheel ships with good success. It was found that there was a short break-in period of several flights in which the brake drag increased due to better mating of the braking surfaces. Thus you should expect the drag to increase during the

(*Continued on page* 24)

HILL SETS FAI CLOSED-COURSE MARK

Maynard Hill, international record setting specialist, added another radio control mark to his string of world record accomplishments on June 4 by a 174-mile closed course flight which lasted 5 hrs. and 41 min., beating the old record of 135 miles. This was the third time Hill broke a Russian-held record by N. Malinkov—this one for distance; the previous for altitude and duration.

Maynard's flight was intentionally concluded at dusk when it became impossible for him to control the aircraft or see the flag man at the far pylon on the 1 km. course laid out near Washington. He still had 2 lbs. of the original 5 lbs. of fuel left and estimated he could have flown almost twice as far.

The model was essentially the same Sampey equipped design used previously. The ship featured wet-wing construction, with the fuel carried in an epoxy-coated tank in the inboard rib sections. Power was by a Merco .49, equipped with a muffler. Maynard credits the muffler for providing considerable fuel economy.

Maynard said this distance record was the most difficult to fly of the three. Flying the course required his constant attention for almost six hours and he finished with a rather stiff neck.

During the early stages of the flight, the heavily-laden aircraft was difficult to keep aloft due to engine overheating and down drafts. Toward the end, lap speed increased with the decreased fuel weight.

THESE DEALERS ARE ACES! READY, WILLING AND ABLE TO SERVE YOUR R/C NEED!

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2100 [illegible]a Blvd.

■ ARIZONA

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DOW'S HOBBY & CRAFTS SHOP
5329 South 12th Ave.

■ CALIFORNIA

California, Burbank
T & A HOBBY LOBBY
3512 West Victory

Covina, California
COVINA HOBBY
140 North Citrus

California, Fullerton
DYCK'S HOBBY HOUSE
1659 West Orangethorpe

California, Los Angeles
COLONEL BOBS
3707-09 West Pico Blvd.

California, Montebello
VICTORY HOBBY SHOP
1411 West Whittier Blvd.

California, Palo Alto
AL'S HOBBYMART
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California, San Jose
HUSTON'S HOBBY SHOP
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California, Santa Monica
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67 Roncesvalles Ave.

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D & S PAINT CENTER INC.
217 West 9th Street

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Connecticut, Windsor Locks
SKIPS ELECTRONIC SERVICE CT.
9 Sp[illegible]reet

■ [illegible]A

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Florida, Miami
ORANGE BLOSSOM HOBBY SHOP
1895 N.W. 36th Street

Florida, Tampa
FARMERS SUNDRIES & HOBBIES
4926 East Broadway

Florida, Jacksonville
INTERNATIONAL MOTOR MART
1038 Kings Avenue

■ ILLINOIS

Illinois, Barrington
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120-A West Main Street

Illinois, Belleville
REMICK HARDWARE CO.
46th St. & West Main

Illinois, Chicago
HOBBY HOUSE
5516 South Damen Avenue

Illinois, Chicago
STANTON HOBBY SHOP
4736 North Milwaukee Avenue

Illinois, Chicago
B & E HOBBYCRAFTERS
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Illinois, Chicago 60651
WEST TOWNS HOBBY SHOP
5714 West Chicago Avenue

Illinois, East St. Louis
EAST SIDE HOBBY SHOP
2303 State Street

Illinois, Harrisburg 62946
THE HOBBY HOUSE
19 S. Main

■ MAINE

Maine, York 03909
DOWNEAST MODEL SUPPLY
Scotland Bridge Rd. RFD #1

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HOBBY HUT
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Massachusetts, Braintree 02185
MODEL RADIO CONTROL CENTER
82 Hancock Street

Massachusetts, Cambridge
CROSBY'S HOBBY CENTRE
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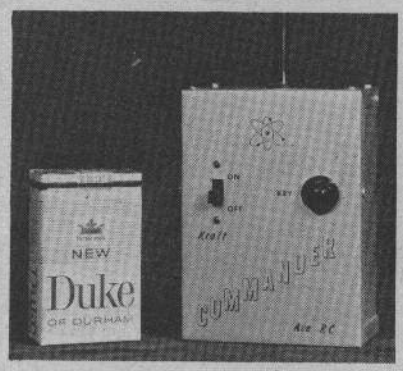
ACE R/C



IT'S HERE—THE ACE COMMANDER TRANSMITTER KIT

It's hard to visualize a package this small and easy to hold that packs the punch that this one does. **The Ace Commander, designed by Phil Kraft,** is the result of many requests for a powerful hand-held single channel transmitter kit that would use a standard 9 volt battery of the Eveready 276 or Burgess 2D6 or Mallory 1603 types. Features a click type push button, which can be not only felt, but heard as well, for a real solid keying action. Has a 54 inch antenna that is base loaded, so that for the input, you probably have the most efficient output of any transistor transmitter available. Has no nulls or dead spots. Features a modulator that produces an audio signal that is clean at 500 cycles per second tone at 100% modulation. May be used with the K3VK, KR1K, or the Kraft Superhet Receiver and most other receivers. Is easily and efficiently converted for pulser operation, since the transmitter will follow the fastest pulsing. When used in conjunction with the Kraft Custom Superhet Receiver, you have one of the finest proportional set ups for simple proportional available today. **Instructions feature easy step by step assembly details, complete with photos and drawings.**

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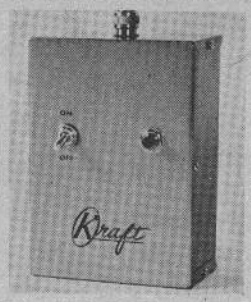
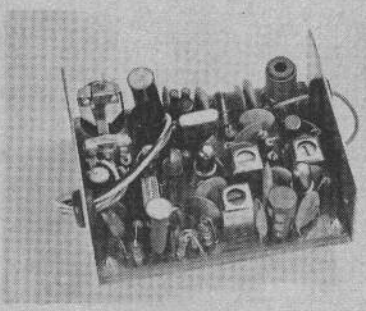


