RADIO CONTROL
and Model Aircraft
WORLD

GRID LEAKS

VOL. 7
NO. 2

MARCH-APRIL 1966 35 CENTS

SKY SQUIRE—HOW TO

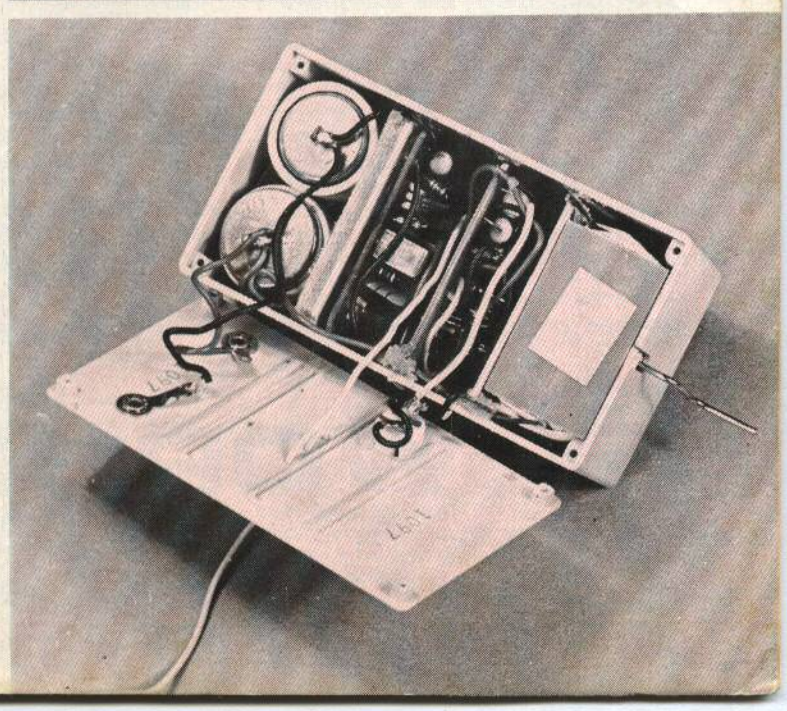
• Simple construction, good looks and ease of flying distinguish this fine aircraft designed by R. Jess Krieser. It can be flown on anything from one to ten channels or equivalent proportional control.

ADVENTURE YOUR DISH?

• Then Neil S. Deye's experiments in proportional control of an Army tank will intrigue you. The toy stores abound with vehicles you can convert. This one pulled a small boy in a wagon. Fine for a change of pace. See Notes on Tracked Vehicles, pg. 10.

HINTS AND KINKS

• Adjusting a reed bank for Margin of safety, by Bill Campbell, pg. 4, is must reading for all multi flyers. Elevators for single-channel? It is done with servos, on page 15. Bits and Pieces, pg. 14, and Designing for the Command Master, pg. 12, round out the many technical features.



8TH YEAR OF SERVICE

DIGITRIO

As most of you undoubtedly know by now, World Engines is kitting the DIGITRIO package. DIGITRIO is a three channel digital proportional system which was designed by Ed Thompson and is currently appearing as a series of construction articles in Radio Control Modeler magazine. Ed Thompson and RCM have given World Engines the exclusive right to kit the DIGITRIO system. Several of these systems have been completed and are being flown; some very enthusiastic reports are already coming in. Those interested in this control system may purchase components separately from the published parts lists, however, a little investigation will reveal that the prices of the parts' kits as packaged by World Engines cannot be beat and represent a substantial savings.

Transmitter Kit

The photo shows a completed DIGITRIO Transmitter with the Bonner Stick option. The Tx kit price of $69.95 includes all parts, crystal and hardware except the control stick assembly and the power pack. The aluminum case (7" wide x 5" high x 3" deep) comes with only the major holes punched. Holes in the printed circuit board have been drilled and the antenna bracket mounted. With each kit we include any pertinent information, minor improvements, circuit corrections, last minute component changes or notes from Ed Thompson. For example, in the Tx a better shielding setup was worked out and we are including notes on this. We'll try to keep you up to date!

Bonner Stick Kit

We are making the Bonner Stick assembly available in kit form less the pots (they are included in the Tx kit). We do not have assembly instructions for these as such however, we must say that they are not too difficult to assemble and quite a number of them have been sold for the DIGITRIO system. There will be an article in RCM later concerning this assembly. Price of the stick kit is $10.95.

Charger Kit

Bob McKnight here at World Engines has worked up a dual output battery charger just for the DIGITRIO system. It will charge the Tx and Rx simultaneously. The charging rate is in the safe area of 30-32 MA to allow longer battery life. The circuit is transformer based for shock protection. All components are mounted on a printed circuit board. Two indicator lights show when the unit is in operation. Price of the complete kit, punched case and all parts is $7.98.

Receiver — Decoder Kit

The DIGITRIO Receiver and Decoder kits contain all parts that are needed including etched and drilled printed circuit boards, all components, crystal, battery and servo connectors. Both the Rx and the Decoder fit into the punched aluminum case (1½" x 1⅝" x 2⁵⁄₁₆") that is provided. The DIGITRIO Receiver kit price is $29.95 and the Decoder kit is $27.95.

Servo Kit

The DIGITRIO Servo was designed around the Controlaire Servo mechanics: motor, case, gears and rack. The amplifier circuitry was developed by Ed Thompson. It uses a regulated voltage to eliminate neutral drift. No short cuts were taken and only top grade components used. The circuit has proven stable and trouble-free. As to the servo mechanics we can only say, "we use them ourselves." With the servo kit as the others everything is furnished. Price is $24.95 for a complete servo kit DTSC-1 (a total of three is needed for the system). For those interested in using parts bought separately we also sell a kit, DTSM-1, of the servo mechanics and miscellaneous items at a price of $13.95.

Complete parts lists with prices for each unit of the DIGITRIO System are available upon request and free of charge from World Engines, Inc.

WORLD ENGINES

INCORPORATED

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Photo by Fremont Davis

RADIO CONTROL and Model Aircraft WORLD

GRID LEAKS®

VOL. 7 NO. 2

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THE MONITOR

NOW THAT RADIO control has "arrived," a man would have to be oblivious to what goes on around him, not to wonder where the black boxes are taking us. If there was a time when radio had to be fought for, when its tiny minority of followers had no influence on modeling at large, the magazines or the trade, it now looms as a kind of benevolent Jolly Green Giant who must be careful not to step on the little characters who shout "ho, ho what now. . . ."

Periodically, modeling has gone through strenuous change brought about by such revolutionary developments as the gas engine and control-line flying. But the swing to radio is different, if only because of its side-effects. In depression times the $21.50 gas engine was a bigger financial hurdle than a multi outfit is in these days of the mink-covered toothbrush handle. It seemed only a powerplant improvement, with free-flight models just a glorified extension of the rubber jobs — which the public continued to accept. There was a war and five lost years. A post war technocracy far beyond anything we had before—smaller, better, and cheaper engines, until, free flight or ukie, the gas engine with all its ramifications was a completely practical, painless, replacement for rubber power, and a stimulant to the entire hobby.

Control-line was, perhaps, a less potent development than the gas engine (which made it possible), but the captive airplane did wrench the hobby into a new shape. Free flighters scorned the U-control model as a brick on a string. The CL people, much like today's RCers, were too numerous, too excited with new worlds to explore, to bother with minorities. Regardless of what kind of model you preferred for your gas engine, its cost was not too prohibitive, or especially discouraging, to masses of youngsters. There never was a Control-Line magazine or even a CL department in a magazine (if you don't count signed columns).

Radio, on the otherhand, justifies two

(Continued on next page)

THE COVER: In keeping with the broadening of the Grid Leaks title to include a more appropriate and descriptive RADIO CONTROL WORLD, this month's cover selection of multiple photographs reaffirms a policy of comprehensive reporting, not only of planes and radio, but of everything of importance to the remote control hobbyist.

The old deBolt biplane is flown impressively by the Czechoslovakian modeler Michalovic, MVVS .35, Orbit 10 (J. Broz)

MONITOR . . . continued

specialist magazines, and the greatest percentage by far of the contents of any magazine in the model field. We doubt that any general model magazine would suggest to an advertiser (radio) than less than half its readers were radio addicts and, in fact, we can safely assume such approximately to be the case. Since the whole must be equal to the sum of its parts—magazine audiences being roughly about as big as they were years ago—we must have converted at least 50% of the hard-core modelers from free flight and control-line to radio. So far the picture appears quite pleasant.

But questions naturally arise. If it is true that the average RCer is 30-odd years of age (in competition he pushes 40), and radio constitutes some 50% of our effort (we ignore ready to fly modeling here), what is happening to the young modeler? And what will happen to model aviation if radio continues to expand, say, to perhaps 75% of that effort? If the great majority of radio modelers had their beginning as kids with either free flight or control-line, and *if* prior modeling is an important factor in sustaining the radio hobby, what will happen when there are fewer than ever juniors coming up? If radio dominates publications and there is no one to explain the A,B,C's, of model airplane building, or even to inspire interest in it, rather than in slots, say, is it an oversimplification to wonder if radio will, in time, kill the model airplane hobby, as we ourselves enjoyed it in more youthful days?

Radio control is our business, avocation, and first love. Need we be concerned about its affects on the hobby in general? All of us, no doubt, should like to see American youth continue its interest in model aviation, to progress, perhaps, into radio itself. Surely such a progression would accomplish all goals and ideals, from a conscientious radio man's point of view. Unfortunately, if there is such a progression, it applies to the few, and not the many.

A glance at any publication confirms our overwhelming preoccupation with expensive multi. Obviously, we have a bitter economic weeding out even in our own circles. This, kind of radio, *might* be a dream of the young boy, but what connection exists between him and radio when he first must complete 16 or 20 years of school, establish a family, and a profession and have left sufficient dollars to finance his way in our kind of adult model airplaning? Especially, if there is no model aviation.

(*Continued on page* 25)

Readers Write

HIGHER STANDARDS?

Enclosed please find my check for $2.00, to continue my subscription to GRID LEAKS, I enjoy the magazine greatly and I know a bargain when I see one.

I would like to offer a suggestion for you to consider as a possible feature. I just went through the dilemma of trying to decide which proportional equipment to purchase. I spent more time making this decision then one might expect. I finally purchased what I thought would be the most reliable, made by a well known manufacturer who grew up in the business.

In general the equipment functions well, but there were many small things that went wrong, indicating a lack of stringent quality control and inspection. As a result, I spent close to $600.00 for the privilege of returning this equipment to the manufacturer. Quite a dishearting situation. I believe the radio equipment manufacturer should be constantly monitored both in the claims they make and the products they produce. Since RC equipment is becoming sophisticated, an evaluation based on past personal experiences does not fit today's equipment.

I would like to see GRID LEAKS start a products report feature, and also go into the field and honestly interview and report the experiences that other flyers have with the equipment. If our great hobby is to grow and flourish, equipment manufacturers must constantly be reminded of the psychological importance for out-of-a-box reliability. False claims, half truths, and the absence of information, can only leave the serious modeler with an up-in-the-air feeling. Then you can't help but wonder about the balance of the equipment in your hand that is suppose to be so wonderful!

E. L. GOULD, O.D., Kittenning, Pa.

• *A meaningful product report would render a vital service, and is something constantly under consideration. The obstacles are many. In general, the care-free producers of dubious equipment were weeded out years ago. The high cost of modern equipment has put the manufacturer on the spot to deliver reliability and GL is satisfied that, to the limit of its own experience, well known people like Orbit, Kraft — and many others — do their level best. Quality control associated with ever-increasing volume introduces constant new problems as, typical of the hobby industry, the founding talent of one or more people is gradually forced to delegate key responsibilities and to depend on hired workers.*

While costly to us, the equipment we use, and what we want from it, would perhaps involve ten times or more the expense if the space industry produced it, with expensive components and overwhelming inspection required to safe guard human life. On the whole, our industry does a surprisingly good job. But troubles will always be with us. When a relay did not work in single channel we got out and got under, so to speak, and cleaned the contacts. With present day exotic equipment we don't begin to comprehend the true nature of the stuff in the boxes. Like the foreign object in the Gemini 6 rocket motor, the tiniest and most simple thing spells trouble. As they say of a wife, it isn't the initial investment (though it breaks the bank!) but the upkeep.

Similarly, the level of effort required of anyone who aspires to a testing service, is extremely high, costly and demanding of talent that no writer or editor known to this publication, suitably possesses. The responsibility attached to such a role is heavy. A mistake, a weighted report, a misunderstanding, can spell disaster for the manufacturer and, a sickening lawsuit for the publication. How many units should one test—$3000 worth perhaps? Do we buy them? Does the struggling model manufacturer donate them? What of the testing equipment? Required is a Bureau of Standards approach and a skilled, expensive, professional staff of laboratory personnel. So, while such a service may be needed, it probably could not be accomplished except by a hands-off independent testing group financed by industry itself (which poses still other questions). Lab tests must be followed by extensive field testing, of multiple units for hundreds of flights each. Any equipment we are able to create probably will show spot failures under those circumstances. Which is where we came in . . .

COMMENT FROM ISRAEL

Enclosed is my renewal check for GRID LEAKS. I am one of the readers you got from the now extinct *Model Aircraft World* and, although I must say I was pretty indignant about the switch at first—I took MAW mainly for the full-size plans, which you don't feature—I found out soon enough that your magazine is far better than MAW ever was. Still, there are two points I would like to make:

A.) Your magazine is rather small physically, so please don't waste its precious pages with lengthy articles that could be expressed just as well by a couple of drawings or pictures. The camera-carrying model article is a good example of the point.

B.) Why don't you carry out detailed tests, and publish reports on new equipment? This might not be such a problem for an American modeler, but when someone over here has to choose his equipment solely by the maker's ads, this is the thing he prays for. The British *Radio Control Models and Electronics* tests are excellent, and I wish you had something like them.

Even so, the result of your effort is pretty good. Keep it up!

CHAIM SHNEURSON, Tel-Aviv, Israel

UNDER-WATER CONTROL

In answer to your query about the antenna — that question bothered me quite awhile during the development stage of the sub. (January-February 1966.)

I originally designed and completed an automatic depth control built from an aircraft airspeed indicator. It was sensitive to within ½ inch of water pressure. Being overenthusiastic, I started running the sub before the depth control was installed. By accident I discovered that the sub would operate under water! (I only tried to go under when I could see it up close.) Further experimentation proved I could control the sub as far out as I dare try. To date this has been several hundred feet at 4 to 4¼ feet down.

I spent an hour one day talking over this problem with Walt Good. He has studied wave penetration of water but not of the frequency I use at 27.145 mc. No one else in the DC/RC club knew anything about it so it wasn't until I talked to several specialists at GE where I now work that I

(*Continued on page* 30)

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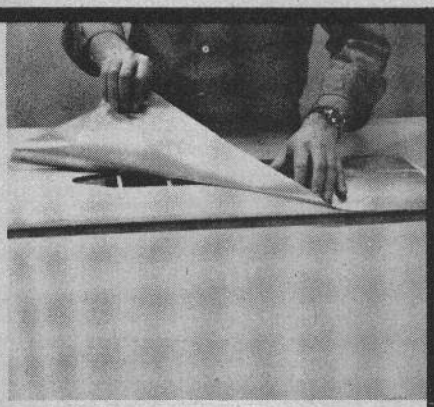

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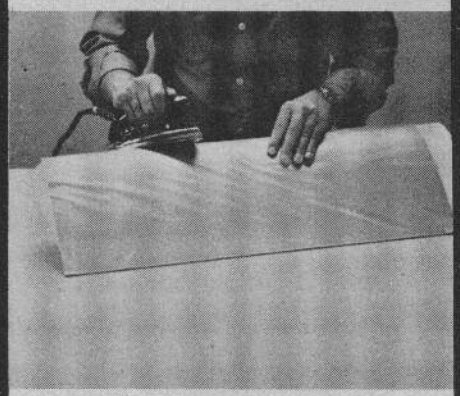

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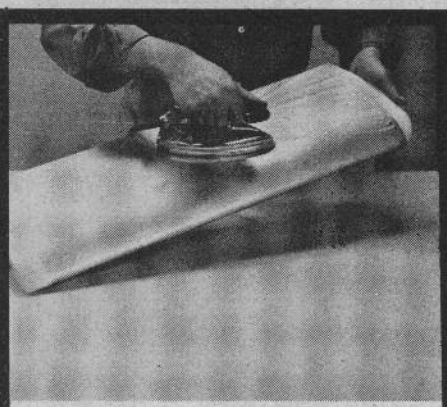

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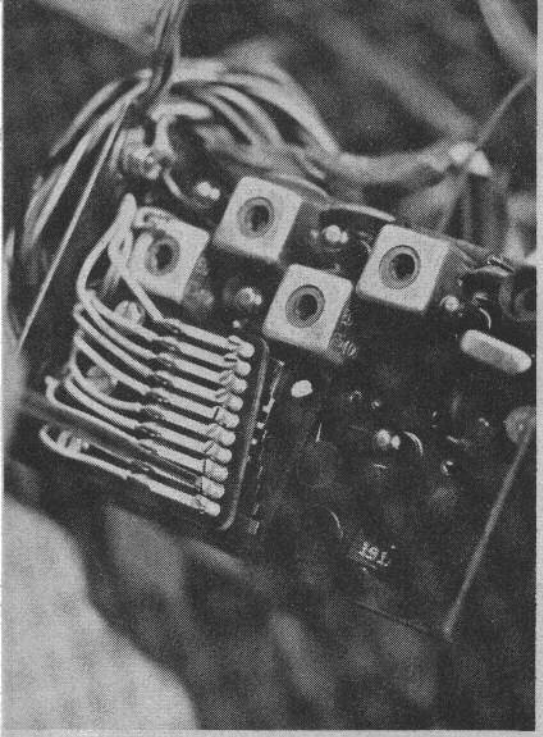


How to Adjust Resonant Reed-Bank Control Systems for Margin of Safety

By BILL CAMPBELL

It is not enough that reeds "work" when this easily applied procedure assures you a maximum reliability.

Fig. 3. Making contact screw adjustment. Poor adjustment can mean a control loss.

THE PURPOSE OF THIS article is to detail the two most important adjustments which are necessary to keep a resonant-reed control system operating with a margin of safety. These adjustments are: 1) Transmitter audio tones 2) Reed-bank contact screws.

A sudden loss of control can result if either of these adjustments is made too close to critical tuning points. Manufacturers normally make these adjustments before shipping the equipment. It is the responsibility of the flyer to maintain these adjustments because they are affected to some small degree by voltage, temperature, humidity, aging of components and hard landings.

We first will discuss the graphs which show the effects of reed-bank-contact-screw and transmitter-audio-tone adjustments on servo operation. The graph presentation will be followed by detailed adjustment procedures.

Discussion of Graphs: Figs. 1 and 2 present the same type of information. Fig. 1 is for the right-rudder servo response and Fig. 2 is for the up-elevator servo response. The two show that slight differences exist between reeds. However, the difference is small and proper adjustments can be made for all reeds by following the procedures outlined later.

The four long bars at the top halves of Fig. 1 and 2 show servo response for four different methods of making audio-tone pot adjustments. The upper two bars on each figure show servo response while holding a *single* control command and rotating the audio tone pot from one side to the other, as indicated by the arrows at upper right, across the servo response band. The upper "single" bars show the servo response band while tuning toward higher frequencies and the lower "single" bars show the servo response band while tuning toward lower frequencies. The lower two bars on each figure show servo response while holding *simultaneous* control commands and rotating the audio tone pot from one side to the other across the servo response band. The upper "simul" bars show the servo response band while tuning toward higher frequencies and the lower "simul" bars show the servo response band while tuning toward lower frequencies.

Notice that the narrowest servo response band is obtained while holding a simultaneous control command and rotating the audio tone pot toward lower frequencies. This is very important to remember since final tuning should always be done in this manner. It should be explained here that the information presented in Fig. 1 and 2 was recorded while holding the commands continuously (not pulsing). Pulsing of the commands will result in the response bands for Up frequency tuning to look more nearly like the response bands for Down frequency tuning. Pulsing while tuning is not recommended since it is too easy to miss the point where the servo first responds. Requirements for adjusting the reed-bank contact screws are not too well publicised.

A look at the lower half of Fig. 1 and 2 shows that a rather critical situation can exist at a contact screw unless a margin of safety has been adjusted in. Resonant-reed contact screws advance about .012 inch for each turn of the contact screw. Best operation of the reed depends on the contact screw being adjusted within a range of ½ turn (.006) inch. It is all too easy for a contact screw to be sitting within .001 of an inch or less from the point where it will not operate at all. Any way you look at it, that is too close for an adjustment screw that is cantilevered an inch out over the reed bank pole piece. The only warning that the contact screw is adjusted too close to the critical "O Turn" point is that the servo response bandwidth is very narrow while tuning the transmitter audio tone pots and this is too easily overlooked.

The curves shown at the bottom halves of Fig. 1 and 2 were plotted by backing the contact screw out (away from the reed) 1/8 turn at a time until the servo no longer responded when the audio-tone pot was tuned toward decreasing frequencies while a control command was held. The contact screw was then advanced 1/8 turn at a time toward the reed between down-frequency sweeps of the transmitter

Fig. 5. Trouble shooting chart for transmitter audio-tone pot and resonant reed-bank contact-screw adjustment. Poor adjustment also can cause a loss of range.

CAUSE	SYMPTOM
1. SERVO CHATTERS	CONTACT SCREW TOO FAR AWAY FROM REED
2. VERY SHARP TUNING AT TRANSMITTER TONE POT	TONE POT OUT OF ADJUSTMENT CONTACT SCREW TOO FAR AWAY FROM REED
3. INTERACTION BETWEEN SERVOS	CONTACT SCREW TOO CLOSE TO REED TONE POT OUT OF ADJUSTMENT
4. TWO REEDS RESPOND AT ONCE	CONTACT SCREW TOO CLOSE TO REED TONE POT OUT OF ADJUSTMENT

tone pot until the servo responded at the "O Turn" point. The contact screw was then advanced in ¼-turn increments while recording the upper and lower servo response frequencies.

Notice that the servo response bandwidth widens as the contact screw is moved toward the reed. The "Open Circle" curve shows the servo response for a single control command and the "Solid Black Dot" curve shows the servo response for simultaneous control commands. The large black "Tune Here" dot at the intersection of the vertical and horizontal lines shows the ideal location for tuning the transmitter audio tone pots and the resonant-reed contact screws for margin-of-safety operation.

