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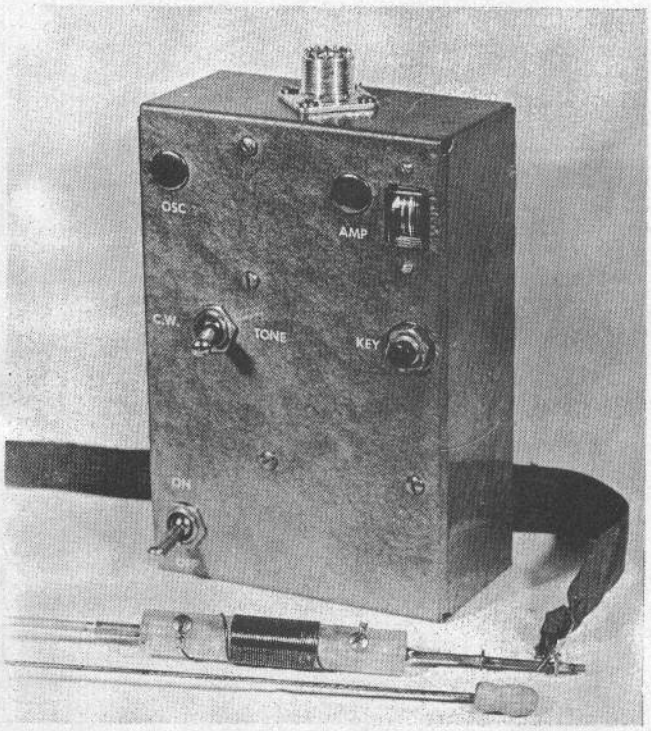


TRANSISTOR TRANSMITTER FOR SINGLE CHANNEL

Fig. 1--Finished Tone-C.W. transmitter enclosed in a 2 x 4 x 6 radio chassis.

IN THIS DAY AND AGE of rapid transportation and jet mobility the modern man has shown a desire to unshackle himself from all binding elements. Look around and observe the increasing numbers of hand-held transmitters. The ground-based modeler asks himself, "What do the hand-held jobs have that I don't?"

I asked myself this question and found it hard to break free from the old arm-breaker of a transmitter. Finally came the realization that there was no real need to be able to control a model airplane at 5 miles distance; after all, I couldn't see that far.

Recent developments have made available power transistors that operate well into the VHF region. Using this as a start, I set out to see how small and light a power transmitter could be built. The following article and illustrations attest the end results of a design, proven in contests and throughout the 1961 season, that is versatile, light, but powerful enough to control a model as far as is practical to see it. Most of all it is mobile, so you can walk around during a flight, or move to a more favorable loading area.

This transmitter is contained on a single printed-circuit board measuring 2 inches by 3 inches, including a tone modulator. Basically, the transmitter operates using a 3rd overtone crystal oscillator of conventional design for RF excitation. Final amplifier design is a grounded-base type operating at 27 megacycles. This amplifier has advantages and disadvantages: (1) It requires considerable RF power drive; however, (2) oscillator power is not lost and appears at the antenna, (3) grounded-base amplifiers require no neutralization; thus, a simple and straight-forward transmitter is born.

Modulator design is conventional to radio amateurs, but not to modelers. A grounded-base RF amplifier was found to require power modulation. In order to accomplish this with low-power transistors required a separate tone generator multivibrator to insure modulator saturation.

Figures 1 and 2 illustrate the finished Tone-C.W. transmitter encased in a 2 x 4 x 6 inch radio chassis. Refinements such as an inexpensive meter are included to monitor the antenna current as an instant, visual indicator of output. Figure 9 gives detail dimensions for all of the necessary case hole drilling operations.

Figures 3 through 8 show the electronic features of the transmitter including detail information on the printed circuit board. Note the shield and bracket, Figure 10, that provide RF shielding between the oscillator and the amplifier. The bracket also supports the printed-circuit board on the case and supplies one other very important function — transistor heat sinking. Remember, we are dealing with power transistors here; while they deliver considerable power, they must also dissipate some power. Effective transistor heat sinks are essential, lest the transistors unsolder themselves. The aluminum devices holding TR-1 and TR-2 do a good job; they are also "hard anodized" for electrical insulation to prevent shorting of the electrically "hot" transistor cases to ground.

TR-1 and TR-2 are standard military cased transistors and are constructed with a key protruding from the case weld flange near the emitter. This key must be removed by snipping and carefully filing smooth to facilitate a clean fit into the heat sink.