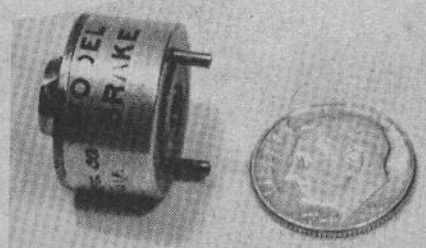
KRAFT CUSTOM SINGLE CHANNEL ALL TRANSISTOR TONE TRANSMITTER

From Kraft Custom comes the Kraft Single Channel All Transistor Tone Transmitter. In a smart gold anodized cabinet, measuring 4⅜ by 6 by 2½, this little jewel packs the punch that is required to override many interfering signals. Uses a 56 inch antenna with base loading so center loading is not required, thus increasing the efficiency of the output. Completely transistorized, uses only one nine volt battery, yet packs the punch of many a vacuum tube type of transmitter. Completely assembled ready to go. Features sine wave—no splatter—modulation. **Signal is 100% clean. 400 cps. . . . . Only $29.95**



KRAFT CUSTOM SINGLE S/H RCVR

Here it is. The Kraft Custom single superhet receiver. With a relay, this is a versatile unit. Pulses excellently and resistant to brush noise when hooked up as shown in the instructions. Measures 1⅛ x 1⅞ x 2⅜". Weighs 2½ ounces. This unit, along with the KTx1, will do much to provide trouble free superhet flying for the beginner. Available in all CB frequencies, except 27.225. Please specify. Also available on 6 meter frequencies in matched combos on request, write for details. This is a breakthrough in price that you have been waiting for. Completely assembled, tested, ready to go. For use with KTx1 shown elsewhere. Uses 1 9 volt battery. **No. 12A40—KR1 Kraft Custom Single Receiver SH $39.95**



NEW! NEW! COMING!

Coming! An electric brake for your R/C models, developed by **Dr. Walter A. Good.** In the testing stage for over a year, this lightweight unit provides up to 8 inch ounces torque drag on 2.4 volts, with a drain of only 160 mils. May be used with 2 to 6 volts. Coil resistance is 15 ohms.

Now get electric braking for your R/C model in this Ace exclusive, by special arrangement with Walt Good.

Braking action is by magnetism—employs no shoes. Use of special formula alloy, cuts residual magnetism to almost nothing.

Will fit most R/C wheels. Designed for a 5/32" axle.

Packaged with one brake and complete instructions per package.

No. 25A55—Ace-WAG Electric Brake $6.95

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(*Continued from page* 22)

first few flights and then become constant.

Dirt and heavy oil have only minor effects on the drag. In general, the energized oily brake will be slightly weaker than a dry brake and the deenergized oily brake will develop a small amount of drag. This may be noticeable if one brake of a two-wheel gear is dry and the other is oily as there will be a slight tendency for the oily one to drag when not energized and the dry one to drag more when energized. The solution, if needed, is to keep both dry or both oily! I find a drop of lubriplate is a good way to keep them oily.

Cleaning the brake can be done by flushing with alcohol, gasoline or a water-detergent solution. Or in an emergency, a squirt of fuel. Do not use cleaning agents like acetone since this will attack some of the insulation

In practice, it is found that 2.4 volts on two brakes or 4.8 volts on one brake will give about 10 oz. of drag force to the plane. This is plenty for bringing the plane to a stop even with a fast idle and a tailwind. It is not enough to stop a plane with high throttle where the engine thrust may exceed 5 lbs! However, it was decided to forego the capability of full-throttle stops and design the brakes to cope with the precision required in the taxi maneuvers.

VARIATIONS

The electric brake lends itself to many variations. The first which comes to mind is to make the braking proportional to the control motion. This can be done by running proportional current or pulses through the brake since its reaction torque is approximately proportional to the average current through the coil.

Another idea is to use two brakes and have the rudder control the braking of the selected wheel and do the steering with the brakes. In a trike gear the nose gear could have a swivel action but would be free and not need a steering linkage.

Many of the new multi rigs have spare channels which could be hooked to the brakes through appropriate amplifiers and have independent and simultaneous operation of several brakes. Perhaps someone will go all out and place three brakes on a trike ship and connect them all independent and simul!

It is possible to bury the brake into the hub of the wheel but it requires a very precise alignment of the hub hole and the brake sleeve. If these are not accurately aligned the brake sleeve will not seat well and the magnetic forces will be severely weakened. If a scheme is used for burying the brake in the hub which still keeps the sleeve floating, there should be no trouble.

The author wishes to thank the many modelers who "flew" the experimental brakes and encouraged him to carry them into production so that others could enjoy the smooth reliability of electromagnetic braking.

Good luck and happy landings—and most important—smooth stoppings!

Curtis Brownlee advises that a valuable technology handbook on "Space Batteries" is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C., 20402. (NASA SP-5004, price 25 cents.)

By Howard T. Francis of the Armour Research Foundation, Illinois Institute of Technology, it covers the history and general concepts for all model batteries of the nickel cadmium type, also silver cadmium and silver zinc.

You Too Can Have A U-2

(*Continued from page* 10)

are turned on and left on, and *then the shutter is cocked.*

If you are using an escapement ship, the shutter tripper could be activated either on "quick blip" or "third position" and, of course, no transistor amplifier would be required.

Originally it was planned to bolt the camera to transverse mounting rails in the fuselage, using rubber grommets in the same way as most servos are mounted. Didn't work. Then engine vibration tripped the shutter every time, just as soon as the engine built up any sort of RPM count. The final solution: 2" (yes, 2") of foam rubber under the camera with a hole for the lens/shutter mechanism; an inch of foam fore and aft and enough foam material on top so that a slight compression was realized as the wing was rubber-banded into place. Luck was with me since there was room enough in the "U-2½" for all this foam rubber. I would recommend to anyone starting from scratch that they plan on needing it.