Notice that the servo response bandwidth is very narrow at the "O Turn" point and, if the contact screw is adjusted too close to this point, only a slight drift of transmitter audio-tone or reed-contact-screw board could be disastrous.

Adjustment of Reed-Bank Contact Screws: The basic requirement for contact-screw adjustment is to be sure the screw is adjusted to a point between ½ and 1 turn from the point where it will not operate at all, ie: the "O Turn" point on Fig. 1 and 2. The lower half of Fig. 1 and 2 show that it makes little difference in finding the "O Turn" (initial contact) point whether using a single or a simultaneous command, so we will use a single command. We have found that the best indicator of proper reed operation is simply to connect a neutralizing servo to the out-put of the reed being tuned, and watch the servo for operation. Contact screws can be adjusted in any sequence.

The following procedure assumes the most likely situation, that is, the control system has been operating and the flyer wants to adjust for margin-of-safety operation.

1. Remove the transmitter antenna.
2. Connect a neutralizing servo to the output of the reed contact screw to be tuned.
3. Turn on all power.
4. Find the "O Turn" point by the following procedure:

4.1) Sweep the transmitter audio-tone pot toward decreasing frequencies across the servo response band.

4.2) Back the contact screw away from the reed 1/8 turn at a time. Be sure to remove the screwdriver from the contact screw while sweeping the audio pot to prevent deflecting the contact screw board.

4.3) Repeat 4.1 and 4.2 alternately until the servo no longer responds when sweeping toward lower frequencies. You have now backed the contact screw out past the "O Turn" point.

4.4) Now turn the contact screw in 1/16 turn at a time until the servo first responds while sweeping toward lower frequencies. The servo just will chatter at first but then a slight turn of the contact screw will make it pull in solid. This is the "O Turn" point.

5. Now turn the contact screw in towards the reed exactly ¾ turn.

This gives a margin of safety since it can be seen from the graph that this setting will put the contact screw at least half a turn (.006) from the plotted curves which are the border between operation and no operation. The ½ turn is a good compromise between being too close to the plotted curve where a slight drift of transmitter tone or slight shift in the reed bank will lose servo response, and being too close to the reed which can result in unwanted reed operation and increased sensitivity to vibration.

It is recommended that the reed-bank

(*Continued on page 27*)

TEST EQUIPMENT USED

The test equipment used was an F&M Matador-Midas-MEDCO-Bonner-Transmite combination which has logged over 250 no-crash flights. A Knight oscilloscope, Heath audio oscillator and a Heath Citizen's Band receiver were used to obtain Lissajous patterns to determine transmitter audio frequencies.

While our test and experience has been with the above type of equipment the tuning procedures apply directly to all audio-type transmitters and to all MEDCO-type reed banks. Reed banks of different styles and makes will no doubt act similarly to the MEDCO described, but it would be wise to check for proper reed operations with the contact screw turned in ½ turn further than described to make sure you are not too close to marginal operation at the setting selected. If no problems arise, return the contact screw to the ¾ turn position described above. If difficulties arise, set the contact screw halfway between the O-Turn point and the point where improper operation begins.

This will provide a "margin-of-safety" adjustment.

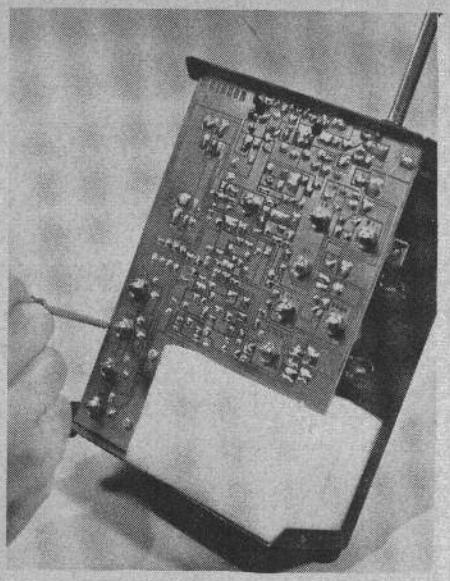


Fig. 4. Making a transmitter audio-tone adjustment. Hollowed-out foam block makes a convenient holder for nickel-cadmium pack. It is a good idea to label clearly identification of each pot for its control. It is easy to turn a wrong pot.

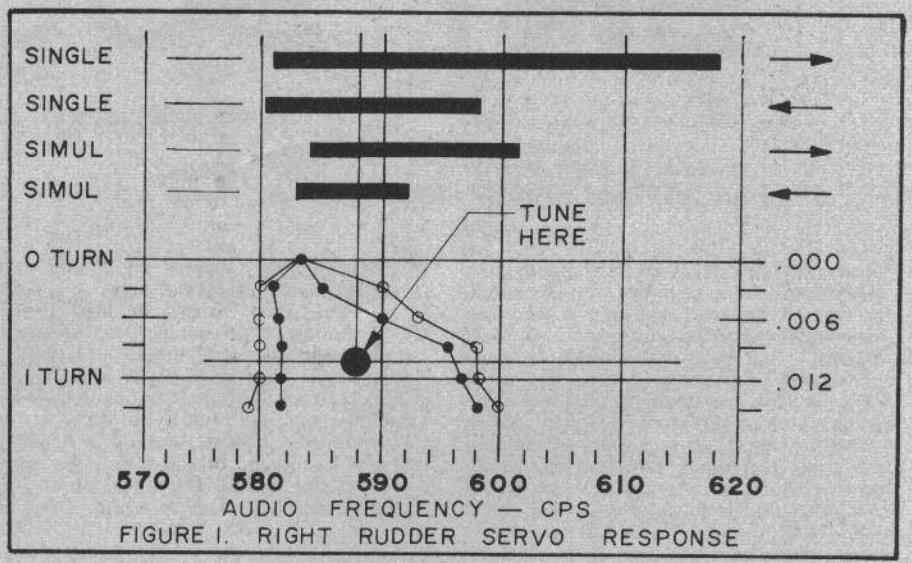


FIGURE I. RIGHT RUDDER SERVO RESPONSE

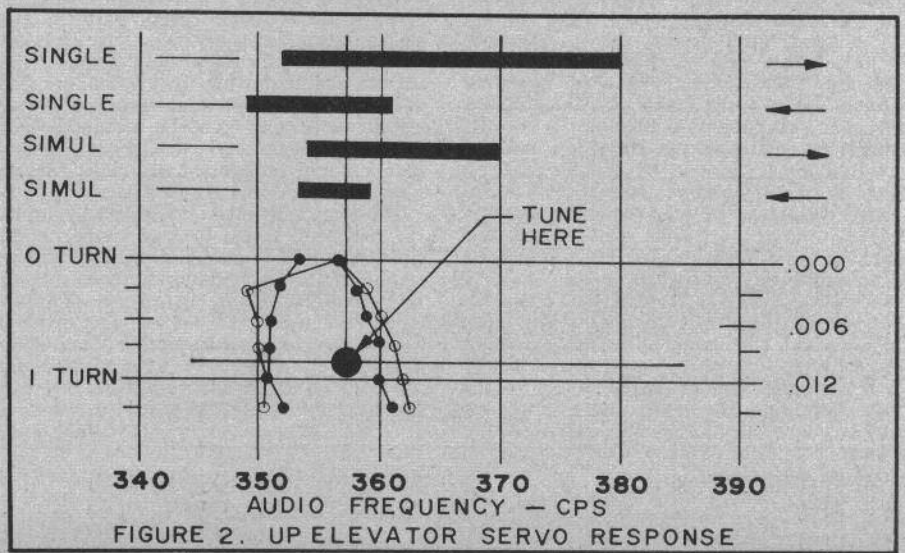


FIGURE 2. UP ELEVATOR SERVO RESPONSE

Cessna Skylane motif is particularly noticeable in this photo of ship with author's son Curtiss. Version shown is REM control.

SKY SQUIRE

By R. JESS KRIESER

This magnificent multi-trainer takes anything up to 10 channels and .19's to .46's.

YOU MIGHT SAY that the Sky Squire was designed by a beginner, for beginners, for when I designed it, I was a rank beginner at flying multi, and quite frustrated, to boot. I had been flying single channel, rudder only, for several years. But when I started to learn to fly multi, I found a different set of circumstances with which to deal. After flying a number of designs, and going through a number of crashes, some of which were totally unrepairable, I concluded that if I was ever to become a skilled multi pilot, I just had to have a more stable, tame airplane to fly. And so, filled to overflowing with frustration, I sat down at my drawing board.

A good multi design, for training and sport flying, had to have three fundamental characteristics blended together. First, it had to be stable. If you got into trouble, you ought to be able to throttle back the engine, and let the ship's inherent stability take it out of trouble, like a stable free-flight ship. Second, it had to have good performance—inherent stability as a trainer, but when you poured the coal to it, it should take on competition capabilities. Third, it had to be simple to build, and simple to repair. There's nothing as discouraging to a beginner multi pilot than a ship that takes an eternity to build and forever to repair. To all of this I added a fourth feature—good looks. I felt that any ship combining these three features could also be given good lines that make it realistic looking—in flight, and at rest on the ground.

Putting these requirements together, I came up with a few fundamental specifications. Wing area should be around 600 square inches, to enable it to take the larger engines. Fuselage should be a box, which could be built fast by just putting sheet sides together with a couple of formers, and adding top and bottom sheeting. Tricycle gear was a must, as was a high wing, cabin configuration to give the necessary inherent stability. Stab would be stuck on the bottom of the fuselage, in the interest of fast assembly and simplicity. Both wing and stab would be of constant chord, again for simplicity and speed of construction.

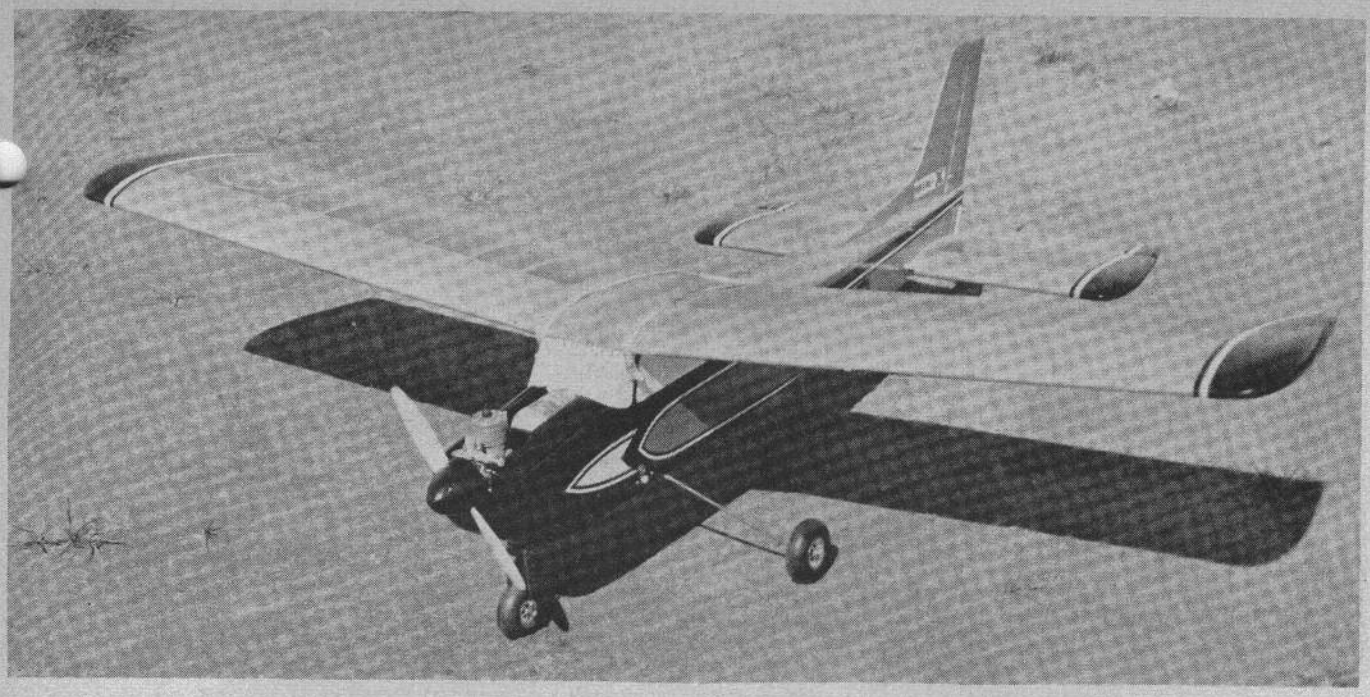
I prefer to stay away from use of downthrust if I can, so I set the thrust line at zero, wing at four degrees positive, and stab at 3¾ degrees positive. This gives the effect of downthrust without actually tilting the engine downward in its mount. My keeping the thrust line at zero, side thrust effects necessary can be attained with smaller settings. And, side thrust requirements would probably vary, depending on how much power was to be used.

Working with all of these specifications, my new ship began to take shape on my drawing board. I gave the fuselage simple, straight lines to facilitate fast construction, and simplify alignment of the fuselage when assembling it flat on the building board. I contoured the nose and windshield area, the cabin area behind the wing, and the fin and rudder to resemble the Cessna Skylane, since it is a beautiful, rakish looking airplane, suggesting at all times that it's poised ready to spring into instant flight. At this point, I had no name for the ship; that came later, almost by accident.

I originally planned to fly the ship on 6 channels, with a Veco .19 for power. I got carried away when installing the servos, and wound up with trim on the elevator, adding a bit of extra flying weight. I must have gotten carried away, too, on the tail moment arm, for when the ship was finished, with the Veco .19 in the nose, the tail sat firmly on the ground, with the nose wheel in the air. Oh, well, a little lead in the nose will fix that, I thought. But then when I started ballasting it, I found I would need over four ounces of lead, and where to put it? As I was contemplating pouring it into the back of the crankcase, I suddenly remembered something. I dove into one of the drawers in my workbench, pulled out a box with a brand-new Supertigre .40 in it, and stuck it on my scale. Eureka! It weighed enough that I could forget the lead!

So there I was, ready to fly my tame, stable new trainer, for beginners, with not much over 580 square inches of wing area, a wing loading of 22 ounces, and a .40 bomb in the nose for power. I got chicken! After getting the engine to idle right, I turned the transmitter over to an expert for the test flying, putting it into the hands of Bob Baldwin.

Bob took the ship off in a fast climb in a run of just a few feet, found the trim he wanted, checked rudder and elevator response, and decided we needed a little right thrust, a little more rudder and elevator throw. After making these adjustments, up it went again, and on the second flight, Bob rolled it over and was flying it all over the place, inverted, and with it's flat-bottom wing yet! Two more flights and Bob had pretty much wrung the ship out, doing



Tricycle landing gear features true multi-steerable nose strut. The wing is flat bottomed but the aerobatic ability is excellent.

everything in the book with it, and a few other things besides.

Next flight, Bob handed me the transmitter after throttling back the engine to about two-thirds power, and said: "Here, fly your own darn airplane!" Gingerly, I took the transmitter, not knowing what to mind, but Bob put me at ease with another remark: "Anybody can fly that thing. It's a real good old man's airplane." This was about the highest compliment he could pay, for that was just the kind of ship I needed, to get away from a case of the shakes every time I took a transmitter in my hands.

Two weeks and 30 flights later, I had flown the ship through a tree on takeoff, hit a telephone pole, landed in telephone wires, stalled and dove it into the ground on its nose three times, and landed it in a cornfield four times. All of this with only one small rip in the wing covering, and a few nicks in the nose. I was now a multi pilot! A 150 flights later I turned it over to my 13-year-old son to learn to fly on, and went to the Mark II version, which is pictured here.

The initial test flying took place late in the fall of 1964, but before good flying weather ended, I had become somewhat skilled at managing to fly multi on my own without getting into trouble. Bob became enthused about the ship as a good trainer and sport airplane, and Frank Garcher was looking for something new to kit for his Midwest Products Co. He looked over the ship and liked what he saw. And herein lies the story of how it got is name. It was originally patterned somewhat after the Cessna Skylane, and it would follow in the Midwest line on the heels of two very famous and classic R/C designs—the Esquire and Tri-Squire. So we took the "Sky" from Skylane, added the "Squire" from the other two, and there we were: The "Sky Squire." It was a name that came easily to mind and fit well into the Midwest lineage.

In the fall of '64, before good flying weather ended, Frank Garcher came out to the club flying field to see the Sky Squire perform, to fly it himself, and to evaluate it as a kit possibility.

I set the elevator with just enough up trim so that I could make smooth turns on rudder only, and brought the ship down from high altitude, flew it around the field in a pattern approach, chopped the throttle on the downwind leg, brought it around in two gentle turns and lined it up on its final approach, all by using only the rudder. I then yelled to Big Frank: "Look! No hands!", and held the transmitter outstretched in my left hand, and let the ship come in and land itself. It touched down on the gear, bounced once about six inches, settled down again to roll to a stop, prop still ticking over.

I did the same thing again, but this time, when the ship was lined up on its final approach. I turned off the transmitter, set it down on the ground, and folded my arms, while watching the ship land itself. It behaved just like before. That did it.

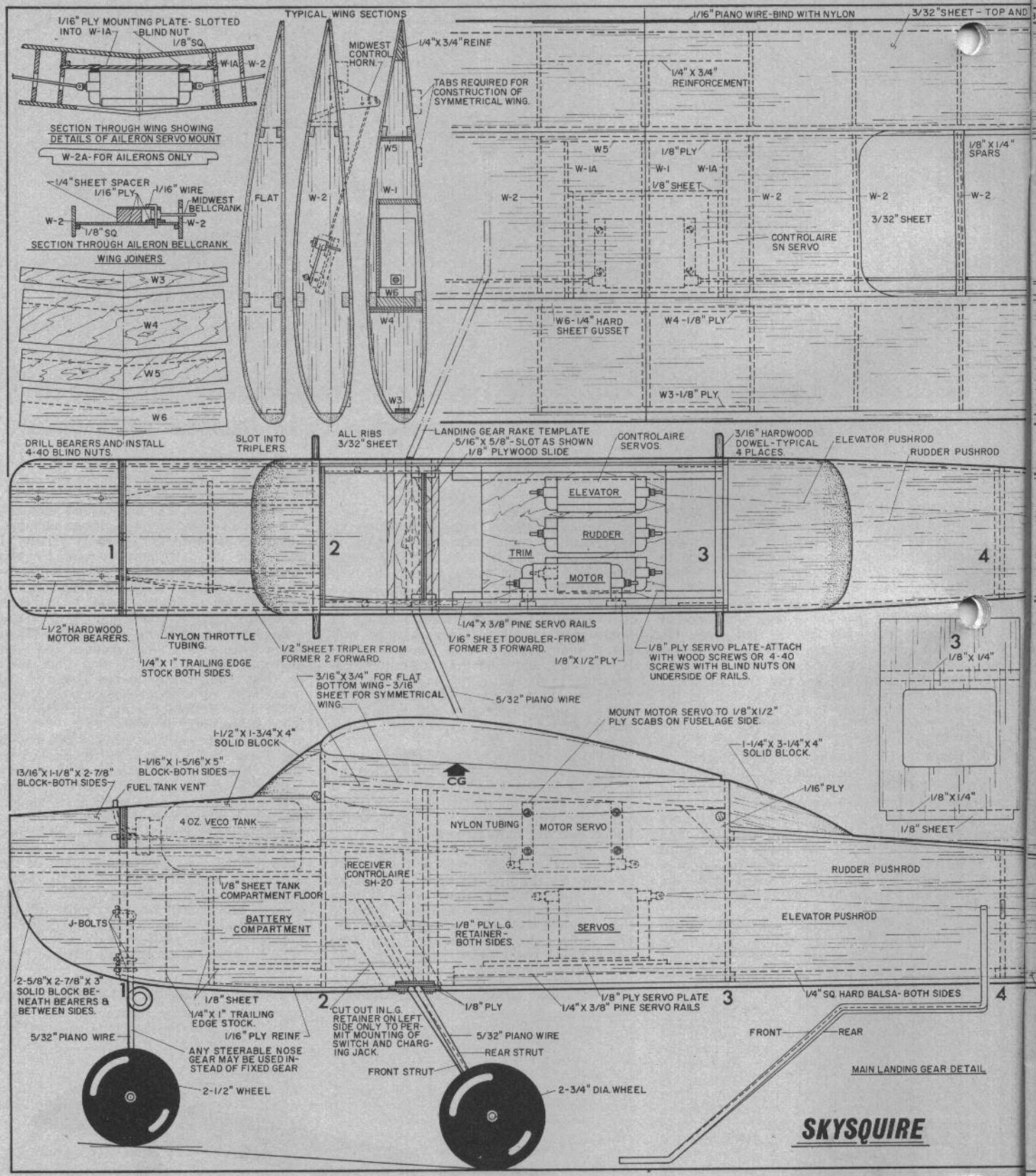
I got inquiries for the plans from around the Chicago area, and from out of state. By the time flying weather broke in the spring of '65, there were at least seven Sky Squires that I knew of, flying in three states, with good reports from all. One builder put a semi-symmetrical wing on it, made from foam, as he was short of building time. He also added ailerons.

I decided to make a few design changes, and emerged with the Mark II version. I shortened the tail moment arm by two inches, so that I wouldn't have CG problems with lighter weight engines. I also slimmed the fuselage about a half-inch through the cabin height, mainly to permit standard sizes of sheet balsa, and worked out a wing with a 2415 section, and with ailerons. Thus, we had a ship that could go from rudder-only to ten channels, be flown with or without ailerons, and with either a flat-bottomed wing, or a semi-symmetrical section.