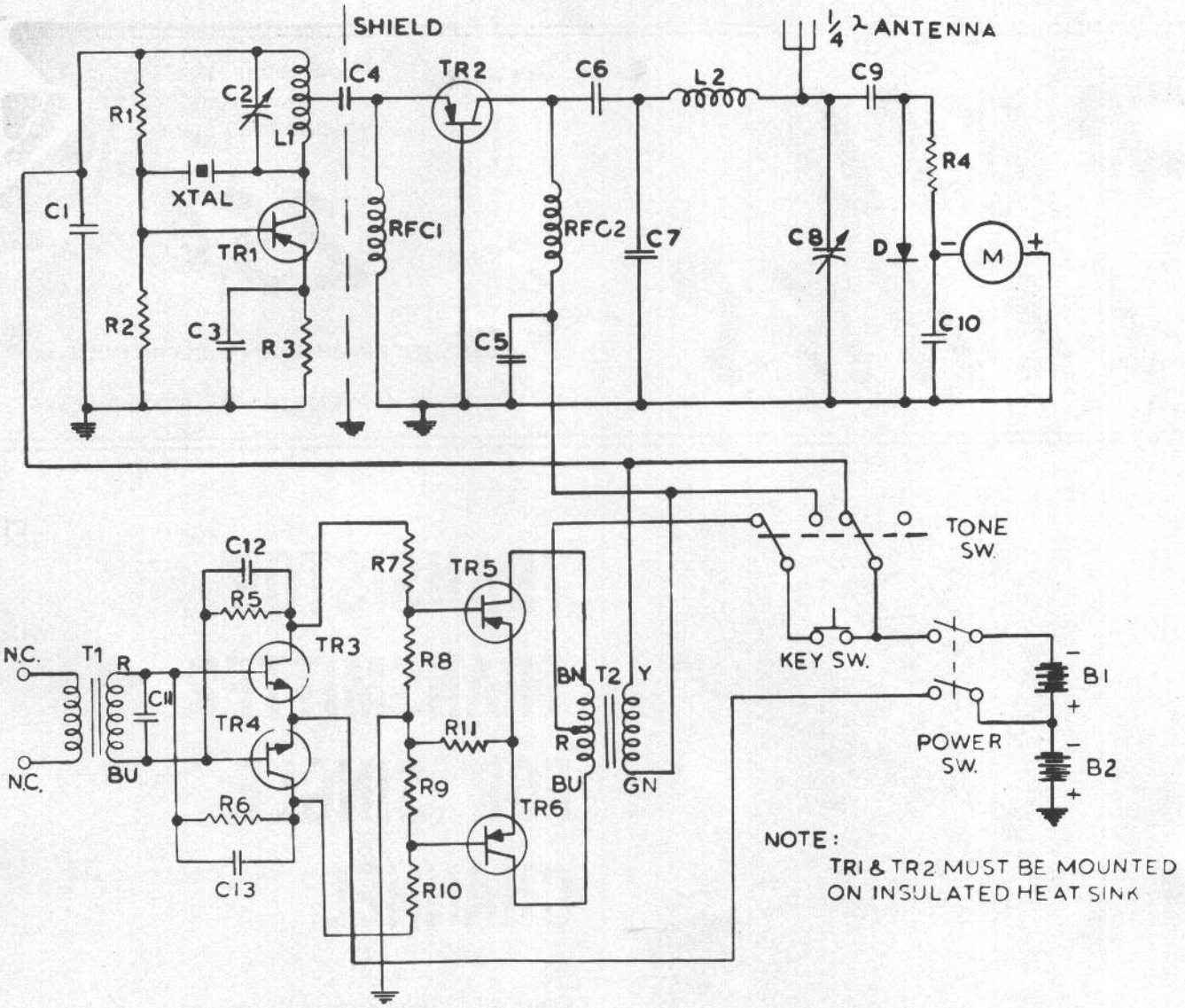
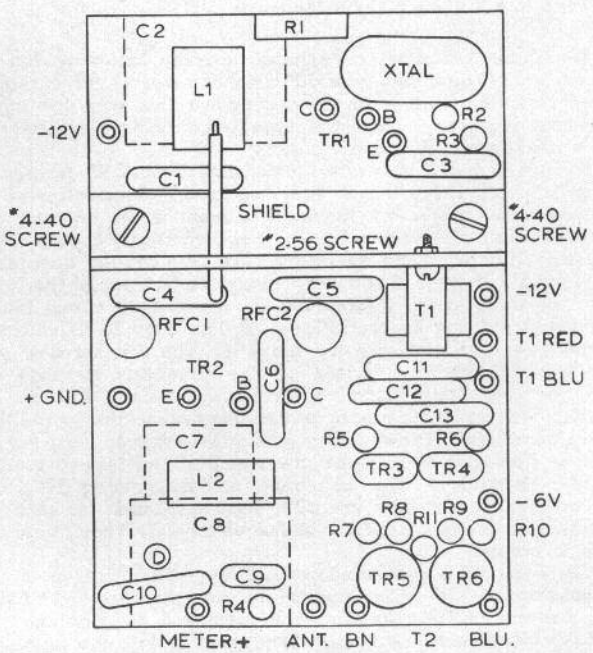


Fig. 3--Above. Electrical schematic. Fig. 6--Below. Component placement. Uses third overtone crystal.



Be sure to use a good ohmmeter between TR-1 and TR-2 collectors and ground to test for several megohm insulation resistance after securing the transistors, heat sinks, and bracket together.

A great deal of work was required to optimize the antenna. For good radiation it needed to be a center-loaded whip antenna; it also had to be very light to balance with the light-weight transmitter. Various arrangements were tried with commercial telescoping antennas, but they were found to be too heavy. As a consequence, the ultra compact telescoping features had to be sacrificed. Figure 11 and Figure 1 (in foreground) show the result.

Constructional features are detailed below: (1) Small wooden knob to keep you from lancing your fellow modeler. (2) 1/16 O.D. music wire. (3) Slight bends in wire to provide a tight slide fit in lower brass tubing. (4) 1/2 inch O.D. polystyrene rod to support antenna sections and loading coil; bore each end with a 5/32 inch drill, 3/4 inch deep. (5) Nest together and solder brass tubing 5/32 O.D. x 3/4 long, 1/8 O.D. x 3/4 long, 3/32 O.D. x 2-3/4 long, and insert into (4). (6) Small flat washers soldered to (5) to retain wind flag. (7) Wire loop to hold wind flag. (8) 1/8 O.D. music wire. (9) 5/32 O.D. x 1-1/4 long brass tubing soldered to (8) with 3/8 inch of tubing overhanging wire; insert into (4). (10) Drill and tap for 4-40 screws through both polystyrene rod and brass tubing. (11) 35 turns of No. 22 magnet wire close wound (allow one turn additional on each end to wind off and meet the 4-40 screws); connect coil ends under screw heads. Cement coil to (4) after winding. (12) PL-259 coax connector. (13) 25/32 O.D. polystyrene rod 1/2 inch long bored with 1/8 inch drill; push on to (8) and into top of (12), cement. (14) Ream out contact of (12) with 1/8 inch drill; insert and solder (8).

Initial transmitter tuning involves the temporary use of a 50-milliampere meter in the -12 volt lead to the final amplifier. Grounded-base amplifiers do not draw current unless they are

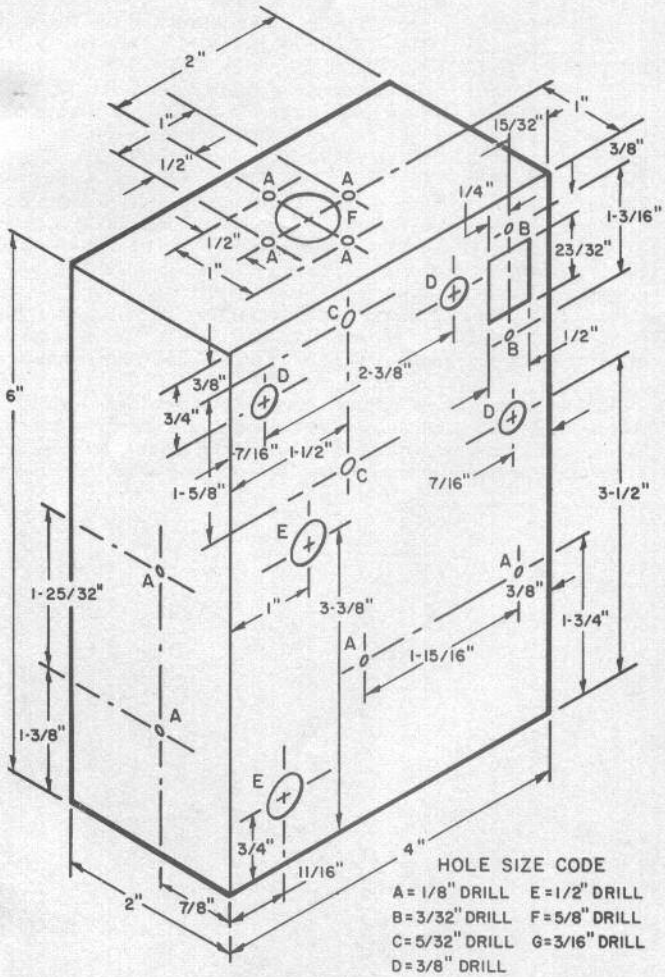


Fig. 9--The case hole locations; keyed hole-size code.