Let's turn now to some of the other aspects of the actual photography:

Films: Recommend you stay away from Verichrome Pan. It just doesn't have enough contrast to make good photos unless you have an unusual ground pattern at your flying site. Plus-X is better and, if you use shutter speeds of 1/200 second, it is plenty fast. If you have a camera with a 1/500- or 1/1000-second shutter, you will probably want to go to Tri-X. I haven't taken any color shots, but there is no reason they shouldn't work.

Exposures: Aerial photographs show the most detail if they are taken in bright sunlight with a sun shadow angle of around 45°. Shadows are very useful in defining the shape of objects on the ground and will probably be the only way in which individual persons will show in the film. I would start with the exposure recommended by the manufacturer—f/16 at 1/200 of a second for Plus-X in bright sunshine for example. If your flying site looks as if it would be highly light reflective, or if your first attempts are overexposed, then close the lens down one stop (f/16 to f/22).

A complete list of the standard lens stops is shown in the following table:

Full f/number stop	*Light units passed/given time*
1.4	1
2	1/2
2.8	1/4
4	1/8
5.6	1/16
8	1/32
11	1/64
16	1/128
22	1/256

Some cameras also have f/6.3, f/4.5 and f/3.5 settings. These are intermediate stops which transmit three-fourths of the light of the next lower f/number stop.

Film response to light is somewhat logarithmic, so that most films have at least one f/number stop leeway in producing acceptable exposures. Note that the speed of the shutter and the f/number work together to determine the amount of light reaching the film. Given a lens and shutter setting of 1/200 at f/11, an exposure of similar density will result from the following combinations:

Shutter speed	*f/number*
1/1000	f/5.6
1/500	f/8
1/200 or 1/250	f/11
1/100 or 1/125	f/16
1/50 or 1/60	f/22

The higher f/numbers will give the

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sharpest pictures, so one should use the highest f/number possible while still keeping shutter speeds fast enough to prevent blurring (1/200 or faster).

Filters: By placing filters of different colors in front of the camera lens, it is possible to highlight different colors of incident light coming up from the ground. This can result in different appearing photographs, even of the same area, and can add interest to the project. Filters are often used, for example, in military aerial photography to detect camouflage since natural and artificial (or dead) foliages reflect light differently and this can be detected by appropriate filters. The table shows a few of the more common filters and their effects.

Filter	*Filter factor**	*Passes*	*Darkens on Print*
K2 (No 8) (yellow)	2	Yellow, green, red, some blue	UV and violet
X1 (No 11) (Lt green)	4	Green	Yellow, red, blue and violet
A (No 25) (red)	8	Red, yellow	Green, blue and violet

* Plus-X film, others may differ

Filter factors: Since colored filters decrease the amount of light reaching the film, compensation must be made to insure correct exposure density. The filter factors in the preceding table are the guide as to how much additional light is required. Every factor of 2 requires one full f/number stop additional lens opening (or doubling the exposure duration, ie. from 1/500 to 1/200 or 1/250 second). Thus, with an X1 (green) filter with a factor of 4, two full f/number stops are required (f/11 to f/5.6, for example). With a filter factor of 8, three full stop increases are required (f/11 to f/4, for example). Both f/numbers and shutter speeds can be changed to accomplish the compensation. Suppose the exposure without filter is f/16 at 1/200 second. If an A filter (red) is added (factor of 8) then any of the following combinations could be used:

Shutter	*f/number lens opening*	
1/200	f/5.6	(3 stops)
1/100	f/8	(2 stops, 1/2 speed)
1/50	f/11	(1 stop, 1/4 speed)
1/25	f/16	(1/8 speed)

Of course, these slower shutter speeds are not satisfactory for aerial photo work.

As indicated in the first installment, this series of articles was designed to encourage others to try their hands at model aerial photography. I have found it a most interesting project, and sufficiently different from run-of-the-mill flying to be both enjoyable and challenging. It is obvious that much progress could be made in the field if the talent in the RC community could be brought to bear. Possible are Polaroid film cameras permitting instant pictures, automatic film advancing systems, movie cameras, perhaps eventually even dog fights or ground strafing using "gun cameras" to score hits as is done in actual military flight training and combat.

Relayless Servo Amplifier

(*Continued from page* 6)

been said about the diode. This is just a cross-coupling diode to protect against burn-out should both reeds actuate simultaneously. In our opinion this is a waste of good diodes, but it seems to be the thing to do if you want people to think you're on the ball. It works, too. Someone *could* need this diode sometime, eh?

This about covers the discussion of this amplifier. Sigma is a Greek letter which usually means "Summation", and we feel that this amplifier is a summation of the best ideas advanced thus far. The nine means that this is the writer's ninth servo amplifier design, and we feel it is the most promising.

BUILDING INSTRUCTIONS

First, note the various ways to trim the circuit board to fit your servo. Looking at the circuit layout, which is shown from the component side looking through the glass board at the copper which is on the other side, you will see four large holes numbered 1,2,3,4. These are mounting holes to be drilled with a 1/16" drill as needed. Holes 1 and 4 are for the standard mounting holes in the Annco and Geni servos. Hole 2 (preferably) or hole 3 may be used to mount the amplifier in Bonner Duramite or Citizen-Ship TNA and RNA servos. Should you wish to transfer the amplifier from an Annco or Geni to a Bonner Duramite, hole 3 is provided. Trim your circuit board accordingly.

The board should be sawed carefully with an X-Acto razor-saw along the dashed lines for the Bonner Duramite, or along the solid line for the Annco and Geni. For the Citizen-Ship servos mentioned, it is

Tom Schaefer's one-channel PT-17. (John Maloney)

recommended that no trimming be done until after the amplifier has been finished, then enough of the upper portion of the board along the dashed line marked "Trim" may be cut away to permit clearance for the mounting bolts of your servo uses. If the board has already been trimmed by accident, simply use hole 3 for mounting in any of the mentioned servos, but it will be necessary to drill a 3/32" hole in the servo case to accommodate the mounting screw in each case. The rest of the mounting details follow at the end.