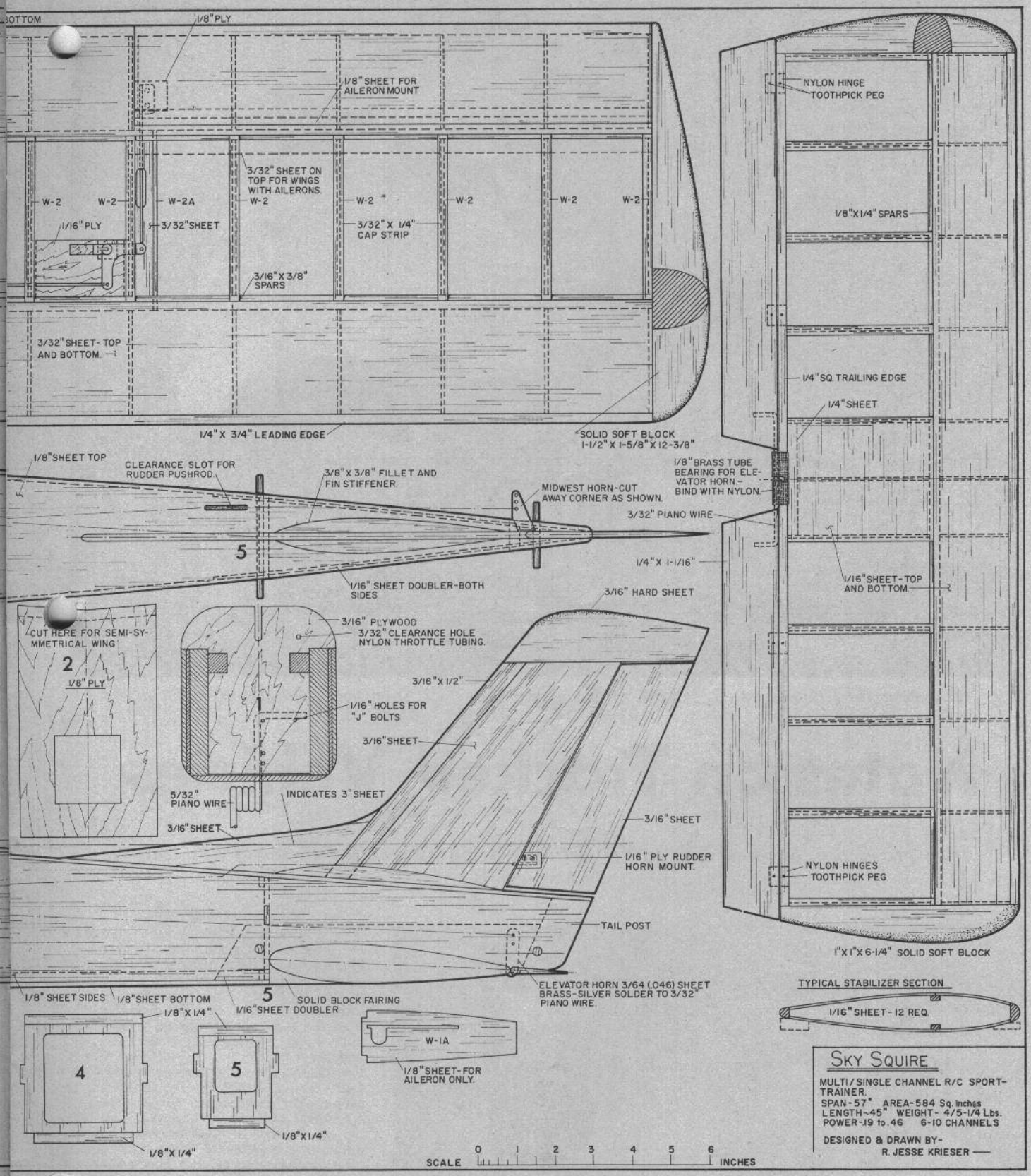
My second ship was initially flown with the Veco .19 in it, mainly to see how it would handle on .19 power. It flew very well, differing little from the larger engine, except the takeoff rolls were a bit longer, and you couldn't pull the nose up quite as steeply after takeoff. After about 20 flights, I changed to an O.S. S-35 R/C, which gave it almost the power and speed of the Supertigre .40. The third ship off the building boards carries ailerons, and a .46 for power. The fourth one is almost off the boards, and will be identical to the third. I may even use a .46.

(*Continued on page* 26)

Parallel-edged surfaces, boxy fuselage and wing section all make for building simplicity.



SKY SQUIRE PLANS



SKY SQUIRE

MULTI / SINGLE CHANNEL R/C SPORT-TRAINER.
SPAN - 57" AREA - 584 Sq. Inches
LENGTH - 45" WEIGHT - 4/5-1/4 Lbs.
POWER - .19 to .46 6-10 CHANNELS

DESIGNED & DRAWN BY-
R. JESSE KRIESER

FULL SIZE PLANS AVAILABLE—SEE PAGE 31

Neil contemplates perfected tank. It is capable of pushing boy in small cart or bowling over small kids—watch it!

Notes on Tracked Vehicles

Attempts at proportional differential between drive motors led to novel application.

Key to successful steering proved electric braking of a motor to be shut off. When tank does heavy duty, motor burn-outs sometimes occur due to inadequate brushes.

THIS TANK HAS BEEN a very interesting project. I learned a lot from it. My first circuit involved using DT 100 power transistors to power the drive motors in proportion to the pulse symmetry. After a satisfactory bench test of the circuit, I tried the tank on the basement floor.

It travels much faster than I expected and, when I gave it a full left turn, it continued straight and knocked down my four-year-old daughter. By the following evening her mother had forgiven me and I resumed work on the tank. I tried a number of methods all involving proportional differential between the two drive motors, all with the same results. The tank would turn from a standing start, but not at top speed.

I took the tank into my yard where the drag on the treads was greater and at last I could steer it. But the steering was not proportional to my control. With full right or left, the rate of turn was dependent upon the speed of the tank and the drag

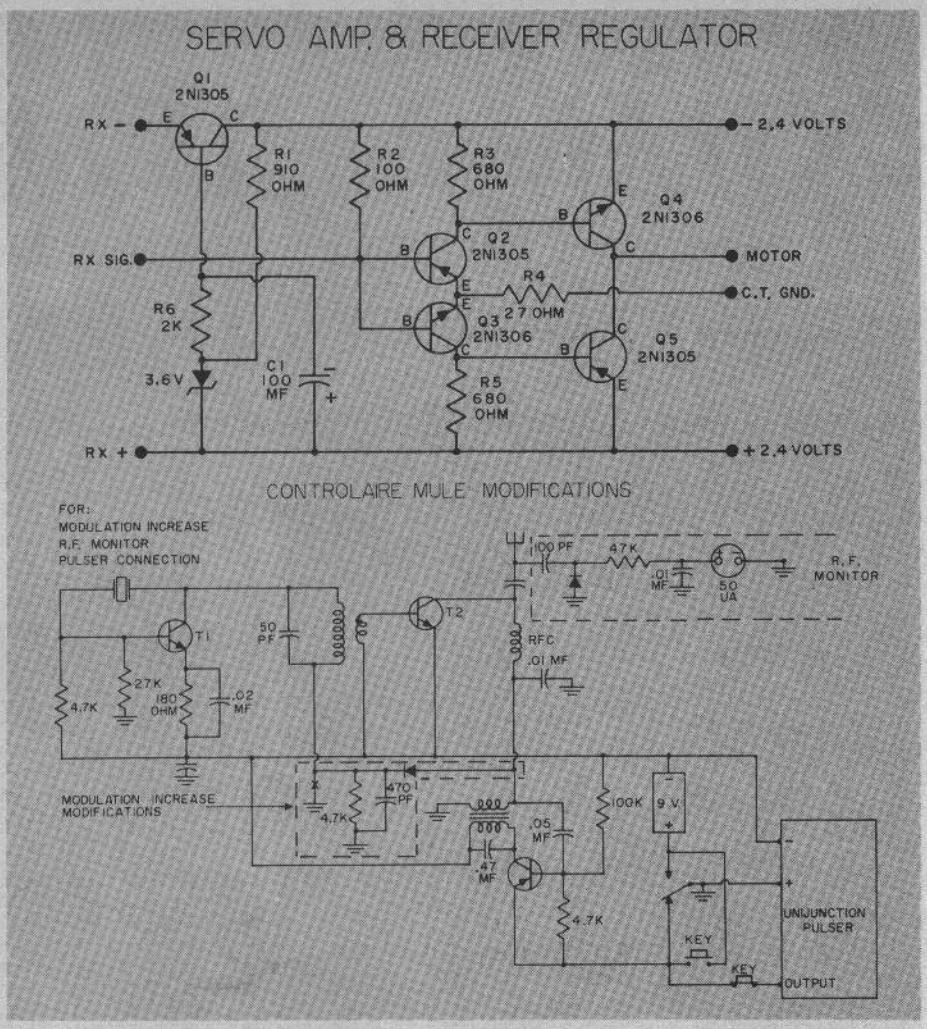
By NEIL S. DEYE

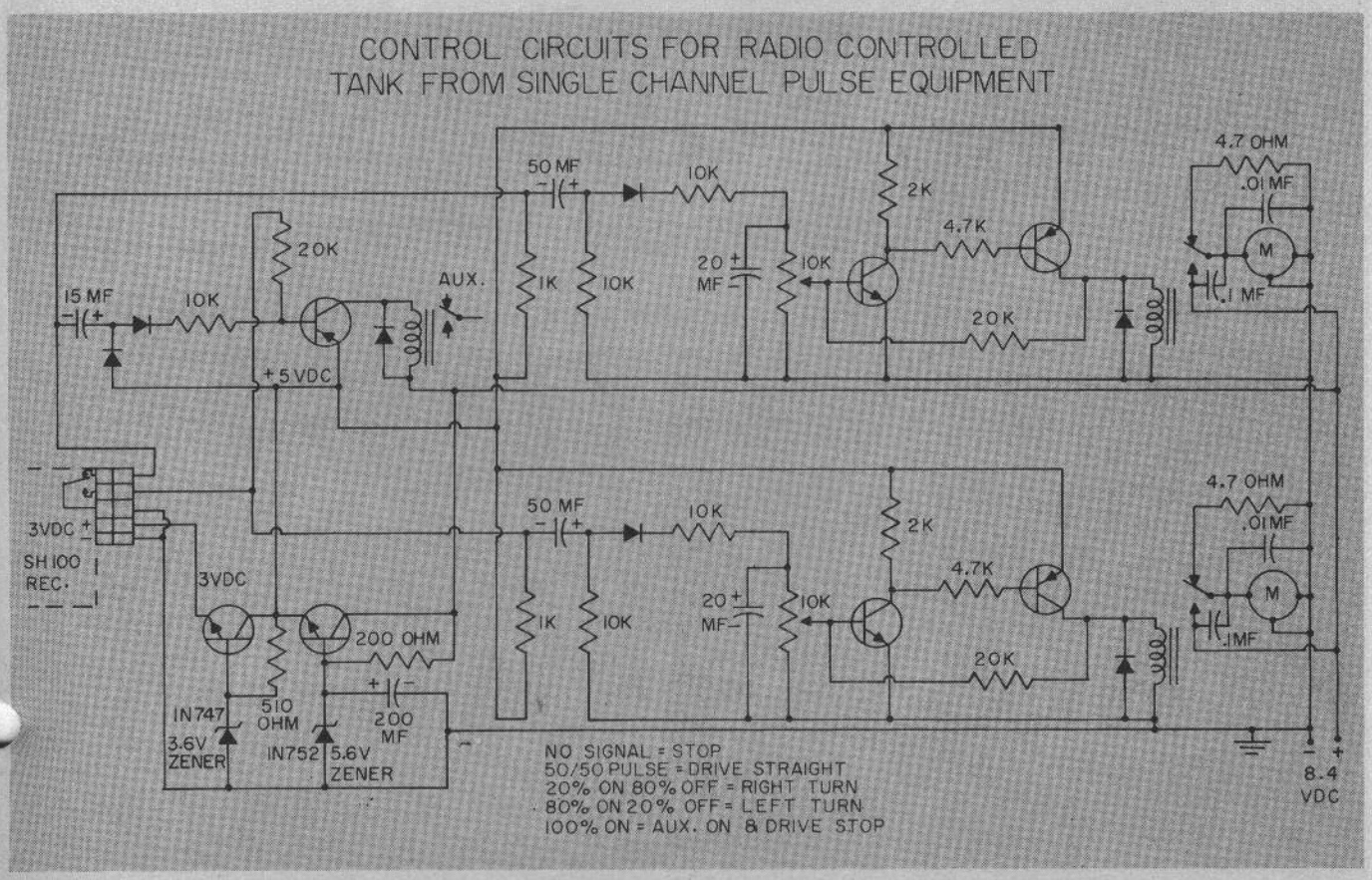
against the treads. The motor armature acted like a flywheel and, as a result, the tank would start into the turn very slowly. I also discovered that on a smooth surface with full power on one drive motor, and power reduced on the other to a point where it just overcomes the frictional losses in the gear train and track, the tank will continue in a straight line. Thus, I concluded that a tank cannot be steered proportionally by varying the power differential between the two motors. Because of the flywheel effect of the motor armature, not even turning one motor off and the other on full, is satisfactory.

Now with a little experience, I started to design a new system. First, to steer a tank requires stopping one tread, so I decided to use electrodynamic braking on the drive motor. This amounts to connecting a heavy load (short circuit) across the motor terminals to absorb the flywheel energy when the motor is coasting, acting like a generator. Since this has now become a bang-bang system, a relay was selected to connect the drive motor to power or to a braking load. For a braking load I chose a 4.7 ohm resistor to limit the current surge and protect the motor brushes.

Next came the mode of operation for the drive motors' relays. I decided it would be desirable to have both motors stopped with no signal and thus have a fail-safe feature as well as an off and on control. Next, I would want a change of pulse symmetry to drop one relay out and hold the other relay in. To this end, I decided to AC couple the pulsed waveform via a 50 uf capacitor to a detector and filter circuit which provided a DC level output proportional to the pulse

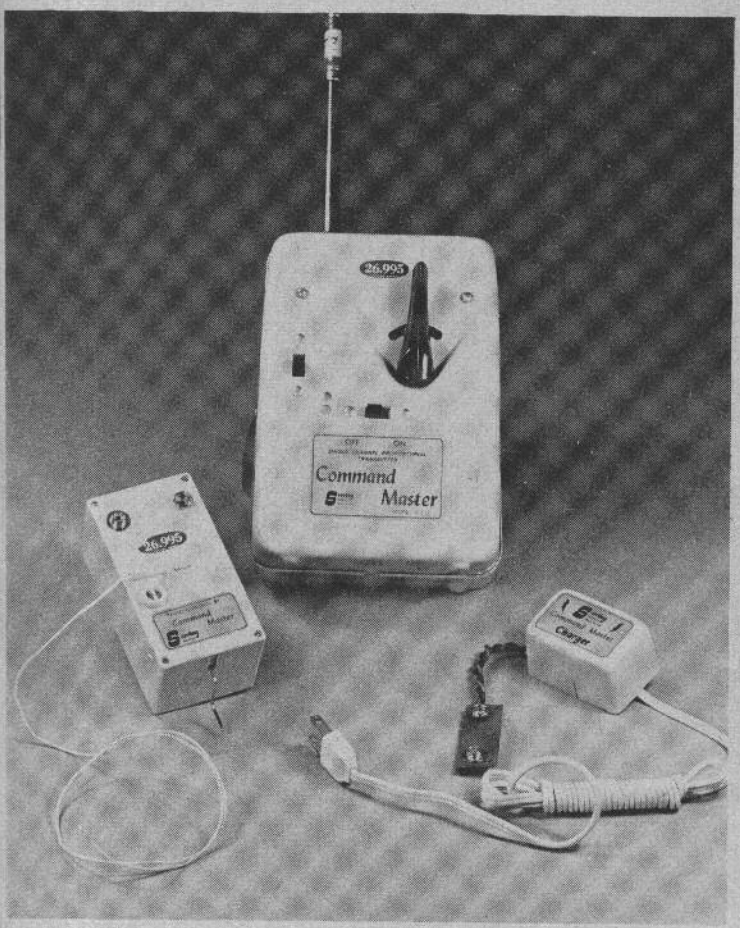
(*Continued on page* 27)





Designing for the
COMMAND MASTER

Many things have been changed by Sterling's concept of single-channel proportional.



This is the complete CM system. The nickel-cad batteries, magnetic actuator and receiver combined into single unit.

THE SYSTEMIZED CONCEPT of Sterling's Command Master equipment, the physical attributes of the airborne installation—and of the advertising and promotion which undoubtedly will expose new customers to the hobby, and old ones in a "step up" to pulse—makes any review of more than passing interest. CM is different..

It brings to single channel, the beginner and the less-well-heeled (for-full-house, that is), the "system" approach associated with exotic proportional outfits. So the receiver, magnetic actuator, circuitry for motor control, power supply, all wiring and switch are incorporated into single, compact, ready-to-fly unit. Measuring 1¾ x 2 x 4, it is housed in a Lexan plastic case, or box, the lid attaching with four corner screws.

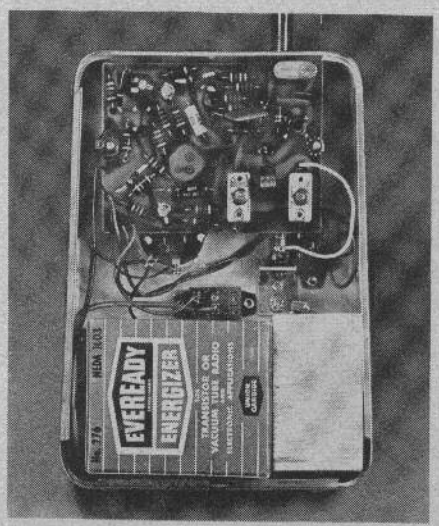
All that appears externally are the two terminals for the snap-on battery charger terminal strap, and the socket for two leads from the motor control escapement—and the crank. The switch handle projects through the bottom of the case. No wiring or soldering—except of torque-rod eyelet—is required. **Transmitter:** Measuring 5 x 7 x 2½, it is an all-transistor, single-tone (3600 CPS), AM-modulated, relayless pulse transmitter, using unijunction and silicon transistors throughout. A 9-volt dry battery is required. Pulse width is four pulses per second for rudder, pulse rate 12 per second for motor control. The 54-in. antenna is collapsible, center loaded. Out-put is 225 milliwatts.

Aircraft control is by means of the upright stick (pivots at bottom), right center of case, which may be moved in any degree to right or left, from a minute to maximum deflection. The newcomer may need to know that no sequence of control commands are required as with an escapement or many single-channel servos. Pulse proportional systems are generally regarded as easier and more precise to fly with superior realism in the air, although they tend to cost more than the "bang-bang" systems. That the rudder wiggles back and forth constantly sometimes surprises the newcomer. Movement of the control stick, of course, causes the rudder to average more time on the right or left side of neutral depending, thus resulting in a corresponding degree of turn and bank of the aircraft. The wiggles are effectively ignored by the plane, which does not betray individual pulses.

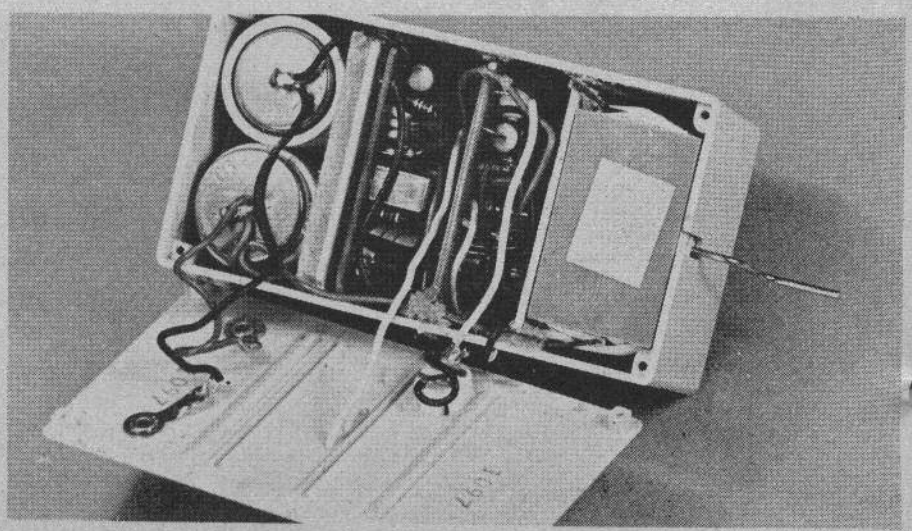
The control (switch handle) at the left of the case changes the pulse rate from 4 to 12, when pushed forward, this triggering the motor control escapement in the aircraft to move the throttle from high to low position. The pulse rate immediately goes back to four CPS, after which another motor command will again trigger the escapement—this time back to high motor position.

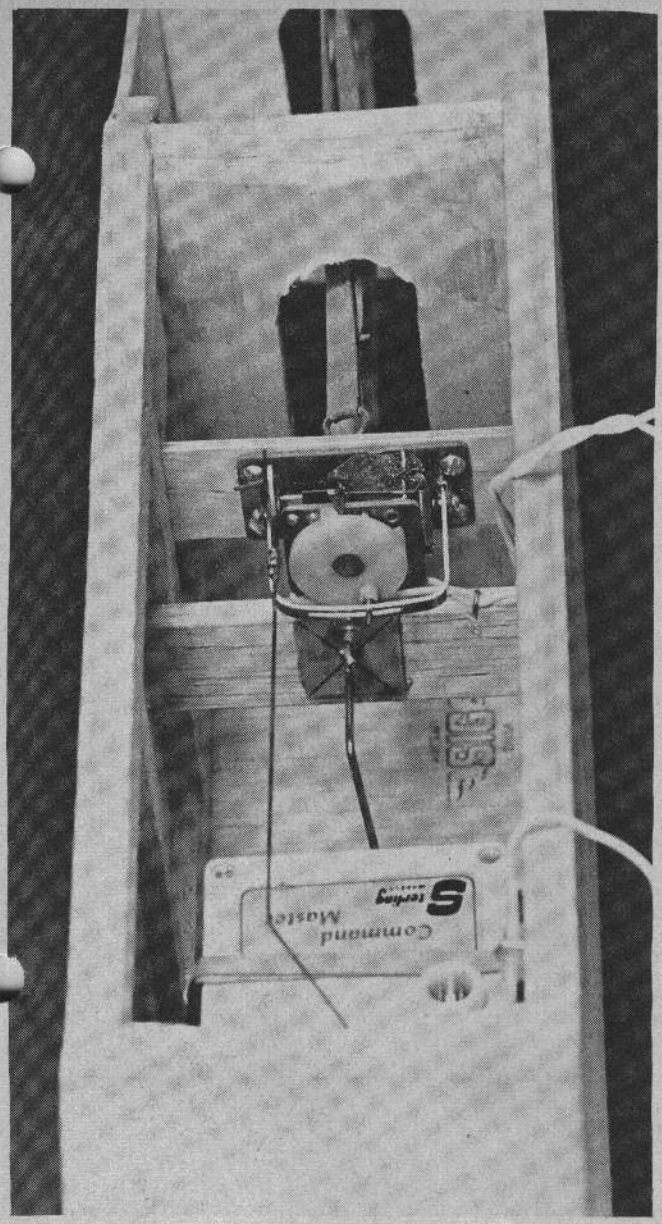
(*Continued on page* 24)

Transmitter requires 9-V battery.