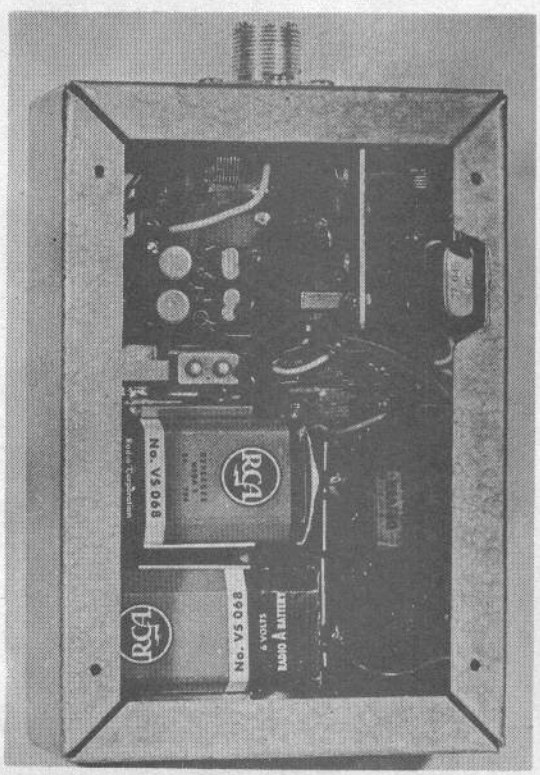
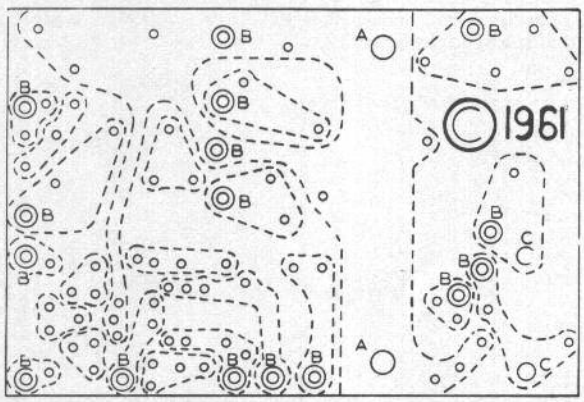


Fig.2--Exposed rear view. Transmitter is contained on single printed-circuit board, including tone generator.

Fig. 4--Top. Fig. 5--Below. Actual size P.C. board.



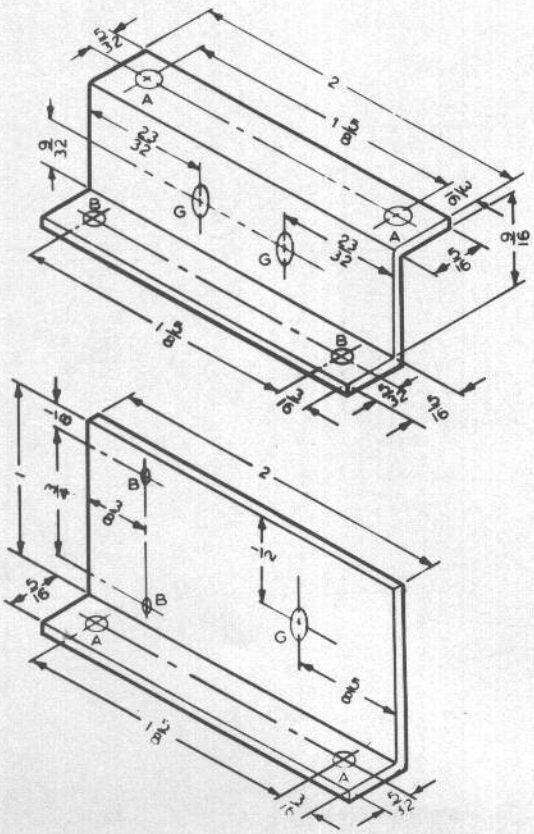
HOLE SIZE CODE

A = $\frac{1}{8}$ DRILL

B = $\frac{3}{32}$ DRILL, STAKE IN EYELETS (16)

C = $\frac{3}{32}$ DRILL

ALL OTHER HOLES #60 DRILL



TRANSISTOR TRANSMITTER

being driven by RF oscillator power. In all probability, the oscillator will be operating when you first try it; however, this is readily checked by tuning the oscillator for maximum final amplifier current. After this step, assemble the transmitter complete with antenna, and tune the final amplifier for maximum RF indication on the output meter.

One other variation to be considered is that by substituting a 15-henry choke, capacitors, and switches for T-1 and C-11 a frequency stable tone generator is available for the non-simul reed modeler. Details of this type circuitry are readily available from technical model periodicals and will not be expanded upon here.

One final note that cannot be over-emphasized, all transmitters using the Class C citizen band *must* be frequency checked to FCC specifications by a qualified Commercial Radio license holder. Modelers who fail to do so, only endanger the use of these frequencies for all of us. The transmitter illustrated in this article has been checked and the certificates attached to the rear of the case. In fact, the frequency chack showed these units to be operating well within the ± 0.005% tolerance, almost on top of the specified frequencies.

PARTS LIST

All resistors 1/2 watt carbon 10%; R1, R5, R6 — 47 K; R2 — 18 K; R3 — 100; R4 — 33 K; R7 R10 — 470; R8, R9, — 1 K; R11 — 4.7. C1, C3, C4, C5, C6, C10, C11, C12, C13 — 0.01 mfd, 500 volt ceramic, 9/16 inch diameter (Erie type ED); C2, C8 — 5 to 80 pfd mica trimmer capacitor; C7 — 100 pfd silver mica; C9 — 10 pfd ceramic. Crystal — 26.995 megacycles to 27.255 megacycles crystal (Ace). TR1, TR2 — 2N1143; TR3. TR4 — 2N1059; TR5, TR6 — 2N270; D — 1N116 or 1N295. M — Lafayette TM 12 meter. Rfc1, Rfc2 — R-33, 50 uhy; L1 — Miniductor 3007, 11 turns taped at 5-1/2 turns; L2 — Miniductor 3007, 7 turns. T1 — Lafayette TR-97; T2 — Thordarson TR-66. B1, B2 — VS 068 battery. Case: 2 x 4 x 6 aluminum chassis (Bud No. AC-431). Crystal socket (Ace). Switches: 1 — DPST; 1 — DPDT; 1 — push button key (Ace). Battery box: Acme No. 12. Transistor heat sinks; 2 — No. 1101A (Thermalloy Co., Dallas, Tex.; available at Lafayette Radio). Antenna: SO-259 and PL-259 coax connectors; 1/8 in. and 1/16 in. music wire; 3/32 O.D., 1/8 O.D., and 5/32 O.D. telescoping brass tubing; polystyrene rod (see text). Miscellaneous 1/16 in aluminum sheet for printed circuit board mount, shield, and rear cover; printed circuit board (Ace); screws, nuts, lock washers, sheet metal screws, eyelets, and wire as required.