Placement of the parts exactly as shown is extremely important. We have tried variations of this arrangement and found this ONP to be the best in every way. The resistors all stand upright on one end. The larger two transistors mount flush with the board, as do the electrolytics. The four smaller transistors should be mounted as follows: Q1, Q2 should be left 1/16" above the board, and should not lean in any direction because of the limited clearance between these transistors and the gears of the Annco or Geni servos. If hole 3 is to be utilized for mounting, Q3 should be left about 3/16" above the circuit board to prevent fouling by the mounting screw. Q4 may also be left about the same distance off the board but you can push it in closer if you prefer. *Do not lean these transistors over.*

The arrangement of the leads for Q1, Q2, Q3, Q4 follows the same pattern shown on the board. The two leads farthest apart are the emitter and collector. The lead in the middle is the base. If you examine them closely, you will note that the base lead forms the 90-degree angle of a right triangle in relation to the emitter and collector leads. The mounting hole for the base also forms the same angle. In other words, the holes the three leads insert into are arranged the same way as the transistor leads. *No leads should cross over.* See the drawing, which is looking from the *top* of the transistor, exactly as you would hold it while inserting it into the board. The diode in this amplifier stands on its *Anode*, which means that the color stripes which identify the diode will be *away* from the board.

Some think it is the best practice to mount all the resistors and capacitors first in order to keep from damaging the transistors with excessive heat. The transistors used in this amplifier will stand normal soldering heat without damage. Probably the most vulnerable component in this amplifier to soldering heat damage is the circuit board itself.

Use your own judgment about the order in which you wish to install the components. It is best to install the wires last. It may sometimes be necessary to file off the high spots of the finished work in order to provide clearance in the servo. This should not be overdone. About 1/16" from the original board surface is about right. *If you use the file, do so with caution.*

After building the amplifier except for the wires, it will be necessary to refer again to the component layout diagram. The wires attach in holes numbered 5 through 15, as follows: Hole 5: Short (6") Brown wire; Hole 6: Short Orange wire;

COLVER SETS FAI GLIDER RECORD

The United States has applied for recognition of a brand new international record for model aircraft—distance in a closed course with a radio controlled glider.

Frank Colver, 30, Costa Mesa, Calif., flew his 8-ft. span Jetco Imperial a total distance of 43.5 miles while circling two pylons 100 meters apart on the cliffs of Corona del Mar on May 8. The sailplane was held aloft during the 2-hr., 40-min. flight by rising air currents coming over the cliffs.

Howard E. Johnson, Academy of Model Aeronautics president, was contest director. Judges for the flight path around the pylons were David Vincent and F. Swaney. Mr. Swaney is a full-scale glider pilot. The flight was tedious and grueling, although thrilling in several ways. About twice every hour, intense thermal activity off the cliffs caused the plane to rise uncontrollably to extreme heights.

The tentative record has been forwarded by the AMA through the National Aeronautic Association to the Federation Aeronautique Internationale in Paris for homologation. If approved, the United States will have captured the first record since this category was established by the Committee for International Aero Modeling of the FAI last year. Other FAI records for radio controlled gliders are held by Russia and New Zealand. The Californians report that they are aiming for the glider speed and other records.

Hole 7: Short Blue wire; Hole 8: Short Black wire; Hole 9: Short Red wire; Hole 10: Long green wire (12"); Hole 11: Long Black wire; Hole 12: Short (6") Green wire; Hole 13: Long (12") Red wire; Hole 14: Long Yellow wire; Hole 15: Long Orange wire.

Once the wires are soldered, the amplifier is ready for installation in the servo. Assuming you have trimmed the board properly, it will be necessary to trim the Micarta insulation sheet to the same dimensions. To locate the proper spot to work a hole in the insulation sheet, you can hold the amplifier up to a light with the sheet in place. Mark this spot with a pencil, then drill a 3/32" hole. Installation in the various servos follows:

Bonner Installation: Locate the spot to drill the hole in the servo case (3/32" hole) according to the diagram. This diagram is shown looking at the top of the servo from the outside. Measure this hole carefully since there is no room to waste. Some modelers prefer to drill this hole with an electric drill. Others prefer to work the hole out with the point of a pocket knife. If a drill is used, be very careful not to let the drill go into the motor.

The wires which run to the wiper plate inside the servo are the short wires, and include all the short colors except Green. Observing the position of the motor and the grommet hole for the long wires, it will be obvious how the wires should be dressed for least interference with other components of the servo.