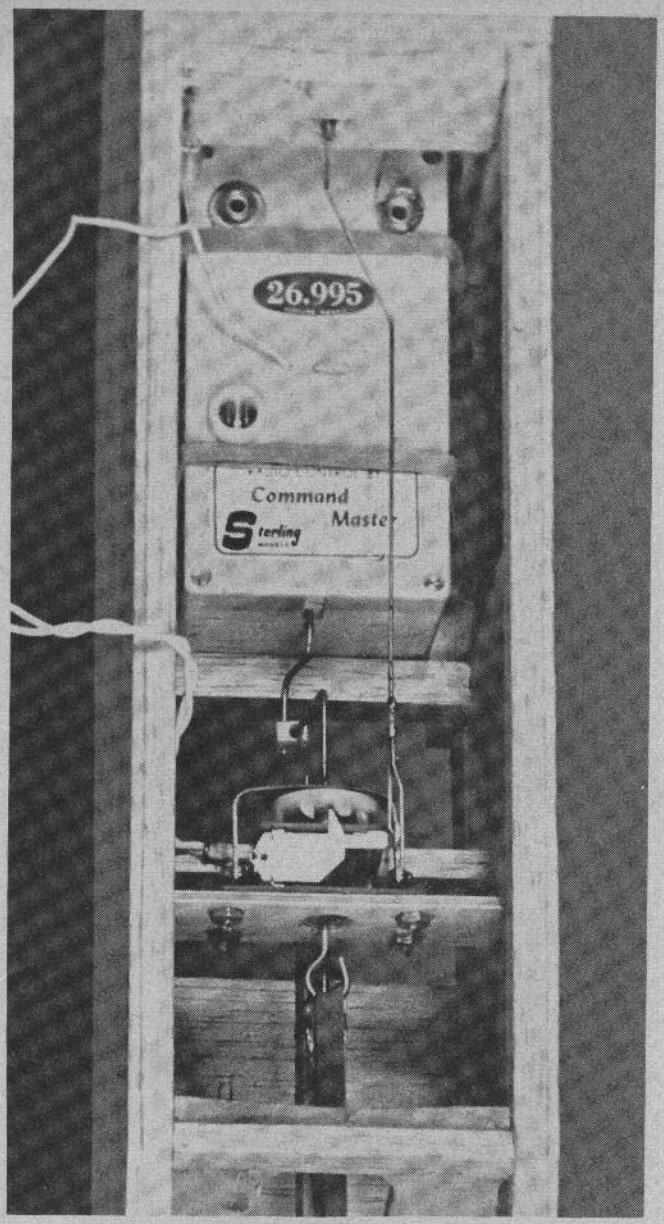


Modular arrangement of batteries, receiver, MC switching circuitry, actuator.



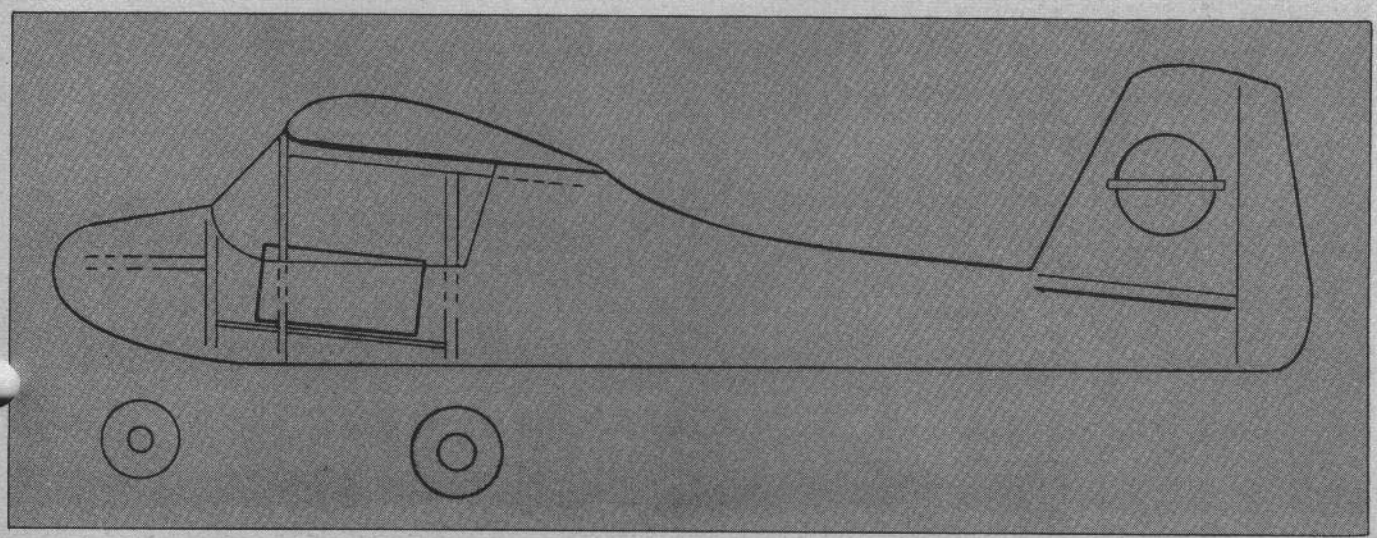


Our test installation ran airborne unit through the cabin bulkhead. The 100-ohm motor control escapement plugs into case, imparts push-pull action. Rubber readily accessible.

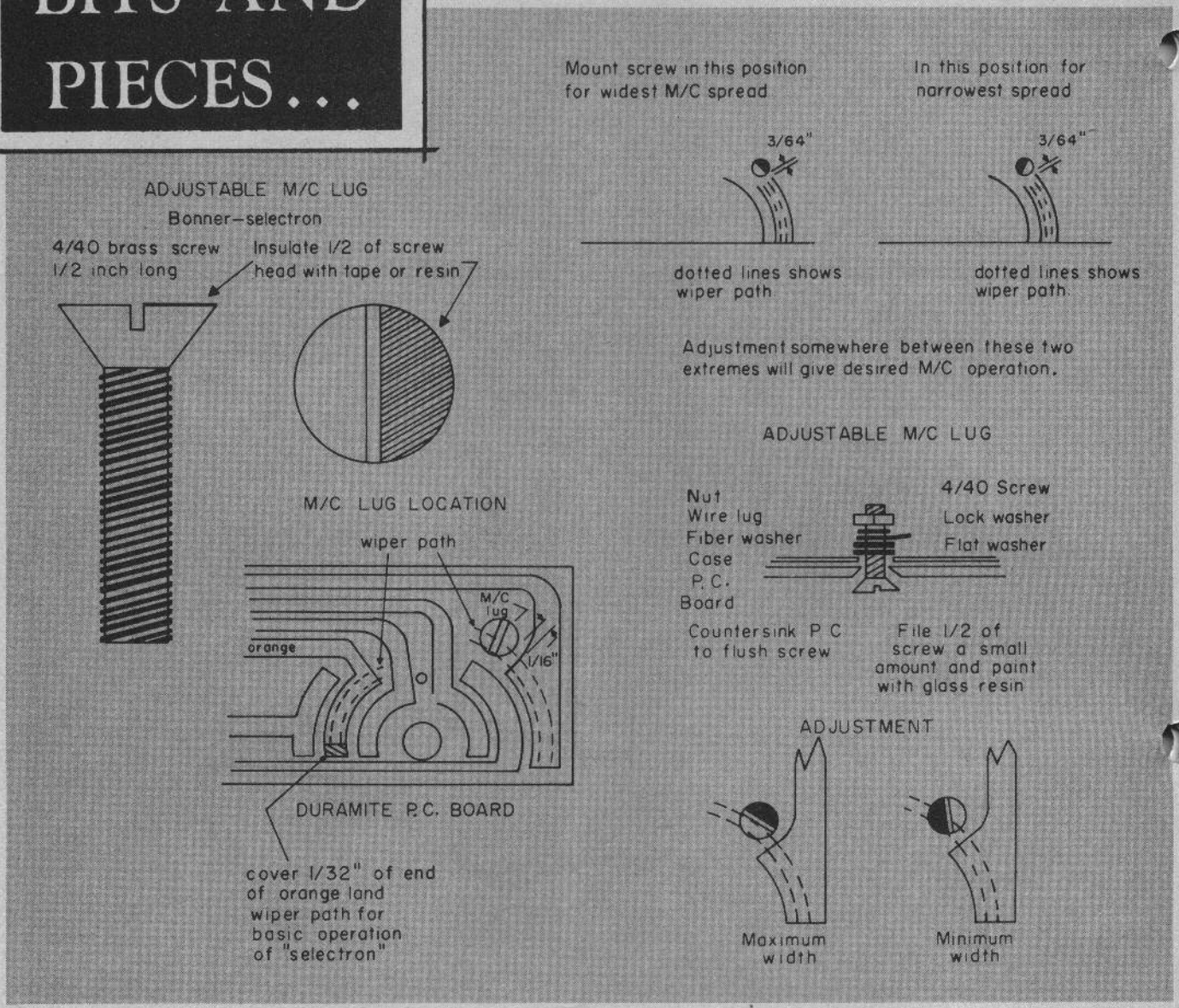


Front bearing for torque rod is standard eyelet. In this instance, it is press fitted into ply plate which then is cemented to a wood support—notched out on its top side.

Profile of test plane shows how receiver unit can be placed to compensate for configurations normally requiring nose batteries.



BITS AND PIECES...



"Selectron" Adjustable Motor Control

By OWEN E. BLACK

■ THE ORIGINAL "SELECTRON" article in *Model Airplane News,* February 1965, showed a two-pulse motor-control circuit but left the switch circuit to the whims of the builder. The may 1965 issue of MAN shows a change in circuit for the basic Selectron and a three-pulse motor-control system, using an escapement or a servo and based on the use of a motor control lug. The circuit change (Tr-2) is highly desirable as it prevents "noisy" servo motors from fouling up your neatly pulsed signals. The motor control lug is a simple way to obtain the motor control switch.

Ace Radio Control has incorporated the above noted change in their new "Selectron" kits plus a printed-circuit board that allows addition of the trim circuit and/or a two-pulse motor control (escapement type) that also uses the motor control lug. This operates the same as the original two-pulse system, two-pulses as if signaling for secondary control, but only holding the pulse long enough for the servo to move across neutral and make the motor control lug. When the signal is released at this point, the motor control escapement snaps to the next position. This is much quicker and easier to do than to describe.

Now that the build-up is out of the way we get to the Adjustable Motor Control Lug. As noted, the motor control operates when the signal is released and the wiper is making the motor control lug. If the lug is too wide, the motor control will work during some portion of the time that the servo is traveling toward the secondary control position. In other words, if one decides that the plane has turned enough and releases the signal when the servo has driven one-third of the distance to the limit, the motor control might work. The adjustable lug allows adjustment of the span of motor control trigger, keeping the motor control easy to hit but also keeping it near the neutral position and out of the control zone. The sketches show how to install the motor control lug. Note that the center of the screw is a bit off to the side of the wiper track. File the insulated half of the screw down a few thousandths and coat with fiber-glass resin.

If a new servo is being used, I recommend that it be connected to the Selectron unit and operated a few times (bet you can't stop at a few) to establish the wiper paths. Be sure that you aren't getting just one side of the wiper. This will establish the end of the path on the orange land also. Insulate about 1/32" of the end of the path for normal basic Selectron operation.

The adjustable motor control lug also works with the three-pulse set-up. (Don't forget to add the extra P.C. insulation for this system.) Hope to have some more info on servo motor-control systems and other variations in future issues of GRID LEAKS.

Add Elevator to Your Single-Channel Servo System

(Editor's Note: When this interesting contribution was received by Publisher Runge, the idea was quickly checked with an O.S. single-channel servo. The particular application did not appear suitable. Your editor then asked Ron Murray at Royal Products if the system was operable with his servos. He reported favorably. The author had used Japanese MK servos. The idea evidently is sound, but may require analysis of your servos.

By BILL WISEMAN

■ HERE IS an extraordinary new adaptation for positive up and down elevator by the use of the new type single-channel servos that are readily available in most hobby shops. I used two "MK" brand servos (made in Japan), but I've seen similar servos with other names and am quite sure the wire colors are the same. Any servo with a barrel-type cam switching mechanism can be adapted and will work fine. The engine servo can be any type. An escapement should work.

I found these advantages:

(1) The job of making and installing a wiper-type switch and putting in an extra grommet in the elevator servo requires only two hours.

(2) Only one surface control at a time is effected. For instance, a slight left rudder is *not* obtained when an engine change is desired.

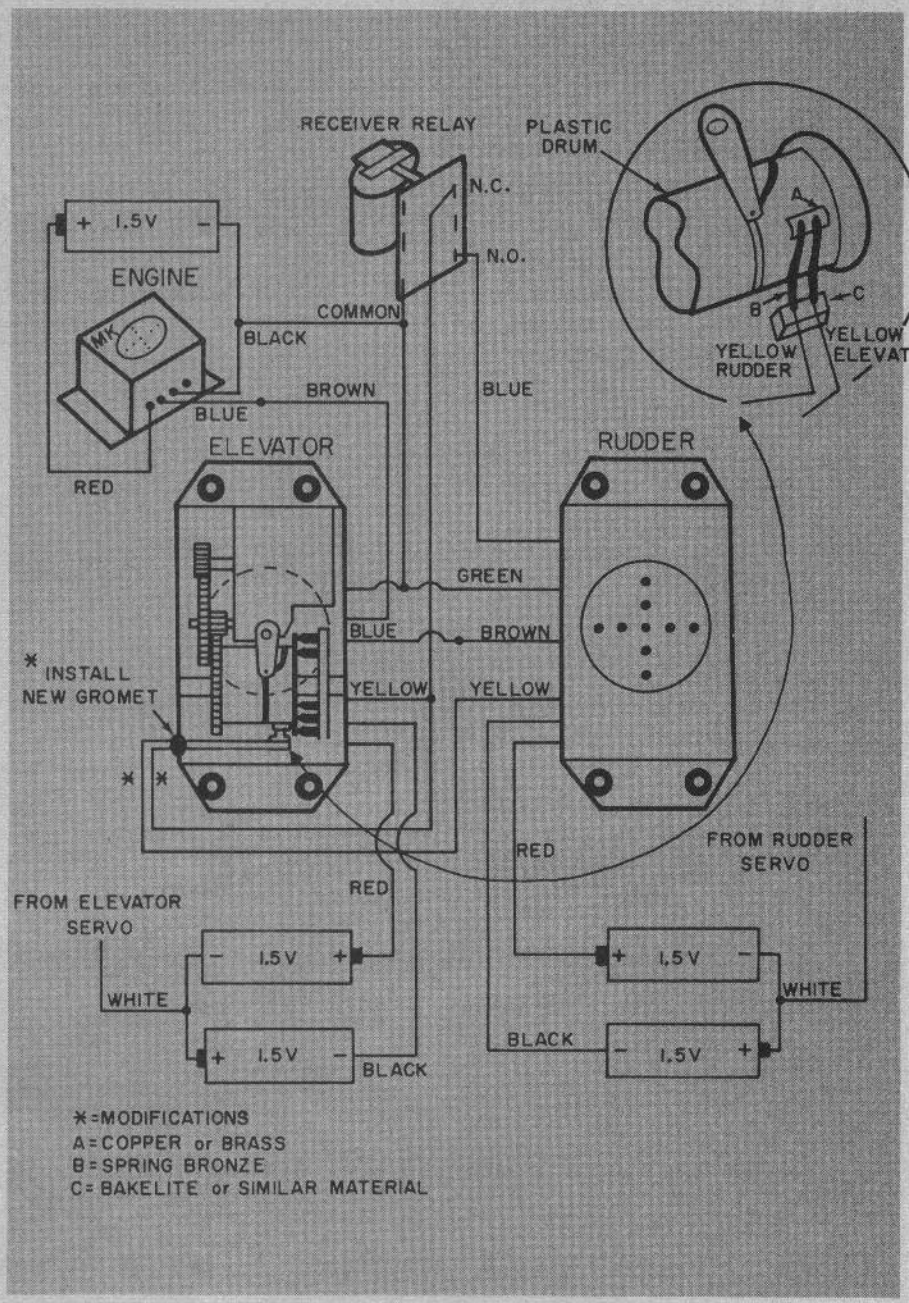
(3) This set-up is easy on batteries.

The revolving contact plate is a thin piece of brass or copper epoxied to the plastic drum. This strip *must* be epoxied on the drum at a point exactly where the drum normally comes to a stop after its regular cycle. The new switching mechanism, therefore *must be closed* at this point. The two wipers are made of thin springy bronze attached to a piece of bakelite or similar material. This assembly is epoxied to the aluminum servo base.

Make sure that the new contact switch does not touch the metal cover when it is installed. Also, secure all wiring against the possibility of rubbing on the nylon gear attached to the revolving drum.

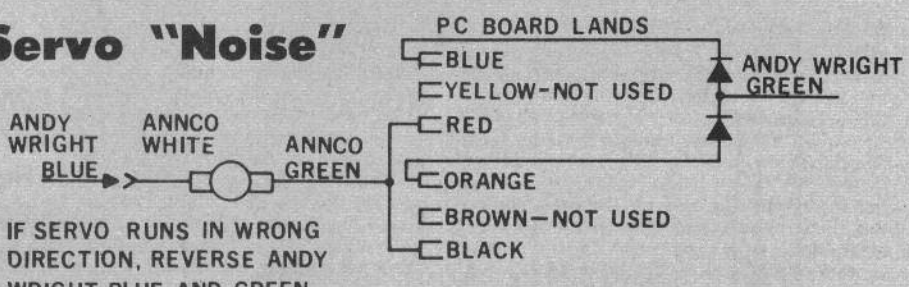
The flying procedure is as follows:

_____ Right Rudder
• _____ Left Rudder
•• _____ Up Elevator
••• _____ Down Elevator
•••• _____ Engine Change



Andy Wright on Servo "Noise"

■ NOISE CONTINUES to be a problem. The following is from Andy Wright Products. "You may be interested in some tests we ran on motor control servos. We received some reports that the unit acted erratically when going to low motor (Off signal). This condition never showed up during our tests. A Kraft single-channel superhet was used during the testing period and proved to be a most reliable receiver. We substituted another receiver and then the condition showed up. The ship rolled when going to low motor 300 to 400 feet away from the transmitter. The system analyzed. Erratic operation was caused by a noisy motor servo. The receiver picked up electrical noise when the AGC was wide open.



Shielding and suppressing the motor servo proved to be tricky and unreliable.

"The best solution is to use a good motor servo to begin with. The Annco relay type multi servo was tested and worked fine without any suppression. The P.C. board was used to stop the servo at the extreme travel of the arm. This has the advantage of being able to shut the transmitter off while retrieving the plane and the whole system shuts down except for the receiver idle. The accompanying schematic shows the modification to the Annco servo. All changes are inside the case. The epoxy silicon type diodes will safely handle the servo current drain."

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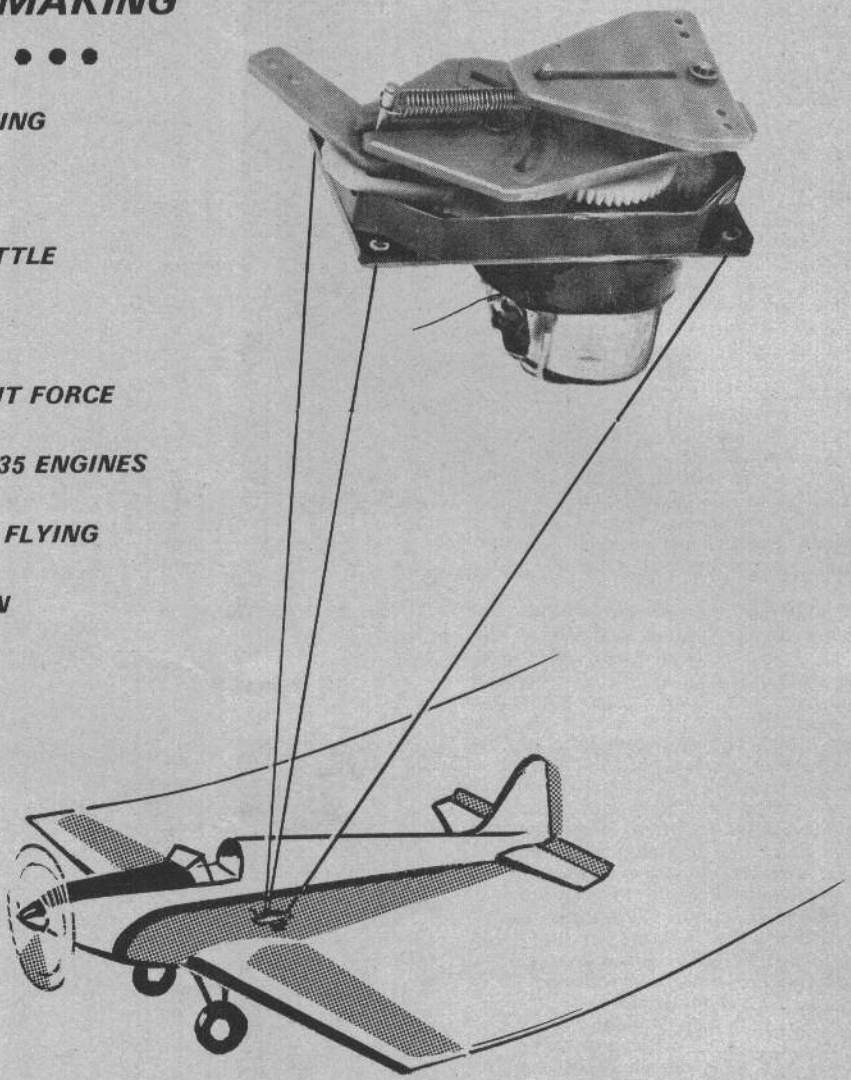

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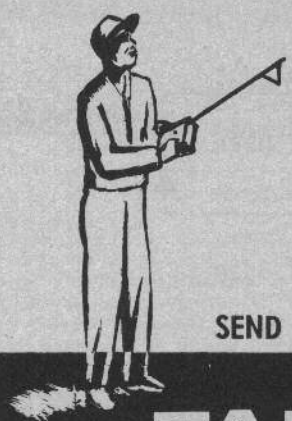

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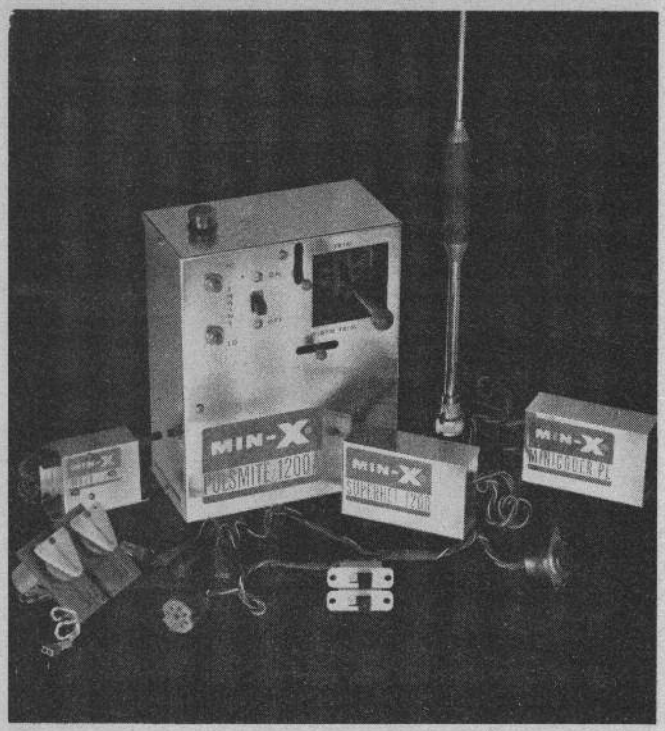

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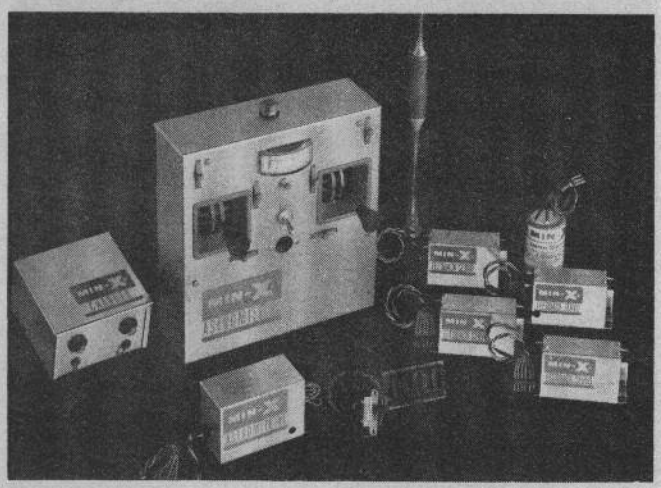
Arc suppressed relay, prewired plug and matching socket.