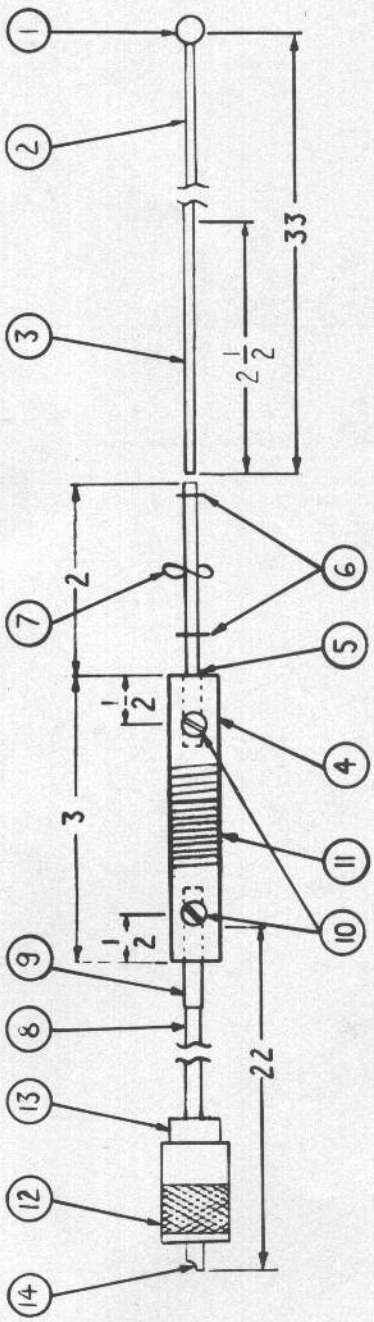


Fig. 11--Antenna assembly.

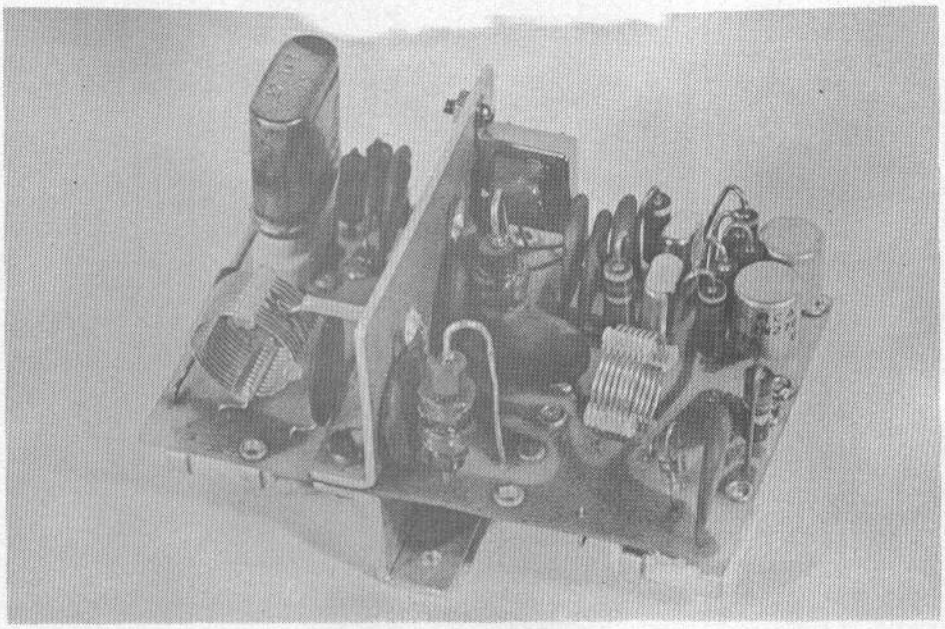
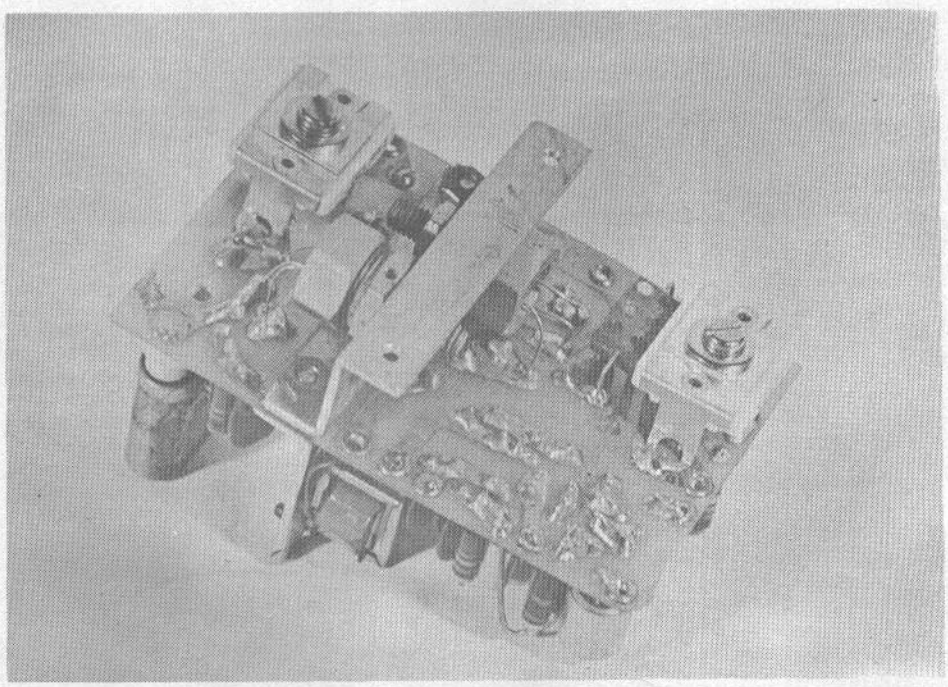


Fig.7--Above. Top view of assembled electronics: Fig.8--Below. Bottom view.