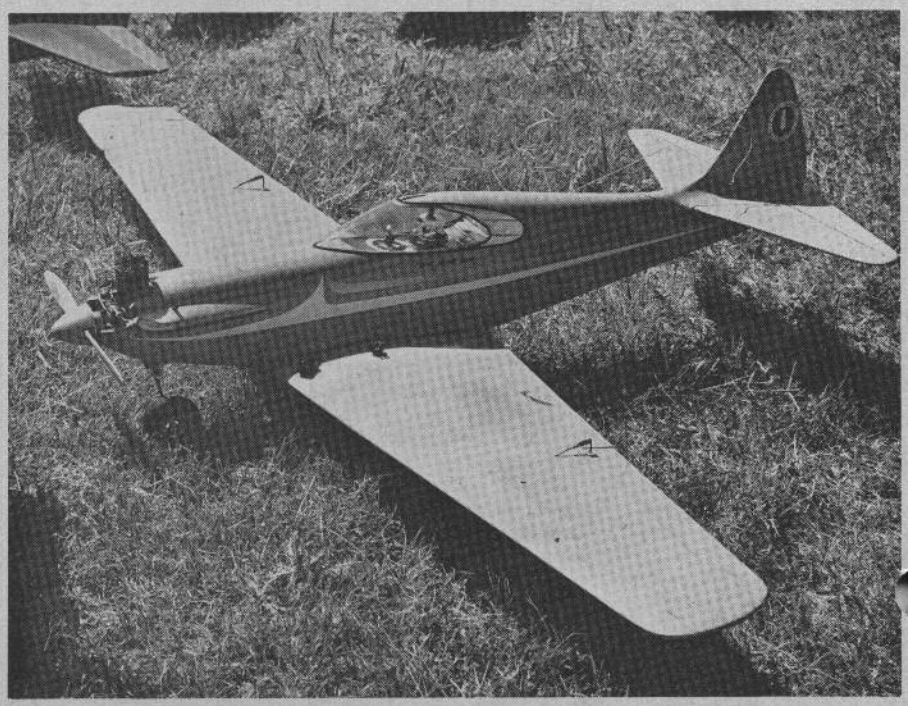
If your amplifier is being fitted to a relay-type Duramite there will be six patches on the wiper plate to which wires of six colors are attached originally. *Mark these colors with a pencil.* Then remove all of them except the Yellow wire. The Yellow wire should be cut off just long enough to form a jumper to the patch formerly occupied by the Brown wire, and should be soldered to this patch coming off in the reverse direction (toward the servo actuating arm). This is important to prevent interference with the electrolytic capacitors.

After the amplifier is in place and the mounting screw attached (don't forget the insulating sheet under the amplifier) the wires (only the short wires, and not including the Green one) should be clipped 1¾ inches out from the edge of the servo mounting flange, then the insulation stripped off the last ⅛" and the ends tinned lightly. They are soldered to the servo wiper plate, with the colors exactly matching those removed from the patches (blue to blue, etc.). The short Green wire goes to one side of the electric motor. This should be the land previously occupied by the green wire from the motor (unless the magnets have been reversed), which should be removed and discarded. In soldering the short wires to the wiper plate, the following is very important. The two patches to which the blue and brown wires attach are very close to the electrolytic capacitors when the top of the servo is replaced. For this reason, these two wires (as was the case of the Yellow jumper) *must* be soldered to the patches so that they come off the wiper plate *toward* the servo actuating arm, or toward the gear end of the servo. The cover will not fit back on otherwise. The long white wire replaces the white wire on the motor if needed for extra length.

In the Transmite type with only five patches on the wiper plate, proceed as before, except ignore the step involving the yellow jumper. All six long wires remaining run through the grommet provided in the Bonner case for this purpose, and form the power and signal connections.

Annco and Geni servos: Mounting in these servos is straight-forward and simple. Follow the steps outlined above about marking the colors and making the Yellow jumper connection. If your servo is one of the older four- or five-transistor 2RL types, this amplifier will not match the wiper plate. If one of the later 7-transistor types of 2RL, or just a relay type (2R), the wiper plate is OK. A 2R wiper plate may be obtained from the manufacturer and substituted for the older type plate. The colors will be the same, as in the Bonner steps outlined above. The leads should be trimmed 1½ inches from the bottom edge of the servo for the short wire connections. After replacing the gear frame and motor, give the motor a couple of turns by flicking the motor gear with a small screwdriver to make sure it is free.

Citizen-Ship servo: Refer to the pictures and diagram. The short wire connections



Something different—Ted White's "La Flecha." (Astjes)

must be routed around the motor end of the servo to the wiper fingers. The sketch provided shows how to hook these wires to the fingers. As in the Bonner and Annco and Geni, the short Green wire goes to the motor green. In the case of the Citizen-Ship servo, the 10-ohm resistor across the motor terminals should be left in place to prevent servo over-run.

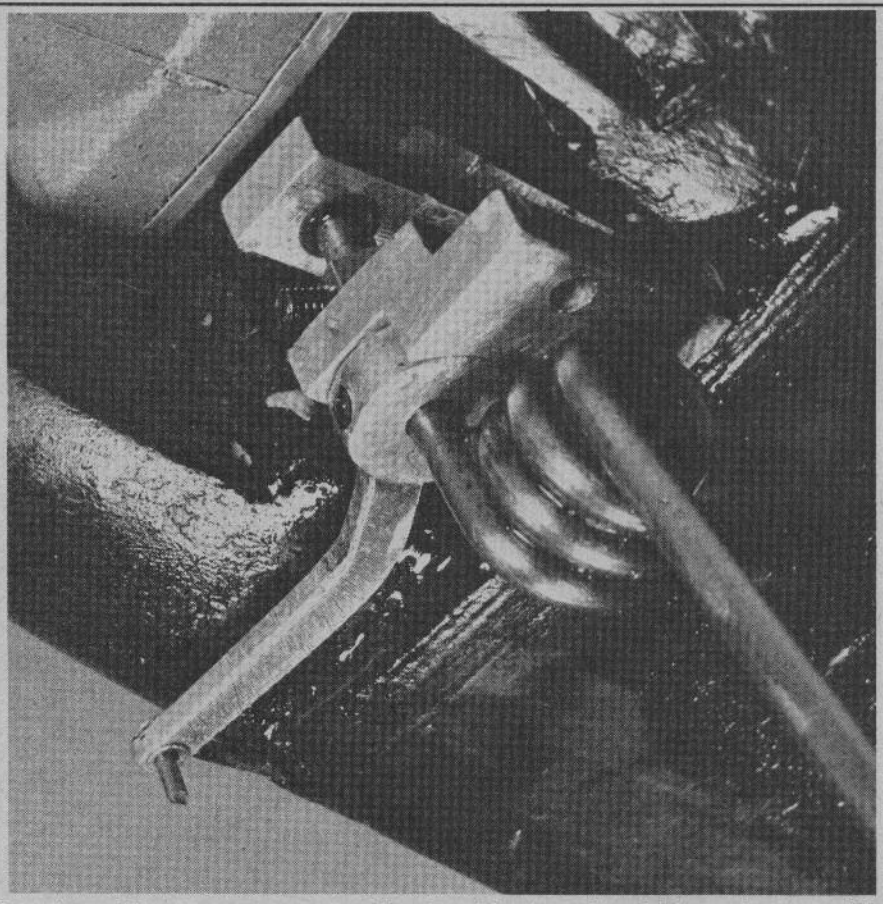
Assuming you have taken all the normal precautions such as inspection of the circuit board for accidental solder bridges, etc., the servo is ready for testing. This amplifier is color-coded in the manner used by most popular makes and will plug in right beside most of them. When first connection is made to the power source, you will probably notice the absence of "Jiggle" or "Waggle" which a majority of Germanium amplifiers will have. The reason for this is the "Squelch" feature mentioned earlier. Very few of these amplifiers have evidenced any jiggle whatever when the power was first applied.