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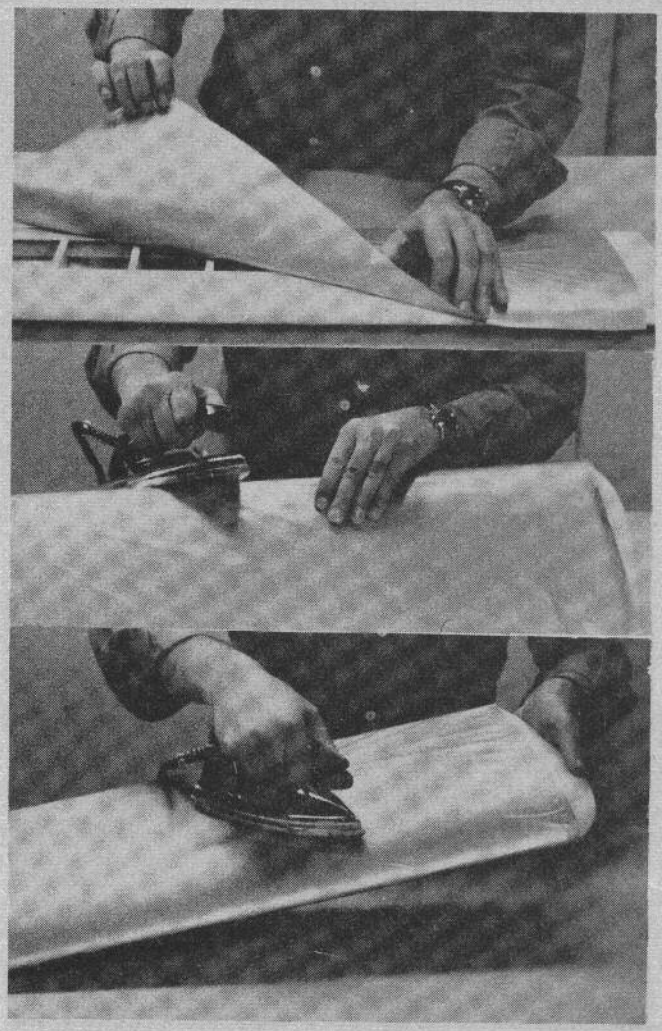


It's called MonoKote and it's a product of Top Flite. You apply it with a flatiron. Nothing else is the same either! A quick briefing . . .

■ The gentleman on the left is covering a wing. The way he is doing it will shake up the silk-dope-and-brushes old-timers. What he is doing takes more time than the telling, but it offers large savings in time and sundry other across-the-board advantages which Top Flite attributes to their new covering material. While the technique really does not take all the work out of covering, as one might presume from the pictures, it certainly cuts it way down by a basic 1, 2, 3 process. Simply expressed, the procedure requires laying on the material, then sealing the edges with the iron, and finally shrinking it tight and removing the wrinkles with the heated iron.

How much heat, and where and how applied, and how fast, is something only the directions can explain properly —but the essentially simple idea is manifest from the photo sequence. The literature doesn't say so, but for the benefit of those who want all the answers, it does cover those double curvatures, but with more attention to detail, and you can cover such unboxy objects as a Taurus fuselage.

THERE'S A CUTE AD on TV for a shirt with creases an iron can't flatten. After a couple of young workers in a Chinese laundry exclaim on the wonders of this shirt, the granddaddy tries with his old fashioned flat-iron to flatten the creases, only to end up wearing the miracle shirt. Now the flat-iron has come to model aviation.

At the recent HIAA trade show in Chicago, hundreds of pop-eyed members of the trade saw a similar scene at the Top Flite booth, but this time the actors were for real, and the material being ironed was MonoKote, not a shirt, and the wrinkles came out—as they were supposed to. A hot iron may be as far away as a guy can get from his dope and brushes—but the results were sensational.

In texture, feel, and brilliance of color, MonoKote is a Mylar-like film, with a peel-off thin backing—like a Band-Aid or tire patch, to use crude but handy examples—which is removed prior to bonding the edges of the material to the structure to be covered. Top Flite states the tensile strength is 25,000 pounds per square inch. The most severe poking of a finger confirms its resistance to punctures and tears. It is described as fuel-proof, moisture proof, stain-proof and fade-proof, and it is claimed it will not dry out, crack or become brittle under normal flying or storage conditions.

As offered by Top Flite, MonoKote comes in six high-gloss mirrorlike finishes in white, black, yellow, orange, red and aluminum in 26 x 36 sheets, at $3.50 each. To completely cover a large radio model, would cost in the vicinity of $10.00.

Unfortunately, insufficient time remained before press, for a through checkout of the manufacturer's claims. We did have Mike Schlesinger air mail some half dozen sheets, from which one of GL's contributing editors covered a large stabilizer and half a fuselage—without an iota of instruction (not then prepared) except that a hot iron was supposed to be used. It was assumed erroneously that double curvatures were not possible but the material *does* accomplish double curvatures when properly handled. Lacking instructions, our man used too much heat, too briefly applied to local areas, and sweeping large areas too quickly, without directly applying the iron with the result that some wrinkles remained. The reader will benefit from detailed instructions.

By phone calls to a cross section of people who had witnessed demonstrations, or tried the material themselves—with verbal instructions—it was confirmed that none had encountered anything objectionable. GL also was informed that editorial features are being prepared by Dewey and Ken Willard on *RC Modeler*, Don McGovern at *Flying Models*, and Bill Northrop at *MAN*.

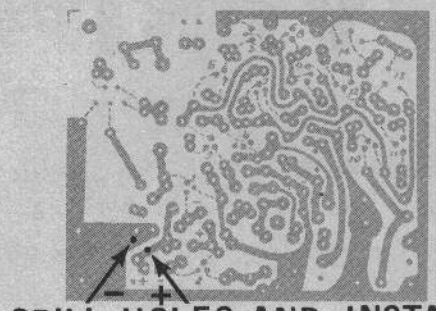
A meaningful evaluation of MonoKote seemingly requires only a point-by-point comparison with silk—as to characteristics, techniques, work, finish, etc. Beginning with preparation of the frame to be covered, it is stated that sanding is reduced with MonoKote, and there is one reference to sanding being eliminated—the latter probably alludes to sanding of the finished covering for smooth finish, since MonoKote is smooth and bright enough to give mirror-image reflections. Of course, any structure requires finished sanding, and any builder worth his salt does a through sanding job anyway. The MonoKote samples were applied, in GL's case, to *undoped* wood.

The pictures tell the story. Just lay it on, seal the edges with an electric iron, and apply heat to shrink the material and to remove the wrinkles. It pulls quite tight, yet does not appear to induce warping. If this suggests that the process is zip, zip, zip, the reader should realize that working this material requires a special technique,

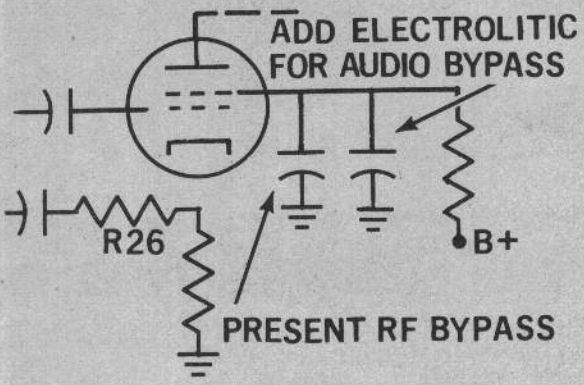
(*Continued on page* 32)

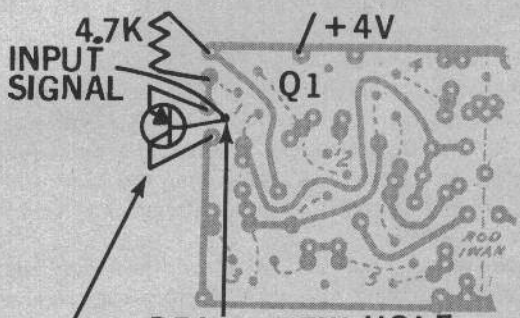
. . . notes on B & D

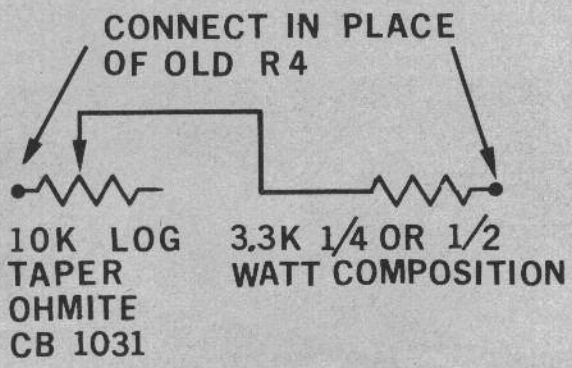
By ROY CARTIER



DRILL HOLES AND INSTALL
4MF 50V CAPACITOR







These proved modifications will eliminate reported shortcomings of this system.

► Here are some hints on the B & D Proportional System. I now have such three systems in use and have helped a few others with them, too.

There are four definite improvements which can be made to improve the system. The four most common complaints are, lack of range, instability, temperature drift of servos, inability to get equal amounts of up-and down-elevator. The solutions I have to offer worked 100 percent on every unit tried them on.

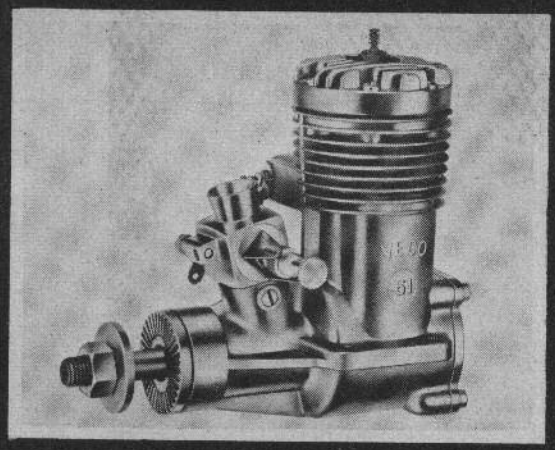
The lack of sensitivity and instability of the receiver is usually caused by the one thing: batteries. If the B battery has even the slightest amount of internal resistance and you have a good hot receiver, it will be unstable. This is usually characterized by the model suddenly doing some manuever the pilot had not commanded. I believe this is too often blamed on interference. This can be cured by installing a 4-mfd 50-volt electrolitic capacitor between B-plus and ground in the receiver. There is room on the PC board. (Note sketch on how I mounted mine.) This will increase the audio signal at collector of Q-2 approximately 25 percent with the resulting increase in range. Since this improves the pulse shaping in the receiver, it might be found necessary to retrim the rudder on the airplane after this change. This should be done by repositioning the control potentiometer in the transmitter pulser.

In most instances, lack of range is due to insufficient modulation of transmitters. This is generally easily cured. Most of the old transmitters which are of the old Walt Good TTPW variety used a pentode output tube. The screen of this tube is well bypassed for RF but not for audio or pulses. The result is that when you modulate the grid you get a large amount of degeneration of the modulating signal. This can be cured by a 4-mfd 150-volt or higher capacity electrolitic capacitor connected in parallel with the screen bypass capacitor. Since this is for audio only, it need not be directly at the tube socket and long leads can be used. The RF bypass capacitor is left in place; it is still needed because electrolitics do not do a very good job of bypassing RF. This change included with the addition of the capacitor to the receiver in all instances, gave me range to out of sight with no more glitches and a smooth flying airplane.

The August 1964 issue of *Model Airplane News* has an article on The B & D system which recommended installing another transistor on the old servo amplifiers to reduce temperature drift. It does not show how to do it to the old PC boards so this is the way it is done. Remove the PC board from the case and do not disconnect from the servo. Unsolder and remove signal input wire from its land. Unsolder and remove plus 4-volt wire from its present location and replace it in another hole on the same land. There are spare holes, unused, and we want to use this hole. Unsolder the base lead of Q1 from its land. Replace it in the hole from which you removed the input signal wire and solder. Drill a number 60 hole in the end of the land where the base of Q1 was connected. Remove the diode and replace it with a piece of wire because it is no longer needed. Drill a hole in the PC board as indicated on the drawing; a number 60 will usually do unless you have a larger than number 24 input signal wire.

Install a 4.7K resistor between the hole where you removed the plus 4-volt wire and the hole you drilled in the land. Remove R2—it is no longer needed. Now install a 2N217 transistor with the emitter lead in the same hole as the base lead of Q1. The base lead goes into the new hole in the PC board indicated on the sketch. The collector goes into the hole from which you removed the ground end of R2. The input signal lead is inserted into the hole with the base lead and the two connected together, then anchored into the hole with epoxy. This change will result in servos whose (*Continued on page* 28)

SEEN THESE



Veco .61

Veco .61 (Veco Products Corp., 3625 W. Pacific Ave., Burbank, Calif.): New .61 delivers more power required for heavier, bigger aircraft in Class III. Designed by Clarence Lee—of Veco .45 fame—it sells for $55.95, has important new features and carries a lifetime guarantee against failure of parts or workmanship during the useful life of the engine. Such parts will be replaced free—regardless of transfers of ownership. Only normal wear and crash damage are excluded.

Carburetion is new, delivers linear power output from idle to wide open, said to be 12,000 rpm with Top Flite 11-8 wood prop. Consumption about ⅞ oz. per. min. in flight. Two Perfect Circle rings, two Fafnir ball bearings on a .59 dia. shaft. Bore .940, stroke .880—so it is less than "square." Weight 14 oz.

Rand Servos and Actuators (Rand Manufacturing Co., Inc., 8909 Hubbell Ave., Detroit 28, Mich.): Manufacturer of precision mechanical devices since 1957, Rand enters the modeling field with new "TAKE OFF" products, including these three radio control actuators with more to come—a complete line of actuators for pulse, and servos for proportional control systems.

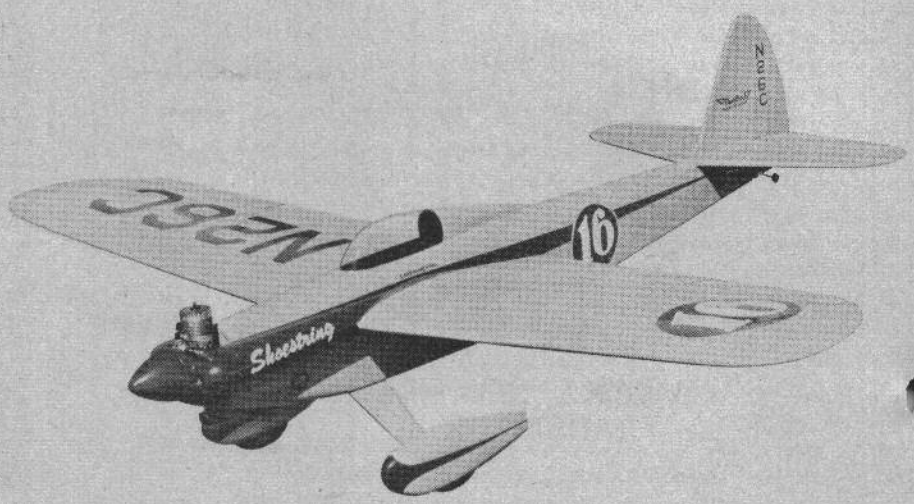
H.R. 1: For use on all pulse proportional systems, a fast-acting actuator has high torque, light weight, and low drain. Power supply, plus or minus 2.5 volts (5-V center-tapped supply). Size 1 x 1⅝ x 2". Weight 1¼ oz. Price, $15.95.

H.R. 2: Proportional rudder with positional engine control. Fast-acting, high torque, light weight and low drain, ideal for any pulser or pulse system. Can also be used with H.R. 1 actuator on "Kicking Duck" applications. Power supply, plus or minus 2.5 volts (5-V center-tapped supply). Size, 1 x 1⅝ x 2". Weight, 1¼ oz. Price, $18.95.

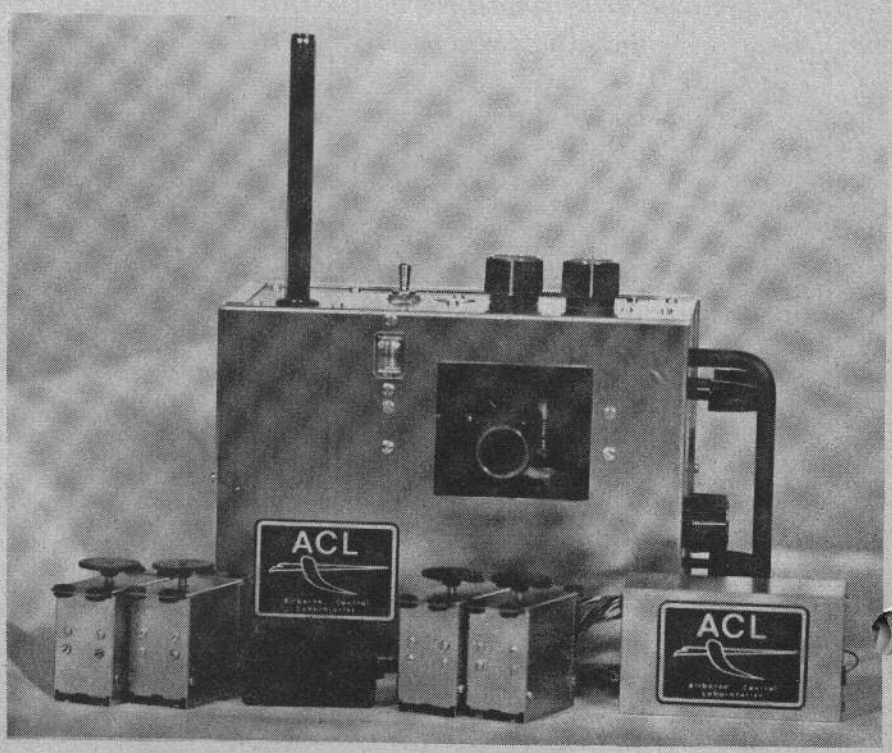
L.R. 3: Proportional rudder and elevator, plus positional engine control, for use with any pulser (or pulse system). Optimum pulse rate 4-12 PPS, 6 PPS neutral. Optimum pulse Width 70-30%—30-70%. Fully RF-suppressed, 5-pole, double-brush, motor. No tricky linkages—all pushrod hookup (beginner's delight). For Galloping Ghost operation, utilizes an entirely new concept for "Gallopless" flying. Two hour operation per charge, using 500 MAH nickel-cad batteries. Power Supply, plus or minus 2.5 volts (5-V center-tapped supply). Size, 1 x 1 11/16 x 2". Weight 1¼ oz. Price, $19.95.