Kraft Relayless 3 V Receiver

HERE IS ONE OF THE MOST EAGERLY AWAITED CIRCUITS GL HAS PUBLISHED

With the increasing interest in Compact type aircraft lighter and smaller R/C receivers of the relayless type have been moving to the front.

Now, to meet a need for the home builder, the Kraft 3VK is ready to go. Offering small size, 3 volt operation, this unit offers the same reliability that the other Kraft units have gained in the field.

Using special Philco RF transistors, this unit matches the reliability and dependability of the vaccuum tube types. This, plus fewer components, means it is an ideal unit for the scratch or kit builder.

And with the addition of a simple Add On Switcher, it offers SPDT relay type action for use in pulse or quick blip applications.

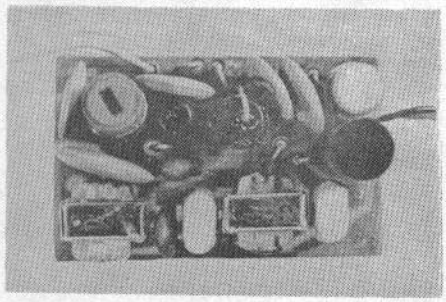
As with all receiver and transmitter kits, the unit requires attention to careful soldering because of its small size, but it is not so small that magnifying glasses are needed to construct.

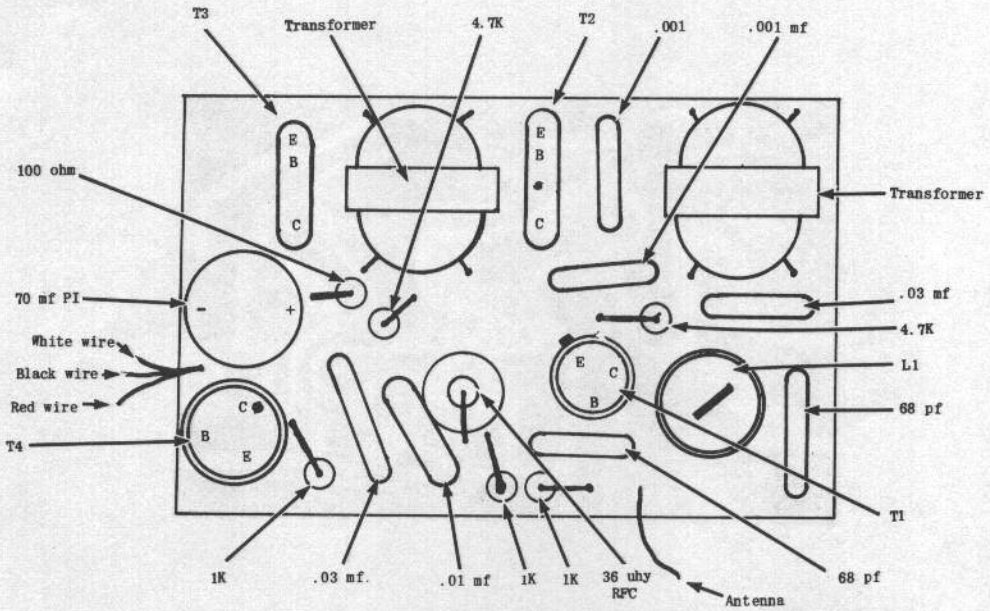
Tune up of the unit may be done by putting a 12-15 ohm resistor in series with a #48 pilot lamp wired across the escapement. Simply tune for maximum brilliance. When using this as a tuning device, make sure to make provisions to disconnect, since with it left on, range is impaired.

We predict the K3VK receiver will score a hit with the modeller, not only for its ease of construction, but also for its reliability.

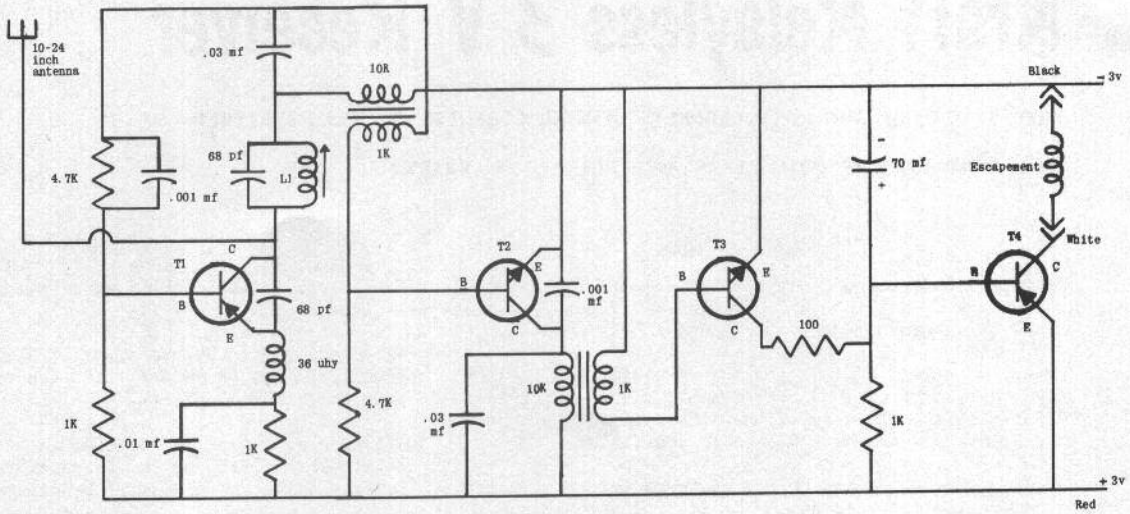
All parts, except the special transformers, are available. The first batch of transformers is being used in kits only, and none will be offered for sale separately.

THIS PHOTOGRAPH IS FULL SIZE

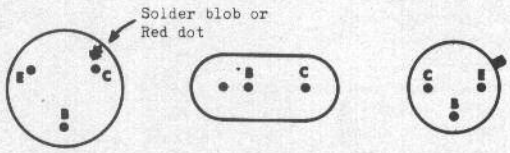




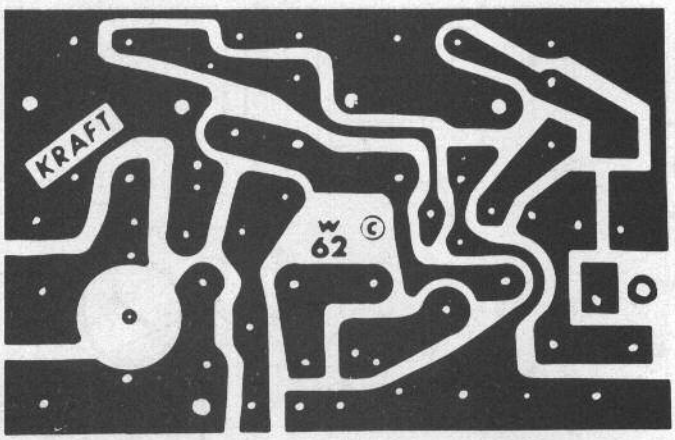
HOLD DRAWING AGAINST STRONG LIGHT. ON THE OTHER SIDE IS THE PC BASE. THIS WILL GIVE A PARTS PLACEMENT GUIDE.