Should your servo run to one extreme and and grind into the case, unplug it immediately. The trouble is that your motor magnets have been reversed or you accidently have made the Green and White connections to the motor backwards. If your servo is hooked up correctly and is off neutral it will neutralize. Actuation of the Orange reed will run it one way, etc. If the reed doesn't actuate the servo but touching the Orange lead to the Positive end of the power supply does actuate the servo, the trouble will be in the electrolytic capacitor.

Other trouble shooting procedures are straight-forward as in other amplifiers. In the smaller servos, occasionally the modeler is not cautious about fouling of the wiper finger arm by the internal wiring. Unless the internal wires have been left excessively long, simply tugging at the power and signal leads gently, one at a time, will pull these wires out of the way. A bad transistor is considered very unlikely. The quality control used in the manufacture of the specified transistors is so high that we have yet to experience a failure.

If you are interested in pulsed reeds, make changes with caution. There are several things to be sure of before altering the circuit, including reed spacing, battery voltage under load, condition of the electric motor, etc. Taking a look at the voltage patterns on both ends of R7 and R5 with a good oscilloscope will give you an idea how the capacitors are doing. One should always keep in mind that the input voltage to the base of Q3 and Q4 must be one volt or more to fire the transistor. This reading should be taken across R6 and R8. A reading across R3 will show you how the transistor Q1 shorts across this resistor with each application of signal. Q2 should turn off each time Q1 fires. Readings across R9 and R11 will show the base saturation voltage of Q5 and Q6. This will vary according to the load imposed but will stay within the range of 0.9 to 1.2 volts. If the capacitors are too large, and widening the reed spacing will not correct the condition, a reading across the capacitors should show this with the pulser going. During the "off" portion of the duty cycle either Q3 or Q4 (depending on which signal is given) will continue to conduct for an excessive time. The servo will then jiggle out to one end and stay there. The use of a shorter duty cycle rather than adjustment of capacitor values is recommended at this time.

If you should have access to close-tolerance capacitors by all means try them if you wish. The rest of the circuit is within 10% tolerance. We hope you find this unit as versatile and pleasing as we did. Your



Impatient with wornout nose gears, Lew Famighetti machined this sturdy mount. The strut proper was given extra hardening which virtually eliminates all distortion.

comments are invited.

PARTS LIST

Q1, Q2, Q3, Q4: Fairchild 2N3564 or Fairchild SE 1010 (four req.)
Q5, Q6: Fairchild 2N3638 (2 req.)
R1, R2: 3.9K (All resistors ¼ Watt composition, 10%)
R3: 1K
R4, R5, R6, R7, R8: 2.2K
R9, R10, R11: 100 Ohms
*C1, C2: 8 to 15 mfd Electrolytic, .25" Dia. max., .5" Height max., plug-in.
D1: Any good general purpose Germanium sub-mini glass (1N60, etc.)
Wires: Short (6") wires, plastic insulated, 26 swg, following colors: Red, Orange, Green, Black, Blue, Brown. Long (12") wires following colors: (wires here are same size, etc. as above) Red, Green, Black, Yellow, Orange, White. Printed circuit board on 1/16" epoxi glass.

Bits and Pieces

(*Continued from page* 21)

the two-stick design, an auxiliary control panel at top of case includes four levers for options, such as spoilers, flaps, retracting gear, fuel mixture. Lefthand stick gives rudder on left-right movements, throttle with fore-and-aft; right stick, progives rudder on left-right movements, up- and down-elevator on fore-and-aft. Thus, although two stick, primary flight controls effectively are one-sticked. Adjacent to each of the two sticks, appropriate trim functions are provided with movement in natural directions. Dual-output meter built into case (top, right) gives RF output (1 watt) or power supply charge rate.

Charging of both transmitter and receiver batteries is handled simultaneously by charger incorporated into transmitter. Cheater cord plugs into 110 AC outlet and transmitter; receiver battery disconnect cable, attaches to transmitter during charge. Nine individual cables (one for power) exit receiver, prewired to connectors.

Enya .60: Claimed hp is .9 to 1.1, rpm 2500 to 12,500. New double-ball bearing engine weighs 13.6 oz., has no gasket, displaces .606. $42.50 from MRC Enya Company Inc., 5300 21st Ave., Brooklyn, N.Y. 11204.

Miscellaneous: Radi-O-Too ¼A biplane for either freeflight or RC, spans 25 in. for wing area of 200 sq. in. RC gross, 10 ozs.; for pulse or escapement. At this writing over 700 of these kits required to meet "grapevine" demand. From Flyline Models, 133 Ashby Pl., Fairfax, Va. $5.95. . . . DeNight Special, by Sterling Models (Belfield & Wister St., Philadelphia, Pa. 19144) is authentic Goodyear-type racer for the new pylon racing craze. Span is 50 in., for .19's to .60's (if you are in a hurry!), pylon maximum, .40. One-piece sides, die-cut sheet tail surfaces, sheet-covered wing. Aluminum gear, plastic cowl cheeks and wheel pants, bubble canopy. $18.95. (Also Ace.)