Goldberg Shoestring (Carl Goldberg Models, Inc., 2541 W. Cermak Rd., Chicago 8, Ill.): All Goodyear-type racers which meet rules for that event are fast

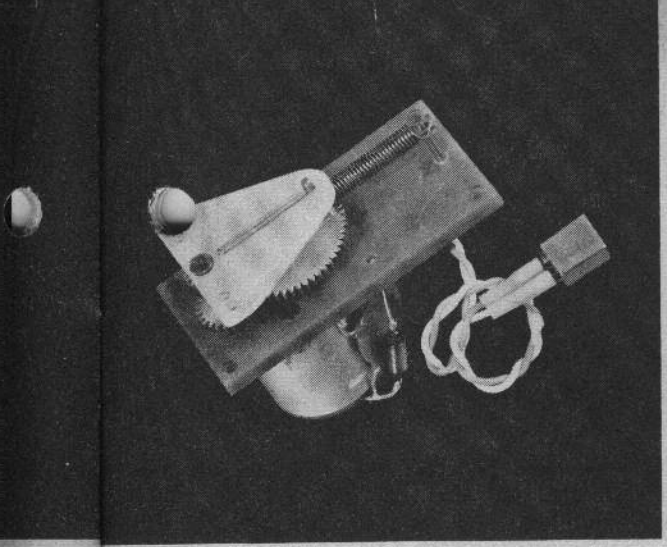
(*Continued on page 22*)



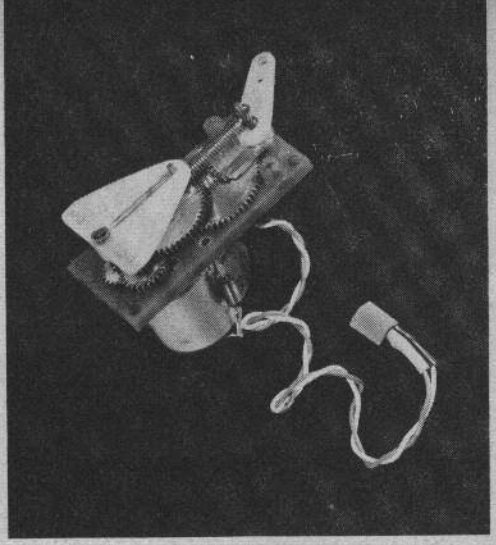
Goldberg Shoestring.



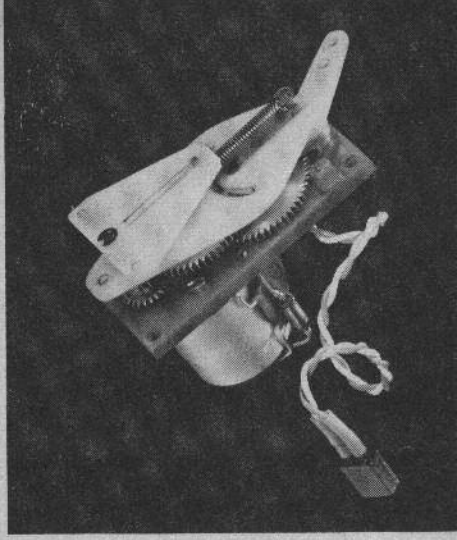
ACL Digilog Proportional.



Rand H.R. 1 Actuator.

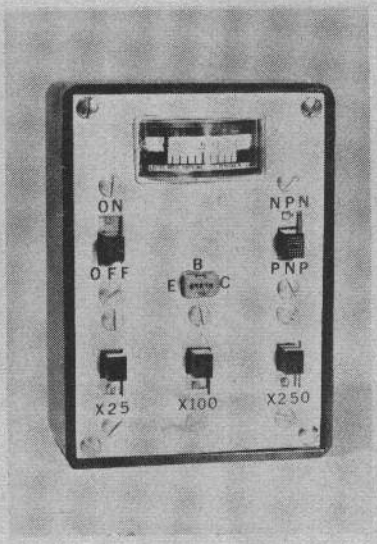


Rand H.R. 2 Actuator.

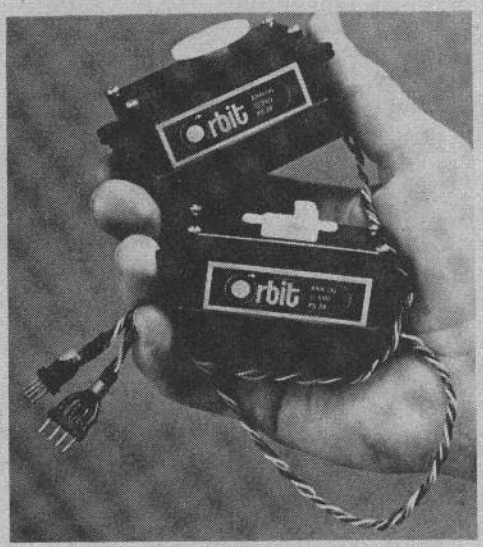


Rand L.R. 3 Actuator.

Ace Digimite Stick Assembly.

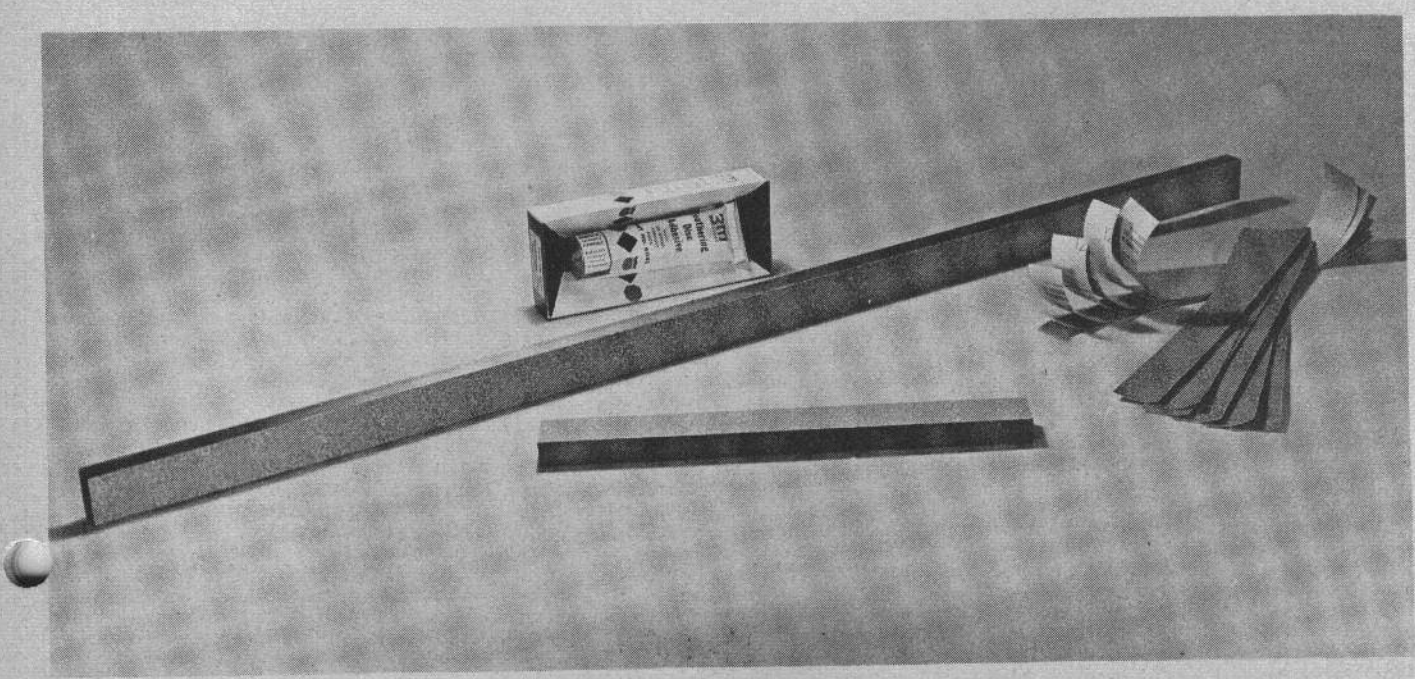


Ace Transistor Checker.

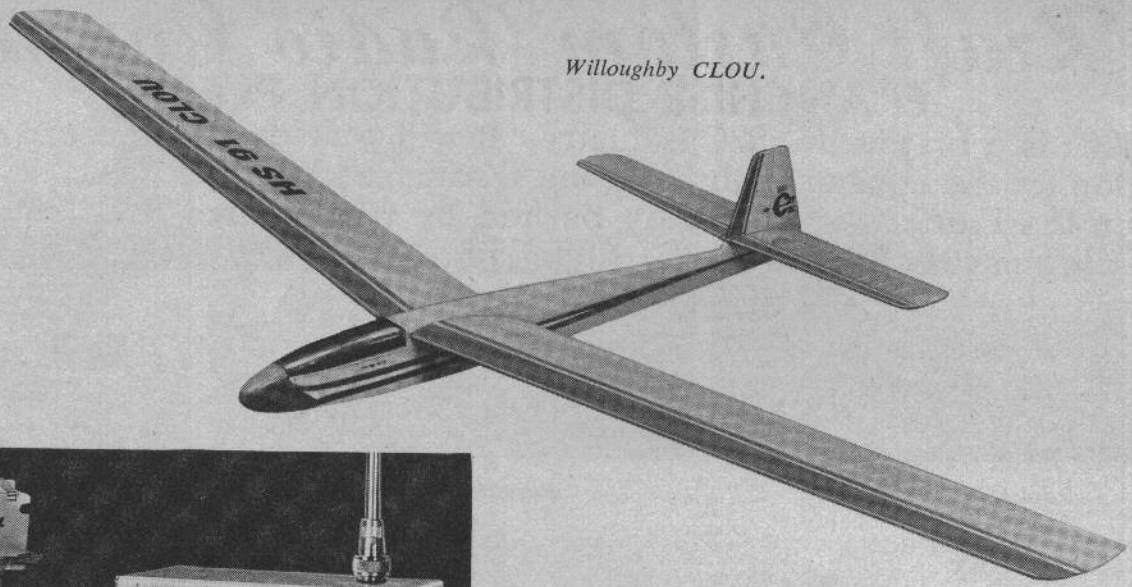


New Orbit Servos.

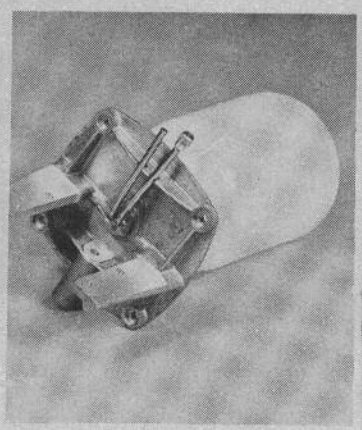
A timely round-up of the newly released trade items which have special significance.



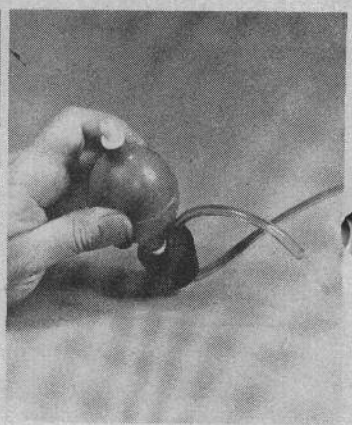
Delta Specialties Sanders.



Bonner Digimite 4.



World Engines Tank-Mount.



C&M Fuel Pump.

(*Continued from page* 20)

and comparatively touchy to pilot on the .40 engine, but less tricky when sport flown on the .19. This one incorporates extra wing area for improved reduced-power flying, does all normal stunts. Area can be removed if speed appeals. Stressing practical aspects for the average flyer, has upright engine (room for side-mounting), torque-rod aileron setup, and wing hold down utilizing a break-away plate. Takes 6, 8 or 10 channels or corresponding proportional, weighs 4½ to 5 lbs. Span is 54 in., length 44 in., area 540 sq. in. $17.95.

Ace Digimite Stick Assembly (Ace R/C, Box 301, Higginsville, Mo.): As used in Jansson Simpl-Simul transmitter. Pot provides rate trim over the mechanical trim of Digimite unit. With Ace unijunction kit makes neat unit, giving single-stick action with limited trim on stick and additional trim on pots. Price, less pots, $10.95—you mount your own; or $14.95 with two Chi Tel 10K pots (revised circuit uses 10K) for Basic Unijunction kit. Customer can supply own pots for factory installation (Ace), at $14.95—advise which goes where.

Transistor Checker (Ace R/C): Kit for those who like to design and/or build transistor pulsers, decoders, servos, etc. Gives good comparative rating checks, matches transistors, checks for excessive leakage, helps choose transistors for critical spots. Measures beta in three ranges, 0-20, 0-100 and 0-200; checks either NPN or PNP transistors.

Bakelite case, front panel of aluminum, completely punched. A 0-1 MA meter is furnished. Transistor socket on front of case for easy insertion of transistor to be checked. Uses 9-V battery. Price, $8.75.

Orbit Analog Servos (Orbit Electronics, 11601 Anabel Ave., Garden Grove, Calif.): Now standard equipment on all Orbit proportional systems, high-torque servos deliver twice power of previous models. PS-2A analog servos are used for entire Orbit 3 + 1 system and "Full House" proportional throttle, aileron and elevator control functions; rudder servo continues to be PS-1A because of system circuitry. Compatible with previous transmitters and receivers. (All Orbit 7-14 Digital Proportional systems use PS-2D digital servos as standard equipment.)

Silver-alloy brushes, hard-surfaced carbon/ceramic potentiometers. These features, combined with new circuitry, deliver full-power servo output on minimum error signals. Built-in rotary and/or linear output permits easy use of any system of control linkage. All-Nylon case with grommet mounting, positioned for maximum crash protection and ease of installation. Net weight, 3 oz. each. PS-2A and PS-2D servos, $40.00 each.

Digilog VI (Airborne Control Laboratories, P.O. Box 1493, Poughkeepsie, N.Y.): Proportional control system capable of accommodating up to 6 feedback-type servos. Pulsed tone transmission with tone discriminator in receiver. Through clock and counter circuits, the six proportional control functions are achieved. Using tones said to obtain high degree of interference immunity possible with tone and selective filter type system. To further enhance this immunity, a sync. tone is used during recycle so effect is continuous tone transmission.

Offers both "full house" control capability of digital type (6 servos) and the interference immunity of the tone-type of system. ACL has been producing tone type proportional feedback systems since 1961. The servo used in Digilog VI has been standard since first unit. The VI has been in production since May 1965. Price $615.00, complete with all batteries and chargers, factory wired and ready-to-fly. Write manufacturer for full details.

Super Tigre Tank-Mount (World En-

(*Continued on page* 28)

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BRICKER & ANDES HOBBY CENTER
290 Atlantic Avenue

NEW YORK, Bronx 71
BROWNS HOBBY CENTER
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2458 Cleveland Avenue

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Route #2, Box 292

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ZEPHYR MINIATURES
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BOBS HOBBY CENTER
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6416 Brandon Avenue

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CORRS, INC.
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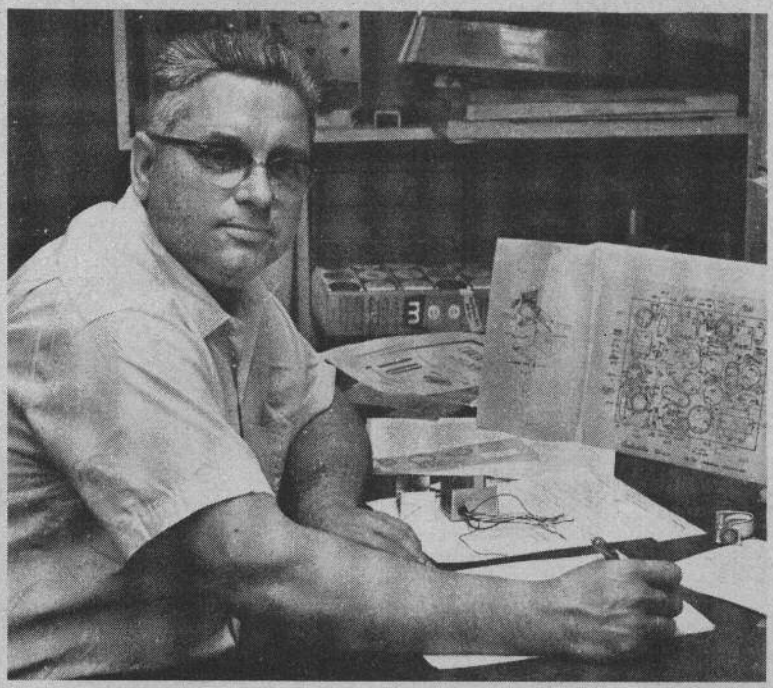
JACK PORT—RC PIONEER



■ Radio control modellers have lost one of their great pioneers. Jack Port passed away Friday night, February 4. Having suffered a heart attack in early December, Jack apparently was recovering fairly well, and was looking forward to a return to work shortly. A few days prior to his passing, he began experiencing some more severe chest pains, and was returned to the hospital Friday afternoon, shortly before he died.

Jack's contribution to the radio control field is hard to assess. His keen engineering mind, his affable personality, won for him many firm fans. Not only has World Engines lost a valuable man, but the entire RC modeling field has lost a man who pioneered some of the radio control developments as we know them today.

Bobbie and I were pleased to be with Jack and Mary at the DC/RC Symposium last year, and attended the banquet with them. As always, Jack was bubbling with new ideas, solutions to old problems, and for him the future looked bright.

Jack will be recalled as an early Nats winner in Class I, with his Controlaire hard-tube receiver design, at the time when the hobby was just emerging from the gas-tube stage. Jack began his operations at his Ace Model Supply in Fairborn, Ohio. Within recent years he became affiliated with World Engines, and contributed greatly to the art and state of radio control.

All of us who knew Jack are saddened by his passing, and while words are very inadequate vehicles for expressing such a loss, we join with countless others in expressing our deepest sympathy to Mary and his family and to John Maloney and his compatriots at World Engines. —PAUL RUNGE

These comments were taken verbatim from a letter to your editor, intended to guide our comments. There is nothing we can add. Our recollections of Jack go back far indeed, to his Nats winning flight, to fun combat at Selinsgrove, to reliable equipment he made and gave us when lost airplanes were the order of the day. Nobody did more to make radio control what it is today. We all shall miss him. —EDITOR

Command Master

(*Continued from page* 13)

By removing three screws, the rear cover of the transmitter case comes off—see picture.

Charger: Designed for charging a 9-volt 250-MAH capacity nickel-cad battery pack it has a transformer to completely isolate it from the 100-volt line, and has automatic cutoff.

Escapement: An OS 100-ohm unit, not included in the price of the system, is sold separately. Note that 100-ohm resistance is imperative. (Babcock has a 100-ohm job which can be substituted.) The OS is a particularly neat unit, with built-in mechanical means of converting rotary to linear motion. This means that the escapement can be mounted with rubber fore-and-aft without resort to trickery. Polarity of the two leads does not matter.

Receiver-unit: The case divides into four sections, the rechargeable batteries forward, then the receiver proper, followed by the motor control switching circuitry, and then the double-coil actuator which is powerful enough to handle up to a .19 engine and a 52 inch airplane. Obviously, many exceptions to that span limitation will prove feasible—as with high aspect type aircraft—but the rudder-area, when large, probably would become the most inhibitive factor. Less power and more serene airspeeds allow latitude, here, however.

The five-transistor relayless superhet receiver has a 3600 cps audio tone selectivity. Weight is 00 ounces. It is not potted, which the warranty warning against opening might suggest to some people.

Aircraft design: The old hand may feel uneasy about having his rubber wrappings taken away, but this unit is mounted, flat, on a plywood tray glued into the fuselage with two sets of wire hooks anchored in the ply, taking hold down rubber bands. Wood rails (⅛ in. sq.) are cemented to the ply, against the sides of the receiver unit to align it and prevent movement. A 1-in. thick block of styrofoam in front, cushions hard impacts. Needless to say, the retaining bulkhead must be solidly built, reenforced and/or supported. Physical alignment is emphasized because shifting of the unit imparts an off-center and changing neutral to the rudder, with obvious control affects. As the pictures indicate a plane was built to check out installation—not as yet flown.

Fore-and-aft placement can be critical in the smaller of the permissable airplane sizes. In any aircraft which normally can mount its battery pack in the cabin area, the balance is approximately the same with the Sterling unit. But, obviously, if you fly ships which require batteries in the nose for trim, some compromise is desirable. Also, if the unit is located within the cabin, its front edge is one inch back of the main bulkhead, due to the styrofoam block. (If you don't mind voiding the warranty, the batteries can be removed from the unit for relocation.)

Additionally, the designer will have to choose between a low or high mounting—both shown in directions. The low mounting is most simple, simply resting on the cabin floor. The high mounting may be desired in some cases—as in a deep cabin which magnifies pendulum effect of a low center of gravity. In our test ship, the high mounting was preferred and, to allow some out in case a tail heavy trim was encountered—as is often the case in a new airplane—the main bulkhead was sturdily framed (or it can be ply) to permit a generous cut-out for the receiver unit; the front edge of the case being just forward of the bulkhead, and the styrofoam shock block resting against the mid-nose

bulkhead which took the rear ends of the motor mounts. Access must be provided for attaching and removing the charger strap.

The designer also must choose whether the torque rod pin points downward to the actuator crank, or upward from the floor (which must be allowed for at the rudder end where movement may be reversed). This consideration will determine what should be done with the aft fuselage profile. Since we had curved the profile down, with the fuselage bottom flat, it was necessary to have the torque rod high—anyway we already had elected to locate the receiver unit high, as well, which froze the decision. The fuselage depth fortunately was great enough not to cramp the motor control escapement location, which should not block access to the receiver, or the crank location (which then would have to be accessible through a bottom hatch). Plan your antenna exit so that it does not run close to a metal motor-control pushrod.

It would be well to execute the torque-rod installation before construction advances. Having waited too long to anchor the front of this rod—as an old escapement man, this new requirement escaped us!—found a simple expedient. The metal eyelet comprising the front bearing was press-fitted through a small 3/32 plywood plate (visible in picture); a vertical slot was cut into the balsa wood cross cabin support, then the ply plate was glued to the front of the support, the neck of the eyelet dropping into the slot.

Directions allude to noise problems, but Dick Jansson apparently found during the five years of Sterling's development of the system, that elimination of steel-to-steel contacts was sufficient. Thus, the metal tubing through the tail block is brass or aluminum. Eyelets are brass. So the only offending contact we found was attachment of the escapement steel wire pushrod to the throttle arm. A nylon clevis will be one suggestion.

One especially nice aspect is the simplification of rudder and torque-rod linkages, with nylon torque-rod connectors. These are small blocks, drilled through two ways to take the linkage extensions, leaving them free for any required control movement. Metal-to-metal noise interference is eliminated (a more severe trouble in rudder-only than most builders realize).

The CM airborne unit should have little or no affect on other portions of the plane design. One quickly will get acquainted with rudder area, movement, and linkage length combinations. It does occur as an afterthought, that the use of low aspect wings (such as 5-1 or 5½-1, as compared to 6-1 and up) will help limit any center-of-gravity adjustments. The location of the unit, with respect to the wing chord, will be more forward percentage-wise with a wide wing, than with a narrow one. In original designs where balance is doubtful, excessively long tail moments could be avoided.

Lastly, there is a five-year guarantee; if the receiver ceases to operate for any reason, immediate replacement is made for $7.50—provided the lid has not been removed. There is no limit to the times, the guarantee may be exercised and it continues to apply after change of ownership.