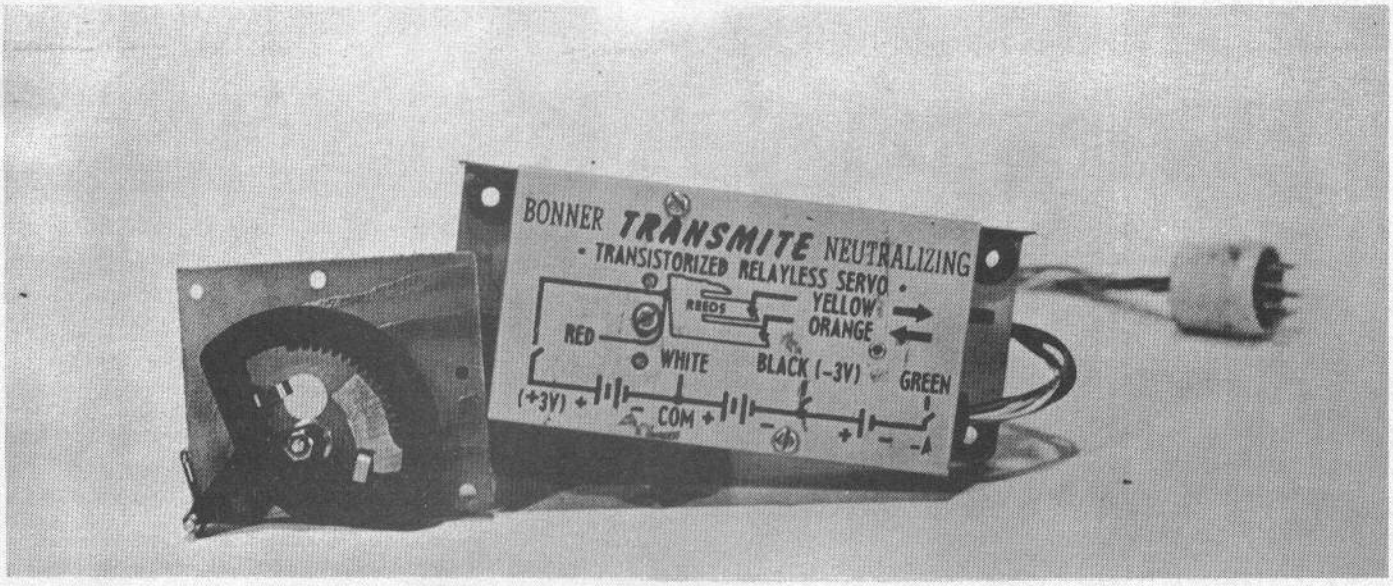


T1--T6058
T2--2N229
T3--2N229
T4--T1046 (2N224)
L1--5½ turns #26 on ¼ inch form



Transistor lead placement as viewed from the bottom.





Max Boal's version of Pike elevator switcher using Transmite servo.

Improvements on Pike's 5-Position Servo

READERS SAY THIS IS A TERRIFIC IDEA!

THE TRANSMITE SWITCHER by Geoffrey Pike, in a recent issue of GRID LEAKS, (Volume III, No. 5), created quite a stir of interest among readers. Many reports of good luck have been received, and we'll share them with you. First, however, an improvement from Mr. Pike:

"Here's the latest on my 5-position-aileron, 5-position-elevator, 10-channel equipped Orion. Have now altered the change over 'channel sharing' switch as shown. This is far better. Low-speed spins and taxiing are still possible, yet I have ben able to add yet another elevator position, making 6 in all. This is achieved simply by adding two spring-leaf contacts to the elevator switcher as shown, so that the circuit is broken as soon as the brass tube slides from between them.

"The 'fast' motor wire from the motor-speed servo is then tapped and connected to the 'down' wire on the elevator, but through this new switch.

"With the switch adjusted for about 2 degrees down elevator, it is now the easiest thing in the world to fly down to almost zero feet by simply keying the fast motor button! This produces a really fast and very shallow descent, and whenever the button is released, the plane smoothly starts a very shallow climb."

From Don Baisden, down Georgia way:

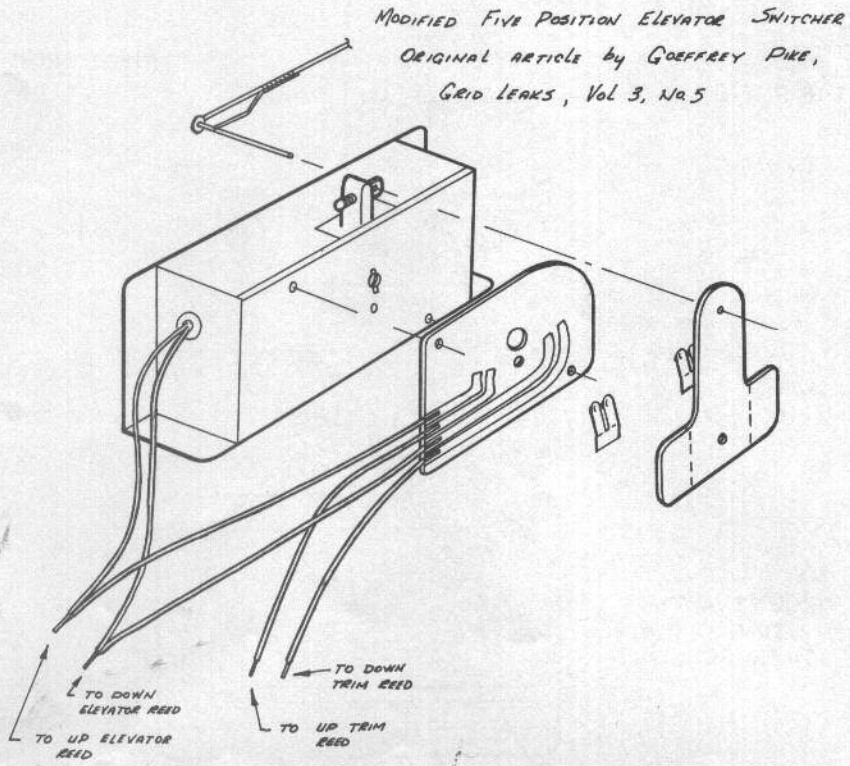
"I built one of Mr. Pike's 5-position elevator gadgets and have used it on an Astro and an Orion; this thing is strickly terrific. Mine was similar to the one shown in the article on his aileron servo. Since this one was non-adjustable I started out with more throw than I needed and trimmed the PC board till I got the amount I needed.