Universal radial engine mount, by deBolt Model Engr. (3833 Harlem Rd., Buffalo 15, N.Y.), is dural plate with mounting holes for most popular .19 to .49 displacement engines. Bolts to ply firewall, with shock absorbing rubber disc between plate and ply. Bolts, nuts, blind nuts. $1.25. . . . Bargain bulletin, America's Hobby Center, 146 W. 22nd St., New York 11, N.Y., is 64-page booklet of new items, including factory releases of exhibitors at HIAA Trade Show and Toledo RC convention. Five-cents, in coin or stamp. Bulletin #AB65.

Orbit's 3 + 1 propo system, already well publicized, merits this further explanation. It delivers, of course, three proportional command functions: elevator, rudder, throttle—with flight trim of the first two. The "plus 1" refers to CAR—coupled aileron and rudder—achieved by fourth servo, delivers rudder control for taxi, takeoff, and less than full-throttle maneuvers. Full-open throttle uncouples rudder for normal aileron and elevator control. Same alternating tone, continuous carrier transmission as firm's full-house equipment. Feedback servos have disc output. Orbit Electronics, 11601 Anabel Ave., Garden Grove, Calif. $350.00—transmitter powerpack and recharger, $35.00 extra.

A 12-oz. visual flow tank, and a clean-flow filter, are latest deBolt releases. The filter, costing 95¢, substitutes for weighted pick-up in any plastic tank. It is made of metal with close-woven stainless-steel screen.

Of the larger tank, the manufacturer doubts need of anything larger—simpler to drop a pint of fuel in the nose! Need for big tank is created by trend to bigger engines. Size is 2½ x 6¼ in., price $1.75.

A 48-in. high special trophy has been awarded to Jerry Nelson by Robert R. Russell & Associates of Des Moines, Iowa, and Des Moines Modelaires Club, for his promotion of the National Miniature Goodyear Pylon Racing Assoc. A combination of silver, gold and walnut, valued at more than $150, the trophy goes to National Champion (Goodyear) at Nats where this extra activity will be flown after contest hours, on Thursday, Friday and Saturday of the meet.

Readers Write

(*Continued from page* 1)

manufacturers, please let me know.

JOSEPH B. CANDLER, Pres.
The Imported Motor Car Corp.

HOW COULD WE?

Please refer to Volume 6, No. 2. On page 7 the article "Radio Control, How-it Works" has confused me. Those of us who are struggling to get a single-channel airplane flying and who are plagued by a lack of manufacturer's *clear, simple* explanation of what their equipment will do and won't do, look to the hobbyist magazines for help.

We are therefore confused to see diagrams like those on page 6 that show four wires coming out of relayless receiver. Two of us who have C & S Honeybee and F & M receivers (single-channel) count only three wires. Was your intention in showing three wires from the receiver in Fig. 1 and four wires in Figs. 2 and 3 to indicate different brand names of receivers? Or was there a typographical error—with "relayless" meant to be "relay" in the captions?

We would be most grateful for clarification in this, since we are already a confused lot that feels put upon and misled by those who would have our dollars but care not at all how we fair with their equipment.

ROBERT L. NELSON, San Mateo, Calif.

• *Editor: We have answered Mr. Nelson directly. The caption should have been more clearly stated. (There was not time to make correction.) The caption under Fig. 2 on page 6 should have explained that this was a double-ended receiver or dual-output-type of receiver, such as the C & S 505 Finch, or the Otarion 0-22 (no longer manufactured). This same effect can be had with any ordinary single-ended receiver, as Fig. 1, by adding an add-on switcher, available in kit form, from both World Engines and Ace R/C, and recommended by Frank R. Adams, manufacturer of the Adams Actuator.*

BACK ISSUES

I have been interested in RC for five years. If it had not been for GRID LEAKS I might have given up in disappointment. However, I have found several articles that have given me hope.

Is there any way of getting back issues of GL? I am greatly interested in getting complete back issues. It has been the greatest help as far as teaching a newcomer the fundamentals. I only wish it came out more often.

MILES J. JACKSON JR., Monroeville, Ala.

• *Editor: Back issues of Grid Leaks are available; but spotty. In Vol. 2, numbers 8 and 10 are available; in Vol. 3 numbers 2, 3, 4, 5, 6, 7, 8, 9 and 10. All 6 issues of Vol. 4 are available, and the 5 issues that made up Vol. 5. (NOTE: There was no November-December 1964 issue). For back issues write* GRID LEAKS *at Higginsville, Mo. and enclose 35 cents for each desired.*

BROTHERLY ADVICE

You may use this answer to Mr. Rose, May issue of GRID LEAKS.

Mr. Rose, I agree with you 100% that there is much junk on the market in single-channel equipment and also in multi-channel though, perhaps, to a lesser extent. However, to say that there is not a decent single-channel escapement might be slightly exaggerated. There is a very good compound escapement that has been manufactured for years and used by nearly all of us at one time or another. Since I don't work for Howard Bonner, I won't mention his name, but you should give it a fair try. Servo-wise (single), I must agree with you.

You owe it to yourself to join an AMA affiliated club such as your KCRC club. You'll be protected from liability claims for possible damage, you'll be helping support a petition for new R/C frequencies, you'll learn safe-flying techniques and most of all you'll be helping in location of flying sites for *sport* flying which is what most club members do most of the time but we don't lone-wolf it.

I am a club member and an AMA member and due to lack of time I don't get to over one or two contests a year. The rest of the time I'm a sports flyer. In fact, to most contestants at a contest I would be called a sport flyer—they just can't believe I'm serious.

Last year, I drove 250 miles and back to Chicago. I won 7th in novice and a subscription to GRID LEAKS. I met the nationally famous modelers, was treated great by all of them, learned a lot about equipment and planes, and incidentally, by accident, I walked off with more stuff than I won. I came home with somebody's needle valve and a quart of home-brew fuel. Might have been Kazmirski's or Frank Madl's or someone else's, I don't remember. The great's were just as friendly as the small one's like myself. Don't knock the contest flyers; they are the sports flyer's friend. They protect us from ourselves.