MANY FLYING SITES BECOME AVAILABLE WITH INSURANCE PROVIDED AMA CLUBS

Monitor

(*Continued from page* 2)

The point therefore becomes, what can we do, as hobbyists, as publicists, as an industry, to better serve the common good, and in so doing to serve ourselves as well. Awareness of an image at least is a starting point.

* * * * *

GRID LEAKS, it must be admitted, finds it relatively easy to ask questions which undoubtedly occur to all of us in this business of publishing magazines. As a specialist magazine it goes to 14,000-plus RCers looking for a certain type content, as compared with, say, 75,000 or more readers (half of them radio?) of a general magazine. There is no burden of having to consider what effects we might have on the hobby at large. GL (fortunately) cannot make a control-line or free-flight fan vanish regardless of policy. Nor is there a burden of having to make money—which is why the magazines are in business, quite naturally. Nor would GL have to avoid coverage of A,B,C stuff (for example) for beginners because of narrow-minded external pressure. Such problems should not exist, nor should any of us cause them to exist. That they do exist is another manifestation of a less-than-perfect radio control world and how it can hurt modeling.

* * * * *

What do you know about GRID LEAKS? The reader who builds and flies simply knows that he likes it—otherwise he would not be reading this. But the confused industrialist has so much trouble pegging the various publications in his mind that, with your indulgence (do stick around!), we shall try to give him some meaningful in-

(*Continued on page* 29)

Sky Squire

(*Continued from page 7*)

CONSTRUCTION

Stab: Ribs are cut with tabs to facilitate building on a flat board. Pin bottom spar of ⅛ x ¼ over the plans, and glue each rib in position. Add top ⅛ x ¼ spar, the ¼ x ½ leading edge, and the ¼ square trailing edge, with its extra reinforcement at center. Sheet top of leading edge with 1/16 sheet, add sheeting to center section, and cap strips. When dry, remove from the building board, turn over, trim off tabs. Add all sheeting and cap strips to bottom, cut tip blocks to outline, glue in place. Carve and sand to final shape.

You may wish to silver-solder control horn for extra strength. Elevators are hinged after silking the entire assembly—nylon or sewn hinges.

Wing: Will it be flat-bottomed or semi-symmetrical? If semi-symmetrical, will you install ailerons? Ribs are shown for these options. Whichever wing, you may either build it in two sections, joining it at final assembly and adding dihedral braces and gussetts, or you can build in one piece, building in the dihedral. I happen to use a Magna-Jig, which makes it easy to build it in one piece. Join two wide pieces of pine, or other soft wood, at the proper angle for one piece building. Tabs on the semi-symmetrical wing ribs help build a flat, true wing either way.

If flat-bottomed wing, first cut leading edges and bottom sheeting to proper length and proper dihedral bevels. Lay down the leading edge, then leading-edge bottom sheeting, butt-gluing to leading edge. Next, lay down bottom trailing edge sheeting, and bottom center section sheeting. Glue cap strips in place. Glue front and rear spars in place on top of this sheeting, install the ribs. Add the center spar filler of ¼ sheet, trailing edge reinforcement, and leading edge dihedral brace, then install top front and rear spars, followed by plywood braces at each spar location.

Addition of the center section rib pieces readies it for top sheeting. Bevel edge of top front sheeting to form tight butt joint with leading edge, bevel it for the dihedral angle, glue in place. Install rear top sheeting, followed by remaining sheeting over center section. Cap strips complete structure, except for adding tip blocks.

If the semi-symmetrical wing, you start by putting down bottom main spars, and gluing all ribs in place. Next, slip bottom rear spars in place, blocking up flush with bottom of ribs. Add leading edge, center spar filler of ¼ sheet, and top front and rear spars. When dry, add the plywood gussetts except one at trailing edge. Now sheet top front and rear of wing as on flat-bottomed wing; add cap strips, center section sheeting. If ailerons, box off aileron openings at rear spar as shown with ⅛ sheet. If you want insurance against warping, add 1/16 sheet webbing between top and bottom spars, at both front and rear spar locations. Helps, but not essential. When dry, remove it from building board, turn upside down.

Trim off all tabs on ribs, install sheeting at leading edge, trailing edge reinforcement and gussett at the center section, and trailing edge sheeting. You can build the ailerons in as you go, cutting away later. Be sure to install plywood blocks in them for receiving the screws that hold the aileron control horns. Box off the center section for servo installation if you're going to use ailerons, then sheet remainder of center section. Add capstrips on the bottom, plywood mounts for aileron bellcranks, and tip blocks. When dry, carve and sand assembly to final shape. If ailerons, add pushrods.

Fuselage: Cut sides from matched sheets of ⅛ x 6 x 48 balsa. Sides are reinforced with 1/16-sheet doublers from former 3 forward, with ½ sheet triplers from former 2 forward. Before cementing doublers in place, be sure to trim bottom portion to allow for the ¼-sq. bottom longeron. Glue doublers in place, using contact bond cement. Then install ¼-sq. bottom longeron, and 1/16 sheet doublers that reinforce stab opening. Cut all formers to shape as shown. Former 1 is 3/16 thick, 5-ply plywood; former 2 is ⅛ ply, rest ⅛ sheet.

Glue ½ sheet triplers in place, install hardwood engine bearers on each side, lining up with slots in former 1. To assemble sides, pin in position over plans and glue formers 2 and 3 in place, squaring up as you do so. Since bottom of fuselage is straight line from former 2 rearward, this simplifies alignment as whole assembly can be pinned over plans. Shape tail post, install it and remaining formers. While assembly is pinned down, install the ⅛ sheeting on top of fuselage. This locks assembly into alignment.

After removing from the board, install ⅛ plywood landing gear retainer pieces to inside of each fuselage side, and add bottom plywood pieces. Pine servo rails glue in place. Bend main landing gear units, use to help attain proper alignment of all plywood landing gear retaining parts. After this is completed, add ⅛-bottom sheeting from the landing gear cross braces rearward.

Box off fuel tank compartment with ⅛ sheet under bearers; then reinforce firewall mounting with pieces of trailing edge stock. Install whatever nose gear you prefer. By installing it at this time, you can make provision for steering linkage. Install tubing for the throttle pushrod. Box in power pack compartment under fuel tank area.

After installation of landing gear, cut and glue lower nose block in place, under motor bearers, first installing blind mounting nuts in bearers. Add remaining bottom sheeting. Cut and glue balsa blocks in place to form sides of tank compartment and nose. Add windshield block, cabin fairing block aft of wing. Add wing saddle pieces to reinforce the wing opening and plywood gussetts to reinforce the dowel mountings. Carve and sand nose to shape, sand fuselage to final finish, slightly rounding the corners.

Fin and rudder are self-explanatory, except that hard sheet used for top of the fin gives protection in nose-overs. Glue the fin and dorsal assembly to top of fuselage, lining it up dead center. Fuel proof engine tank compartments with a couple of coats of fibreglass resin.

Covering and Finishing: I covered with colored silk, using colored dope only for trimming. I used F & N "Air Span" Heavy Duty silk for its deep color. After fine-sanding the entire ship, apply coat of clear dope with talcum powder added, followed with a coat of untreated clear dope. After silking give eight coats of thinned-out clear dope. Trim and window areas are masked off and sprayed with two coats of aluminum dope wherever white striping will be used. This prevents "bleed-through" from the color in the silk. Apply several coats of white to these areas, masking to achieve final trim pattern. After a few coats of trim color remove masking tape, and sprayed ship with two coats of thinned-out clear. This gives ship a uniformly even sheen, helps level off ridges left by masking tape. The ship shown is solid orange, with black-and-white trim.

Test flying: Install whatever equipment you decide to use. If you're going to fly with a .19 you'll want a lighter weight ship than if a .45. All of the prototypes came in with wing loading of 21 to 22 ounces, with no problems in flying ability. Ship has flown with reeds and proportional with equal results; also with Min-X Pulsemite 1200-A system using Bellamatic servos to give proportional rudder and elevator with an Annco servo for trimmable throttle. The ship flew very well with this equipment, and installation is given. Only problem was erratic centering of Bellamatics.

Min-X encountered the same problem, and to correct it, have designed a servo to go with the system, which should be on market by now.

Check location of CG Sky Squire is not sensitive to CG displacement, which can vary a half-inch either way. If your CG is farther to the rear, decrease stabilizer decalage as necessary in flight tests; if farther forward, increase decalage slightly. (Decalage means angular difference—Ed.) Second, if to rear, a rearward displacement of the CG enhances stalling and spinning characteristics, and can cause a tendency to spin out on tight, steep turns. Not a characteristic of the Sky Squire, but simply a fact of aerodynamic life.

If all surfaces are true, with no warps, and properly aligned, a few test hops should be all that is needed to trim. Try for smooth, flat glide approaches at idle power with elevator trim at zero. Shim stab as necessary to achieve this, or add up- or down-trim to elevator by adjusting clevis, or the servo pushrod connection. Add right or left rudder adjustment as necessary to ship to track straight in its glide approach, and if using ailerons, a little adjustment of these might be in order. If ship glides straight, but pulls to either side under power, off-set the engine thrust line.

If trouble with rolls, either with ailerons, or using only rudder, where ship rolls smartly in one direction, but very slowly in other direction, look for a warped wing. On my second ship, without ailerons, it rolled beautifully to right, but when I tried left rolls, it rolled slowly over on its back and stayed there! Full left rudder woudn't bring it around, and a half inside loop resumed level flight. Investigation revealed a wing warp, and after I steamed it out, rolls were equally good in either direction.

My Sky Squires are trimmed to give short takeoff run with slight up trim, and rapid, smooth climp-out under power. When the desired altitude is obtained, a few short taps of down trim flatten it into level flight for performing aerobatics. To land, I simply chop throttle back, get into a pattern, apply a few taps of up trim, and forget elevator until nearly on the ground. Gentle pulsing of up elevator produces a nice flare out and ship settles gracefully to a three-point landing.

Tracked Vehicles

(*Continued from page* 11)

symmetry, and no output without an AC input. The DC level was in turn detected by a regenerative circuit very similar in operation to a Schmidt Trigger.

Both drive motor circuits are the same and they get their phase difference by method of connection to the receiver relay. The auxiliary relay is normally off and any AC is detected in such a fashion to hold the relay driver transistor off. However, when the receiver relay is held on by a steady signal, the auxiliary relay driver is forward biased via a 20K resistor after the 15 uf coupling capacitor is discharged and then the auxiliary relay pulls in.

While I have this installed and operating, I have never used it for anything. I had thought about operating a three-position servo to drive a switch to provide two speeds and a reverse. Because the surplus relays in my junk box would not operate from 3 VDC, I made a 5-VDC regulator to supply power to the control circuits. Since the level detectors are voltage sensitive, I felt it necessary to use a regulated voltage to compensate for the dropping of the battery voltage during their normal discharge cycle. The second 3-VDC regulator was provided for the receiver for similar reasons and to provide some electrical isolation. The relays all have diodes across their coils to clip the inductive voltage spike when they are turned off.

The circuit as shown will work and is, in fact, currently working. The pots are adjusted so the relays just pull in at 50/50 pulse signal. However, I wouldn't recommend it as a construction article because I feel it could be improved and simplified. I do believe many will find it interesting and a bit unusual in its concept. I didn't list the components because I used parts from my junk box, but I would recommend any low cost diodes such as 1N48 or 1N66 or transistors such as 2N1303 and 2N1304.

Reedbanks

(*Continued from page* 5)

contact screws be adjusted before installing the receiver in the airplane, at least once each flying season and certainly after any crashes.

Adjustment of Transmitter Audio Tone Pots: The basic requirements for margin-of-safety audio-tone pot adjustment is to be sure that, during simultaneous operation, the audio-tone pot is set between ¼ and ½ of the way between the highest and the lowest servo response frequencies.

Again servo response will be used to determine proper audio-tone pot settings, since this is what really counts when you're up in the air. This adjustment easily can be made at the flying field—if necessary. When tuning the audio-tone pot of trim-type servos it is always necessary to run the trim servo to the opposite extreme before each frequency sweep so the servo is able to respond when the reed starts vibrating. The following procedure assumes that the control system has been operating and the flyer wants to check his audio-tone pot adjustments for margin of safety operation.

1. Retract or remove the transmitter antenna
2. Connect servos to all reeds to be tuned.
3. Turn on all power
4. Determine the servo response bandwidth by the following procedure:

4.1) While holding a simultaneous control, slowly sweep the audio-tone pot across the servo-response band toward lower frequencies and mentally note the pot rotation from the point where the servo first pulls in, to the point where the servo drops out. This band width *must* be determined while tuning from higher toward lower frequencies. It may be necessary to sweep across the band several times until you get the feel of the bandwidth available.

5. Now make the audio-tone pot adjustment by approaching the band from the high-frequency side (still holding simultaneous). Find the high-frequency point and then continue to rotate the pot shaft down-frequency to a position approximately ¼ to ½ of the way from the high-frequency end to the low-frequency end. This is the proper position for margin-of-safety audio-pot adjustment.

Proceed to tune all other pots to the same relative positions in their respective simultaneous operational bandwidths.

On most reed banks it will be found that one combination of reeds cannot be adjusted for good simultaneous operation. This normally involves one of the trim reeds and the reed next to it. Don't worry

(*Continued on page* 28)

(*Continued from page 27*)

about this as it is nearly impossible to get two reeds directly adjacent to one another to operate simultaneous properly and, anyway, trim normally is never required simultaneously with another control. It may be necessary to go over all tone pots several times to get everything working most smoothly until you get the feel of tuning the tone pots.

Before each flight check for simultaneous operation of all controls. Whenever simultaneous operation is scratchy or nonexistant it is time to retune the audio pots and pick up that margin of safety to insure many successful flights.

Before making any adjustments always check to be sure that both the transmitter and receiver batteries are supplying proper voltage as low voltage generally shows up first as a loss of simultaneous operation.

Fig. 5 is a cause-and-effect chart which gives some insight into some typical problems encountered with reed-driven servo operation. In general, the resonant-reed systems are very good about holding their adjustments, but since it has always seemed wise to refill the gasoline tank of the family automobile before it goes dry, it also makes sense to know that the two adjustments just covered have a little "gas to spare" before they are non-operable.

ABOUT THE AUTHOR

Age 29, married, a mechanical engineer at McDonnell Aircraft, St. Louis, Mo. In partnership with brother Jack in a new manufacturing venture—Delta Specialties, manufacturers of precision sanders and heavy-duty starting battery systems for the R|C HOBBY. Active in R|C for 8 years, member of the McDonnell R|C M.A.C. served as Technical Director and fall Contest Director during 1965. Contest Coordinator for AMA District VI during 1966 and 1967. Contributed several articles to the McDonnell R|C Publication Carrier Wave—picked up by leading model magazines. Designed Single-Channel Gemini Switcher for GRID LEAKS *about two years ago.*

Notes on B & D

(*Continued from page 19*)

temperature drift is well within the range of the trim pots on the pulse box. A 2N408 and several other types of Germanium transistors should work as subs for the 2N217, but I had plenty of these and used them.

In order to get the same amount of up-elevator and down-elevator, replace R4 in the pulser box. The present potentiometer is a linear taper and you can replace it with a logarithmic taper of the same resistance. It is an Ohmite CB-1031, Newark Electronics number 9F932. Connect a 3.3K-ohm resistance in series with it so operation will be in the part of the curve you want. The result is that you get a 1500-ohm change in resistance from neutral (in the increased resistance direction), and a 1000-ohm change in the other direction. This results in the same pulse-rate change in both directions from neutral, and your airplane now has the same amount of up and down.

The changes have had considerable testing and gave the desired results every time. I recommend installing the capacitor in the receiver even if you do not want to make the other changes since it helps the range —and it might save your airplane.

Seen These?

(*Continued from page 22*)

gines, Inc., 8206 Blue Ash Rd., Cincinnati, O., 45236): Simplifies motor and tank installations. Size shown comes drilled or undrilled for .51, .56, .60, incorpor[illegible] molded-in nose-gear bracket for 5/32 w[illegible] Tank capacity, 10 ounces. Bolts to firewall. Has fill, feed and vent tubes; tank threads onto mount for easy removal, installation. Offset thrust incorporated. $7.98

Straight Edge Sanders (Delta Specialties, P.O. Box 754, Bridgeton, Mo. 63044): Although an ad describes these sanders, only a good picture reflects the cleverness and appearance. We've found it especially useful on ribbed wings where inconsistent rib depths once resulted from a moment of carelessness—to say nothing of breaking ribs with a knee while sanding or ripping out cap strips! Short sanding boards can break ribs; this gadget insures precision sanding. Our sample is red anodized aluminum, comes in handy for checking alignments, too! A great conversation piece. Sandpaper strips, coarse and fine, attach with special cement to opposite sides. Sander shown is 42 in. long, $8.95. Small one called Mini-Sander, 14 in. long, $3.95. These fine tools have many uses: smoothing core wings, truing up balsa sheet edges, etc.

Digimite 4/ and 8 (Bonner Specialties, Inc., 9522 W. Jefferson Blvd., Culver City, Calif.): At $425 complete and ready to operate, former operates four proportional servos simultaneously ($20 extra for 52MC, to be available on 72 MC when and if authorized); latter, $615 on 27, $635 for 52, to be available when and if on 72, will operate up to eight servos simultaneously. Not shown in the picture, the eight has auxiliary control panel [illegible] upper, left, front of case.

Starlite 300 (Sampey & Co., Orlando, Fla.): A three-channel proportional system, with provisions for incorporating additional airborne capabilities, the Starlite 300, meets both Class II and III requirements.

The new tri-channel + system utilizes 80% of the same circuitry of the Starlite 500 quad-channel. Accuracy of surface control servos to centering is stated within 1%.

Three channels control motor, pitch and roll, making the analog system compatible with a great variety of model aircraft. All control functions may be trimmed in flight.

Insertion of an additional servo into the yaw channels can adapt to full-house multi-operation. Additional provisions may be incorporated to allow rudder channel to be disconnected during flight when throttle is greater than three-fourths open. Aileron and rudder control surfaces can be mechanically coupled.

Cost of the complete ready-to-use system, which includes one-watt transmitter, receiver, three 2.4 VDC servos and prewired connector plugs, is $245.00 (less rechargable batteries and charger). Complete system with batteries and chargers is $295.00.

Willoughby CLOU: (Willoughby Enterprises, 14695 Candeda Pl., Tustin, Calif.): CLOU is unique as gliders go, for the kit provides two wings of 75- and 95-in. spans, and a removeable nose section for installation of a .049 to .051 engine. In this manner, the CLOU can be flown as a thermal seeker on tow lines, or with the power in the nose with the 95-in wing; can be flown as an aerobatic glider with power with the 75-in. wing, or without power on the slope with 95-in. wing. Equipped with an all-moving tail, 4- to 6-channel multi equipment is recommended. Fully detailed step-by-step photo instructions. Full description

of the CLOU, together with 20 other radio controlled gliders, can be had by mailing 10¢ in coin to cover handling and postage to 14695 Candeda Place, Tustin, California. 92680. (Please mention GL!) $30.00.

Fuel Pump (C&M Products Co., P.O. Box 98, Blue Springs, Mo.): Nicely made and truly useful pump enjoyed by your editor during '65. Inserts into top of standard (two neck sizes) supermarket plastic bottles. To operate place finger tip over small vent hole in the neck-stopper, and squeeze bulb a few times to establish pressure within the bottle or other fuel container; fuel then flows into your tank. Flow stops instantly when finger removed from vent. No. 6½ pump shown, $2.79. C&M has engine primer, bottle 29 cents —useful, too, for dispensing Glo-Life into venturi of running engines.

Worth investigating are C&M fuel plastic bottle tanks, wing attachment nylon screw kits, nylon screws, shrink tubing, polypropylene hinge material.

Tocsin Reed Relays (Tocsin Electronics, Inc., 1808-76th St., Brooklyn N.Y. 11214): Reed Relays are used in all types of electrical controls because of reliable operation, small size and freedom from contact malfunctions. A reed relay is quite simple, consisting only of magnetically operated set of contacts hermetically sealed inside of a glass tube filled with an inert gas. The sealed tube is surrounded by a actuating coil. Tocsin has developed a new process for making these relays operate with a minimum of power, without increasing their physical size. The Tocsin Model A (SPST) and Model C (SPDT) only require 0.7 ma. at 6-volts (Nom).

Tocsin has encapsulated the relays to protect them from shock, water, fuel and vibration; also uses standard reed switches made by Hamlin. Gordos or G.E.—which have contact ratings of 12va for AC and 10 watts DC. These new reed relays have found acceptance in the industrial electronics field and because of mass-production they can be sold at lower cost than un-encapsulated, higher current units. (See ad in January-February issue for details.)

Monitor

(*Continued from page* 25)

sight into the mysterious world of publishing.

He is frequently vulnerable. For example, one might assume that six people read every issue of GL. Or 10. Or whatever it takes. So instead of 14,000 plus, you could say that 140,000 people read GL. (A king-sized fib for sure.) But we've seen such figures concocted in the past, of a half-million.

GL is proud to have the smallest circulation. And brag about it. It's the kind of people that count. You can't sell acoustical ceilings to Soupy Sales fans on TV. Even more confusing is the fact that the big magazines serve diverse interests, so that the "little" RC specialist should be compared to portion of the bigger magazine's audience, not the whole thing. Then all books seem to have newstand circulation—GL does not. What the manufacturer doesn't understand about fine print statements is that normal expectations of newsstands sales in the hobby field run to about a 50% return. In other words, if you print, say, 100,000 (for the sake of round numbers, and not for comparisons) and put 60,000 of that on the stands, you normally end up with a 30,000 sale. Of course, there are subscriptions too. And special distribution in the hobby shops.

If you peddle half as many copies in hobby shops as you do on the stands, you are doing well. Half of 30,000 in this case being 15,000, we now have 45,000. Add, say 5,000 to 20,000 subscriptions depending, and you've got 50,000 to 65,000 out of the 100,000 printed, more or less. And that's a fairly nice business in the hobby publishing field. Of course, manufacturers sometimes extract the impression that 100,000 printed is actual circulation. Why disturb their bliss? (Published statements are "certified" not sworn to.)

How small is GRID LEAKS? Well, it has almost 100% more subscriptions than *RC Modeler*, and about 75% of the subscriptions of a 40-year old giant like the *American Modeler*. Really. But we stack the cards on these august temporaries who really sell more copies than GL does.