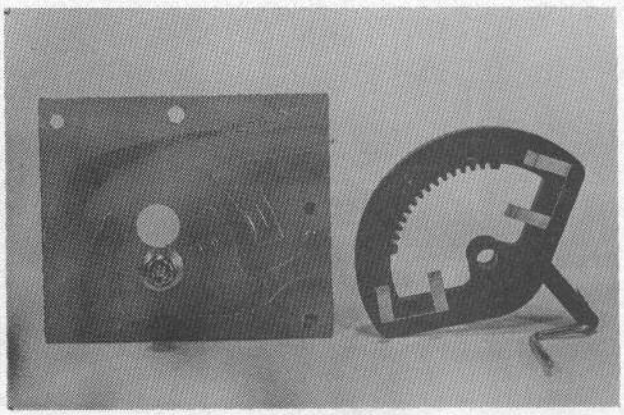
"Al Pinson, who is probably the best competition flyer in the Southeast, put three flights on my Orion and is very excited about it.

"This all leads up to the question why not get Mr. Pike to redesign his aileron-type unit to make it adjustable and make it available to the modeler in a simple kit? The advantage of the aileron type is that everything mounts on the side of the servo and only takes up about 3/8 inch of fuselage width and gets away from the knitting needle rig and linkage.

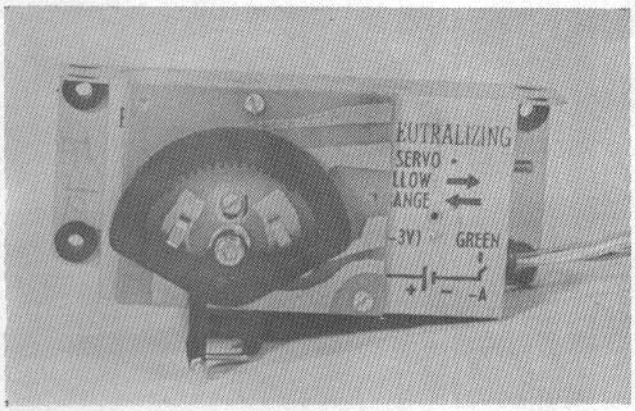
"Al says that properly adjusted, this thing would be a tremendous asset in competition, as well as being good for beginners, since the airplane can be flown on this entirely. Mine was set for a very slight climb while inverted, which kepes the nose from dropping during the inverted eights. Up trim provides the prettiest loops you can imagine; the plane *flies* through them without the speed dropping off greatly, perfectly round and without loss of altitude."

Below. Modified 5-position elevator switcher showing wiring hookup.





Details Boal's printed circuit board for aileron servo.



Switcher placed. Max uses for full rudder and 1/3 aileron.

From fellow KC/RC member Max Boal:

"Here is the new 5-position device with some information you may be able to share with GRID LEAKS readers. I installed one of these on my aileron servo, then hooked lands 3 and 4 to the rudder servo. This gives full rudder, (which I cut to minimum throw) and about 1/3 aileron throw. The airplane will still spin, but the coordinated rudder-aileron turns are smo-o-oth and gentle.

"As Mr. Pike says. the surface in the 1/2 or new position does pulse a little bit, but this is not detectable in the air. I think this is a beautiful and simple approach and I'm sold on it. I want to thank Mr. Pike for the idea.

"Here is how I set about making my unit:

"Drill hole Z with No. 44 drill and countersink hole on back side for 2-56 x 1/2" long bolt. Blackwell Torque Rod Bearing is tapped with a 2-56 tap, then is cut off to 1/4" plus just a little! Then it is screwed on to 2-56 bolt in hole Z.

"A Bonner Servo Sector is drilled with a No. 26 drill at hole X. Also drill new holes with a No. 52 drill at point Y and point C on elevator servo.

"Break center contacts off of new sector gear and install on Torque Rod Bearing, securing with washer, lock washer and nut. The contacts should match PC lands on board, shown in full size.

"Bend 1/16" wire as shown in sketch, and install in new sector gear by soldered washer top side. This is at Y on the new sector. Bottom part will fit into newly drilled hole C.

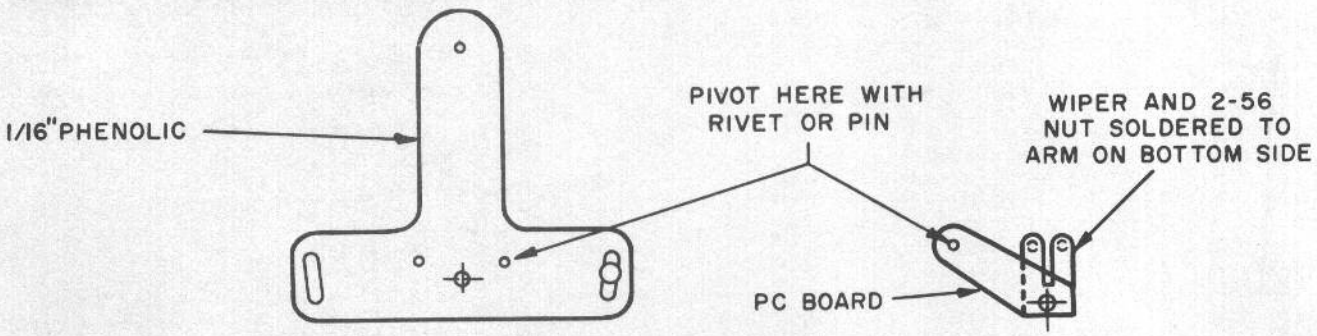
"Prill PC board at points A and B with No. 32 drill and drill a 5/16" hole at Q. Remove A and B screws from Transmite and install the new device using No. 2 self taps. If these strip out, simply go to No. 4 x 1/4".

"Trim now becomes 1/2 or new elevator positions. Trim or cut PC lands 3 and 4 at points T with an Exacto knife for the amount of movement wanted. Take this slow and cut only about 1/16" at a time.