JOHN MCNERNEY, Cedar Rapids Skyhawks

WHEN YOU RESUBSCRIBE TO GRID LEAKS—

BE SURE TO INCLUDE YOUR ZIP CODE #

THE MONITOR

(*Continued from page* 2)

made ready-to-fly Class III ships suitable for competition.

What are the ethical considerations?

In principle, the anti-BOM case has been simply stated in those editorials: When people disobey the law, abandon the law. But laws can be enforced, it will be said. In the past two years we have seen serious crime go unpunished, yet the laws forbidding such deeds have not been abolished. If 100% enforcement were possible, no one would ever break the law against speeding. Have you broken the speeding law? Speeding laws will never be abandoned. Especially not on the ground—as the anti-BOM argument puts it—that we would be making honest men out of rules breakers, who should not be submitted to the degrading business of willfully being personally dishonest. Can you make an honest man, by waiving a rule?

If the BOM rule is to be abolished simply because it is not enforceable, why continue it for other modeling events, even for the young boys with their first airplanes? It is not enforceable there either. We cannot insure that some zealous dad won't push his boy too hard, or make more than his proper share of the model. Yet we have to keep the rule to protect somebody—in this case, the underprivileged kid without help or much money, or just the honest kid (God bless him!) who prides himself on making his own craft—even though he may see some less deserving lad go home with the glory and the trophy. Isn't it likely that radio flyers require protection?

What makes BOM workable, though not perfect, in other categories—especially with yet untainted juniors and seniors—is that they have proven more honest by far, as a group, than the 30-to-40 year old experts of Class III. Actually, we do not consider ourselves dishonest. Rather, we have generously condoned the first infractions as not being of consequence, and we have come by degrees to condone anything. We are older and should be good sports! For our attitude we are going to have to pay a price. That price may well be fewer, rather than more, contestants someday in Class III when, and if, BOM is removed.

Is it unreasonable to ask that grown men exhibit the fortitude to honestly maintain a code they (those who then competed) practiced as younger modelers? When we brag about the community virtues of modeling—such as anti-juvenile delinquency—and seek sites, public support and co-operation, should not we at least set an example for younger modelers who read everywhere in print that winning (for us) is all that matters, that rules are conveniences to be bent and broken whenever personal ethics become burdensome?

So men (the editorials tell us) don't fly their own models at the Nationals. Have we conceded that ethics and honesty are a thing of the past? Evidently, we do, because it is on precisely these grounds that we are asked to vote out BOM.

Yet, strangely enough, we already have a good BOM rule.

"This ruling does not prohibit the use of styrofoam wings or fiberglass fuselages," editorialized Dewey. "It does prohibit ready-to-fly models (of which there are none, at present, suitable for competition), or models built for the flier by another person, persons, or commercial concern. Sound unreasonable? Seemingly no."

Beginning with that "seemingly no" Don then makes the case against BOM on the basis of the rule being uninforceable, of people being made to seem dishonest. Eliminate the "seemingly" from the quote, and we concur with Don.

Perhaps the BOM rule will be killed, or modified. Perhaps not. None of us wishes conflict that will harm competition. It is not our intention here to defend or to attack BOM. But if we are urged to change a keystone rule, we do require a more comprehensive fill-in than what was given in one magazine's editorials, however well-done and deserving they may be.

In this editorial we seek no solutions. When an issue is drawn, protagonists see only in black and white, ignoring shadings. There are suggestions, actual and implied, at best of doubtful merit, at worst, a "cure" worse than the disease itself.

Bonus points are suggested for the guy who builds his own model. While this proposal concedes our existence, it is doubtful that any pro impatient with limitations, is going to be happy about yielding a handicap or penalty to his competition. Afraid of the other expert, he may have to build his own model so not to lose precious points.

The spectre of professional pilots has been raised. In responsible circles it already is being discussed that an airplane owner be permitted to hire a pilot—in scale of all things! It seems to us that scale would be a mockery if the entrant did not make his model. Is it better if he does make the model but then hires a national expert to fly it? Without BOM he would not have to make the model. He can order the model built, then hire the pilot. He can order the model designed, then order it built, then hire the pilot! He writes a check, and commissions a task force. Who wires him confirmation that he has "won" at "Indianapolis?" Fantastic? Perhaps. But where do we draw the line?

We join with Don in urging you to register your feelings, pro or con, with your Contest Board District member whose name and address you will find on the last page of each issue of *Model Aviation*—assuming you are an AMA member.

B & D Power Converter

(*Continued from page* 11)

porated on the circuit board which serves this purpose very well. If the converter is to be used in some other application, provision for this capacitor should be made by extending the printed circuit board. Note that the capacitor is shown on the schematic.

Since all the circuits are AC prior to rectification, polarity of the coils makes no difference, with the exception of the feedback winding. This must be in proper phase with the primary coil in order to oscillate. The easiest way to determine this is to hook the converter to power (after a final check for wiring errors). If it fails to oscillate, reversing the feedback windings should cure the problem, barring defective components.

The transmitter filament supply may be supplied by either one additional cell, or using a dropping resistor to drop 4.8 volts to 1.5 volts. The total power drain using a dropping resistor is a little over one ampere, giving better than three hours operation between charges for 4-ampere hour batteries.

CORRECTION: Min-X points out substitution last issue of picture of Pulsemite 800A x-mitter, Capri rcvr, Minicoder PL for 800S and Capri for Galloping Ghost. "S" systems are GG and RO; "A" systems, dual propo with Minicoder PL.

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The Babcock BC-22 Proportional System has been designed to give the single channel flier maximum performance and consistent reliability at a minimum cost. Designed and engineered with the sport flier in mind, the BC-22 is ideal for the small-field airplane in the .010 to 049 size range.

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