If we pretend you'll see through us—being model builders and flyers. Doffing our caps to all those biggies out there, a salute from the proud smallest! GL prefers to remain a low-key but traditional part of the radio control publishing field. Come to think of it, like Avis, we aren't too proud to be *second* best (numerically speaking).

* * * * *

What's in a name? Eight years ago when this publication was begun, GL was a perfect title. Now everything is transistorized. So why Grid Leaks? Well, anyone gets used to a given name and, if the name grows dated, it is still the handle by which your many good friends know you.

Actually, GL owns more titles than anybody! Model Aircraft World—thought up by John Maloney—is a beaut. Then there is R/C Date Service. With so many titles and cover announcements knocking about, we have more cover decorations than a Russian general has ribbons and medals!

So, sadly, a change should be made.

(*Continued on page* 30)

GRID LEAKS—like a faithful ship flown so well for years—is hung up in the upper lefthand corner of the cover, to remind us of past pleasantness—and good things to come. Use it if you like! For the newcomers, the majority of folks as this hobby continues to grow, we bow to John's gift for coining apt titles, but prefix his old *Model Aircraft World* with *Radio Control*, which is what we all are here for.

We'll all be saying and using GRID LEAKS for a long time to come. We'll also know it is a "Radio Control World."

* * * * *

One of the more inspiring aspects of radio, is the plethora of imaginative, wonderful accessories and equipment. In free flight, one's notion of a nice accessory was a Tatone tick-off timer, or merely a good determalizer fuse! To the control-line man, a good set of wheels, a U-Reely handle, or even just a throttle, was a big deal. To most of those who have lived through the remarkable expansion of radio, today's gadgetry is something out of James Bond. It is hard to get used to—even to believe.

Foam wings and cutting devices. Fiberglass shells. Brakes—electric no less! Steerable nose struts. Enough hardware for a single manufacturer to find it hard to squeeze into his page ads all the things he makes. Nylon screws, all kind of hinges, nice tanks, tubing, quality kits that one almost hates to put together for fear of messing up the box of goodies. It has gotten to the point where a designer is apt to list all the gadgets and pieces he'd like to use for convenience, or fun, and create a ship to accommodate them all.

Kwik-Links. flexible cable and noiseless tubing. Nickel-cads. Chargers. Provided you are good enough (and lucky?) to keep the dream crate in one piece—it's like owning an extra sport car, or your own big airplane—perhaps much better! No wonder it's so hard to think of anything, or anybody, else when you get those sticks under your finger tips and a smooth, bright colored beauty zipping across a clear blue sky.

Readers Write

(*Continued from page* 2)

found out why it works.

The trick is that using this frequency *fresh and not salt water* must be used. The penetration is quite deep in fresh water and the refraction angle of this frequency is such that, even if the sub is too far away, if it's close to the surface, it still works. As to the particulars of my system, the antenna is painted with enamel (black) so that it is not electrically "grounded."

However, there is another more important point, that I use a reed system which must be actuated with a particular frequency signal. Therefore the system will not go haywire if there is a rust spot on the antenna or if the paint is chipped off. The system will just not respond to a command. This will occur if the antenna is over approximately 100 feet from the transmitter. If the sub is closer than 100 feet it will work even if the paint is chipped and the antenna exposed.

I have even operated the sub with the antenna completely within the sub hull but, because the antenna is in a horizontal position relative to the radiation refraction plane (the surface of the water), the response is faulty at certain distances and a given depth of water.

So in short, the antenna works best in a vertical position, and is neither electrically, electromagnetically or magnetically grounded, just partially insulated by the water.

ARTHUR S. MEYER, Cincinnati, O.

THOSE DRATTED WARPS

Since I am trying multi now, I am having trouble building some symmetrical wings. I have built the *Tauri* and then the *Mighty Mombo*. My trouble is warps. Will some of GRID LEAKS readers send in ideas? I would like to know how modelers use warped spars or do they throw them out and cut their own. Also, do they pin the wing structure down to base wood, or do they use a heavy cardboard (½ inch) as I do. I do not know whether it's these warped spars that are doing the dirty work or whether it's the glue drying, or both, that is making the warps. Anyhow I feel sure my wings were straight after pinning down. I have never had this trouble with flat-bottom airfoils.

I'll never buy another model kit until I find a way to overcome this, unless I can find straight spars or a way to build these wings.

I steamed, heated and counterwarper my wings, only to have these wings warp right back in when dry. It appears to me that these thick section airfoils have to have some bricks on them to hold them straight till they dry.

SYLVON WOHEUTOR, Columbus, O.

• *Warps are a common problem. One way to lick the warp is a foam wing—but it costs more and requires its own building technique. Never hesitate to replace a bent or wrongly soft piece of spar or edge material. Balsa often warps in the box, or on the shelf — even when laid flat. A bent piece of wood should never forced into position, or forced flat with pins on the bench. The bench—or work board—should be true, smooth and thick enough not to develop warps in itself. Parts should never be force-fitted into a wing or tail. Never remove the panel from the board until the glue is really dry. (If still wet from wax paper, allow to dry.) If a warp is built into a D-sectioned sheeted wing, it probably cannot be removed. Flying surfaces with a slight warp sometimes can be propped up for an opposite twist and left under weight for a number of days. If warps are steam removed hold the surface with excess opposite warp until cool — don't just come back to true, go beyond it, because the surface will fight back toward the original warp and, if you are lucky, will neutralize*

between the old and new twist. Don't stretch wet silk to the breaking point, especially toward the rear, outer tip. Probably the greatest unsuspected cause of warps is a careless job in joining dihedralled panels. Don't force anything. Be sure things fit and line up the leading—or trailing—edge with the bench edge; many a wing has a degree or two of sweep, either forward or backward according to the builder's mistakes. Jig up the wing firmly, accurately—preparation for assembly is half the battle.

EXUBERANT

I cannot, in any unique way, express my delight and exuberance over your editorial in the November-December issue of G.L. I can only say that I felt good, very good, after reading it. Your explanation and description of what single-channel flying is, put on paper what I have desperately been trying to convey to those who are indifferent.

I am a freshman at Lafayette College and hope to become an electrical engineer. It was because of my hobby that I chose the curriculum I am now in, and I hope that when I finish school I can contribute in every way possible to the hobby.

CALVIN P. ROACH, JR., Easton, Pa.

PLAY BOY? WHAT'S THAT?

A friend of mine recently gave me about a years back issues of GRID LEAKS. It just happened that my December issue of *PLAY BOY* arrived the same day. To date GRID LEAKS has had the upper hand. Enclosed you will find a check for our first subscription to GRID LEAKS. Keep up the tremendous work. Your magazine is a cornerstone of this great hobby.

DUARD MATENKOSKY, McDonald, Pa.

SOMETHING FOR EVERYONE

Just a few lines to let you know that I sure enjoyed GRID LEAKS. I never thought that the help I gave way back when, would result in such a wonderful magazine. GRID LEAKS has something for everyone, whether beginner, expert, or experimenter.

I have several beginners in my North American Aviation Eagles R/C Club, and they get a lot of their questions answered by GRID LEAKS.

If there is anything I can do to assist your effort (it is an effort, I know) please let me know. Keep up the terrific job, it is appreciated by all those who can't afford the expensive and exotic proportional systems.

BOB BOWEN, Torrance, Calif.

(*Continued on page* 32)

ONE MAN'S MEAT . . .

You seem to be leaning more toward the single channel flyer—and I hope this continues. The other magazines are going to the multi-channel pilot, so let's keep GRID LEAKS for the single-channel pilot. I recently bought and sold a multi-channel outfit. Having been a commercial pilot with many thousands of hours, I simply could not get used to jumping all over the transmitter to give the various control signals. I have gone back to the single-channel pulse-proportional, via the Controlaire GG Transmitter, SH-100 receiver, Andy Wright Decoder, Reynold's Proportional servos and a modified Duramite for motor control. The control function is beyond belief, exactly what an old pilot needs, but only time will tell how the unit will hold up for durability. This system is, in my opinion far superior to the multi-channel.

I must agree with Mr. Arnold Curtiss of New Zealand re his reference to the *Airknocker*. Having built and flown one on plain single-channel, I know what he means. Am going to build another one this winter, and use the above equipment and a Cox 15 RC. Think this will have a marvelous glide but be as wild at full throttle as the modified Jenny (modified by removing some of the wing incidence closer to 1° for pulse) with a McCoy 35 in the nose.

As your G/L Report in this issue on the Citizenship Proportional and the McCoy 35 points out, this McCoy 35 is probably, along with the McCoy 19 RC, the best buy and performing engines on the market, particularly in view of their cost. Anyone over looking these two are making serious mistakes. Can't see spending twice as much for an RC engine that doesn't idle as well, and respond as well when you open the throttle.

BOB ROSE, Kansas City, Mo.

• *GL is not a single-channel magazine! Because the popular press is so multi conscious, GL's balanced coverage of all kinds of radio, and models, makes it the leading exponent of single-channel. Actually, the staff primarily flies multi but believes in screening contributions for both quality and variety. If every reader was required to spend $1000 for ship and equipment as the price of participation, the magazines would go the way of the gas tube.*

Covering

(*Continued from page* 18)

and quite a few hours of careful working to instructions. But measured against the repeated coats of dope applied to silk, with the wait for each to dry, it saves considerable time and, the bigger the area to be covered, the bigger the saving. Avoiding that first coat, or two, of clear on dry silk is a bonus in itself! While MonoKote will take double curvatures, the larger flat or single-curvature sections —as on fuselage sides or on wings, go faster, with more time, relatively speaking, being spent on small-radius double curvatures that require progressive working with the iron, and hand.

Exactly how much time can be saved, we cannot say. But if filling, color doping and finishing are included, it could—as a wild guess—be 50 percent. Top Flite says 75 percent. You can do it in less than a day with MonoKote, but *at least* two days is required for the completely finished and painted silking.

MonoKote applies suitably to either the solid or skinned structure, or to an open frame. Trade-show demonstrations included covering of a Nordic-type wing, which is much lighter and less twist resistant than sturdy radio wings.

It is surprisingly light. At deadline GL was unable to make actual weight comparisons of identical surfaces covered with silk and MonoKote but can say that th stabilizer so hurriedly covered, was sur prisingly light, and definitely lighter than what would be anticipated with color-doped silk. Comparing both materials dry is meaningless, since most of the silk covering weight comes from the doping, which involves an absolute minimum of five coats, probably six, and usually closer to ten before the job is done.

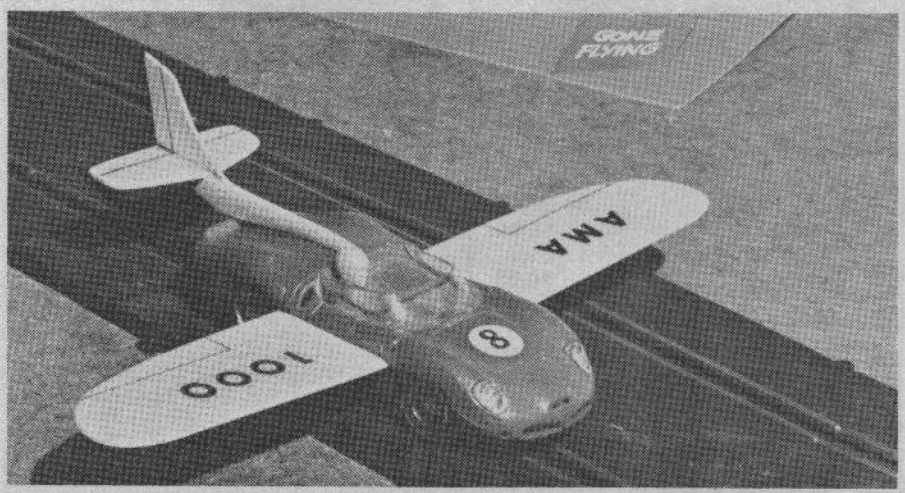
Patching is easy. Due to the strength of MonoKote, obstacles that ordinarily jab holes through silk, in this case, make dents. These remove with a hot iron. Actual tears can be patched with pieces of material, bonded and shrunk as before. Trimming is accomplished by bonding the desired color, cut-out material, to the base covering.

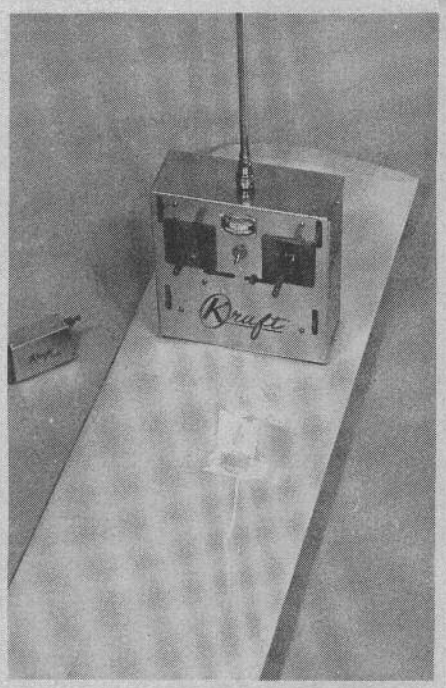
It is embarrassing to repeat manufacturers claims for any product, yet despite the many glowing claims made for MonoKote the promotional statements do appear to be specifically realistic. Not all builders go along with things so revolutionary and many, no doubt, will stick to their familiar silk and dope. Many, we suspect, will go MonoKote.

Indicative of its plausibility to the builder is the fact that pro-and-con discussion narrows down to just one point: cost. This is so because the one thing that catches the eye is the "high" price per sheet, where the consumer is conditioned to thinking in terms of a maximum of $1.50 per square yard of silk—but less dope. MonoKote, costs more than twice the price of silk alone. Agreement quickly follows that it is not significantly more costly than silk when the price of finished covering jobs are compared.

If we assume that a difference between the two raw materials runs to roughly $5 for a big aircraft, most of the difference will be dissipated by the cost of clear and colored dopes, and fillers if you use them.

If this new material offers a better finish, greater strength, and a saving in time, the cost will give pause to no one.





SLOTS OF FUN

Pete Moss, (no relation to Stirling), darling of the slot race set, has quit racing. He claims it was because of his big wreck at the Hobby Trade Show. Pete popped his slot in the hairpin. It was bloody awful. A three-quarter inch scratch on the bonnet of his Lotus.

Pete had been in the same groove too long—was ready for a change—for some real excitement—for flying a model airplane.

Pete never got off the ground in his first model airplane contest. But, now he is on the right track, has joined the Academy of Model Aeronautics.

Retired slot racers attention! Pete Moss says, "For real speed, thrills, satisfaction and attention—build a model airplane and join the AMA."

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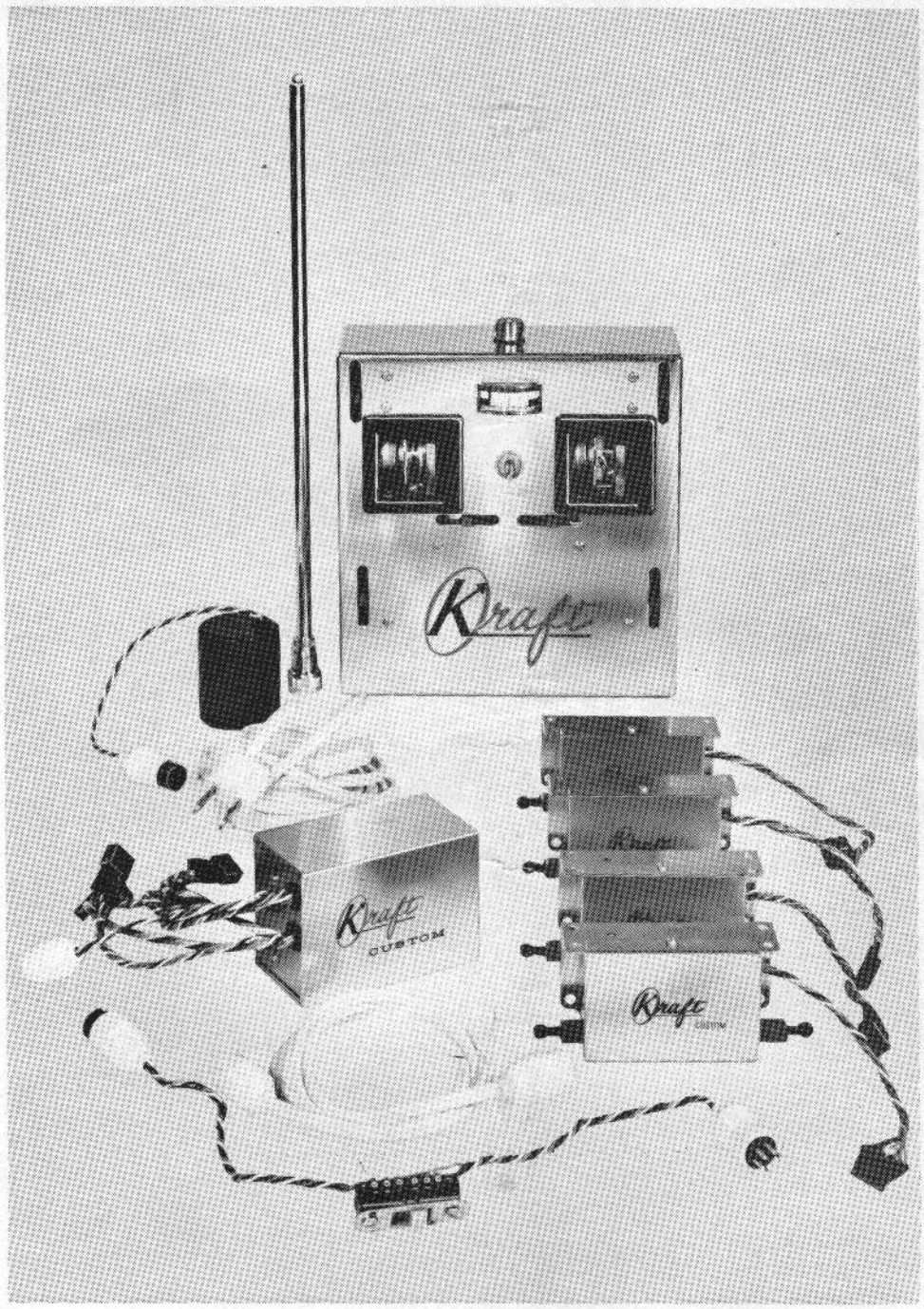

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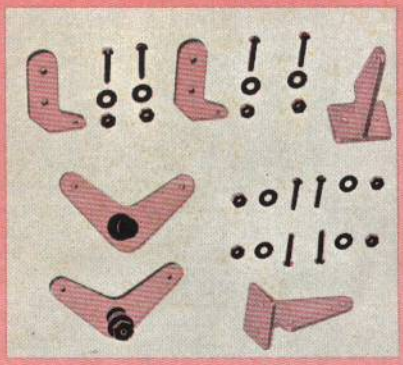

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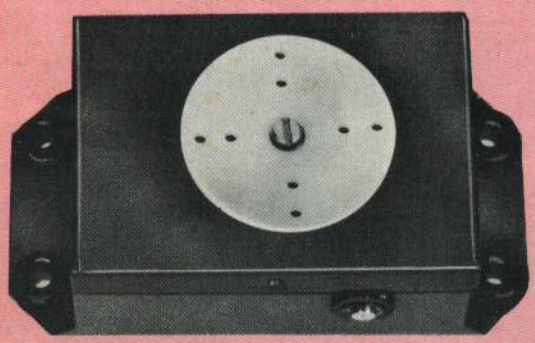
All necessary mounting hardware
Cat. # R-35 . . . . . 95¢



The finest single channel servo available today. The combination of Royal Model No. 7 and No. 7A gives the single channel flier *positive* rudder control plus three position throttle. Each servo measures 1⅞" x 1⅜" x 1" and weighs 2 ounces. 3 pencells power the entire system. Price of each servo is $14.45.

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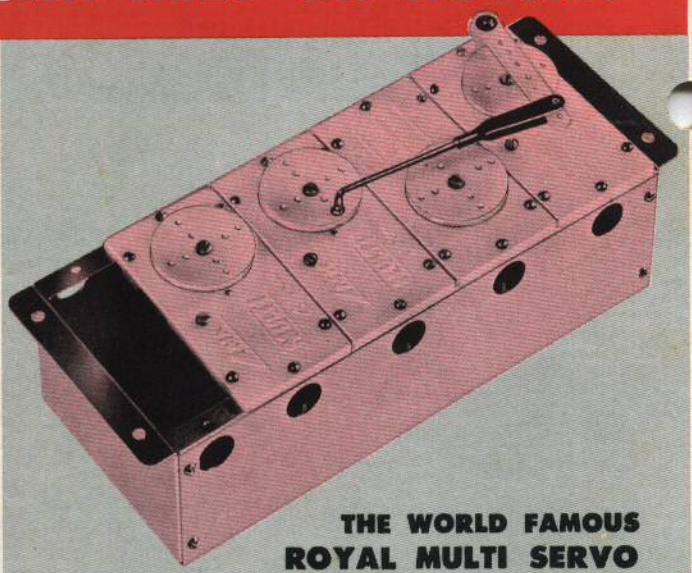

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RMK-S Servo Tray, Trim Bar and Hardware
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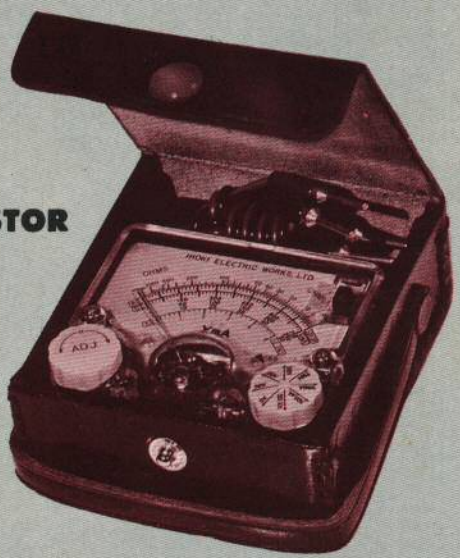

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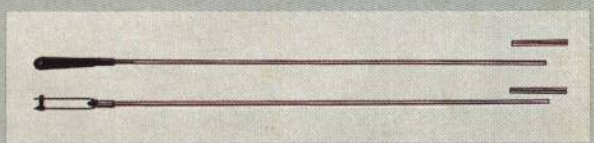

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