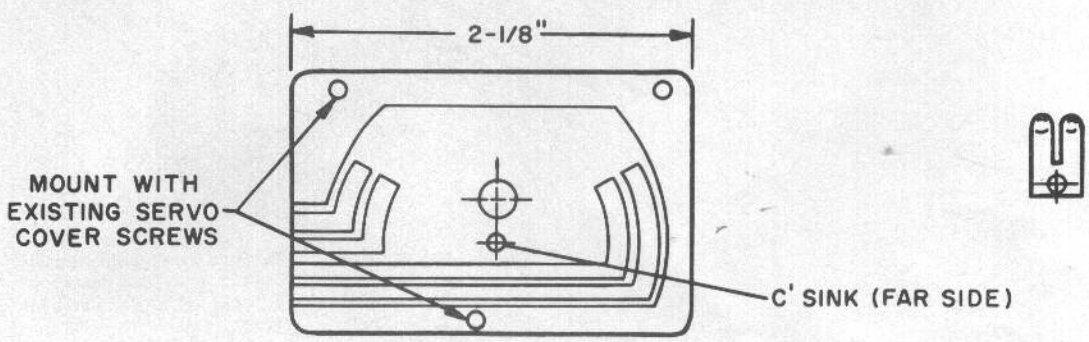
"If some of the flyers want to try this device but can't or don't want to make it, I could force myself to make and sell them!"

Thanks Goeff, Don and Max. Any more comments anyone else would like to add? Sounds as if Geoffrey started something. In the concluding paragraph of his letter Geoff makes the following comment:

"Have probably explained this thing a little poorly, but can assure you that it all works beautifully and 'full proportional' had better be really good if it's going to beat this simple but proven setup!"

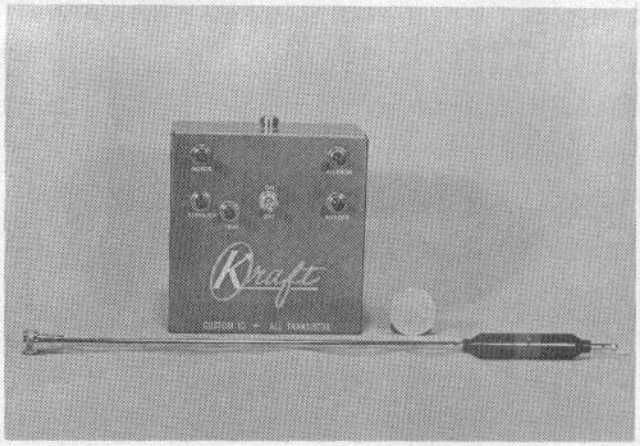


ADJUSTABLE FIVE POSITION ELEVATOR SWITCHER



What's New

KRAFT 10 SIMUL TRANSISTOR TRANSMITTER



This little package packs a potent wallop, much more than you'd expect from something this small. Extensively tested under actual flight conditions, this small unit packs more punch than vacuum tube version. This is due to a very efficient design, which allows the ultimate from every component. Especially graded and selected transistors by Philco make this dream transmitter a reality.

Imagine a package only 6¼ x 3 x 6, weighing only 3 pounds 12 ounces, giving ten channels simultaneous operation from an inexpensive 9 volt battery outperforming almost all vacuum tube types! Center Loading of the antenna makes the 26 ma at 9 volts punch into the air the signal you need to override interference.

Available on a custom built basis only. Each unit is checked out under the supervision of Phil Kraft--and guaranteed to meet his specs--or it is not shipped.

We urge you to get your orders in for these custom built jobs. This KTTx10M, designed for the Kraft Custom Superhets with the Medco reed bank cps, will be THE R/C multi transmitter of the sensation of 62.

Drop shipped from California--deliveries in 3 to 4 weeks after placement of order. Price is only $118.50! Order KTTx10M.

This unit will not be offered in a kit form until 1963. Circuit is copyrighted and will not be published until kit is available.

NEW PRICE ON TRIPLE 10 KIT

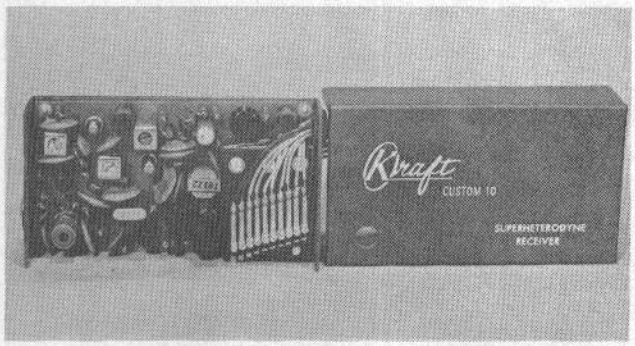
NOTE--This unit does not obsolete the 10 channel Kraft Triple Kit. This will continue to be available for both the Deans and Medco Reed Banks. But, and this will be good news, due to quantity purchasing, the price has been reduced. Now only $87.50! Order KT10K-D or KT10K-M for either Deans or Medco reed bank use. Available in 26.995. 27.145 or 27.255 frequency. Please specify.

CENTRALAB TRIM POTS

ACTUAL SIZE

Extra small, these trim pots are just it for PC or other work. Use in circuits where a value needs to be exactly determined for best performance. Small enough to leave in the circuit. See drawing--this is full size. In 10K and 25K resistance. For 10K order VR10KPC. For 25K order VR25KPC. Price each 69¢.

KRAFT CUSTOM 10 SUPERHETS



Also rolling from the Kraft production lines on a custom basis, the tops in the R/C field--these Receivers are going to make a big dent in the 1962 showing. Designed by Phil Kraft, debugged by some of the top R/C men in the country, these units are now rolling from the Kraft production lines, as well as the servo switcher. Tested under the personal supervision of Phil Kraft, they are tops! For the completely built up receiver units, order EKR10SH--$89.95. For the Hybrid units, with all the alignment done, and only the audio section transistors, transformer and reed bank to be wired, order EKR10SHK, only $74.95. For the servo switcher, giving 3 neutralizing and 2 trim actions, designed to piggy back on foregoing receivers, custom built. Order EKSS10, only $69.50

HYBRID FRONT ENDS ONLY

For the do it yourselfer, who wants to build a super monitor, use this as front end for proportional (Dick Jansson will present papers on this at DC/RC Symposium) completely aligned front end, but no reed bank or audio parts--you take it and go with it from the RF section any way you want! Complete with case, tested. Order KHFE, only $44.95.

COMING -- MARCY FEED BACK SERVO

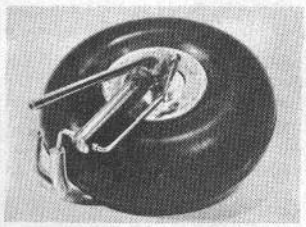
Coming Soon--The Marcy Feed Back Servo. Designed for the do it yourselfer, it will also be available in a Custom Built version.

Compatible to many existing feedback units on the market, and more which will appear, this unit also may be used with relay receivers, with only a few extra components, to give true proportional without flapping of the surfaces, and drawing current only while in motion!

Unit utilizes six transistors. In the kit form the gear train is assembled, and only the PC wiring and the hook up to the motor remains. Price for the kit will be $27.95, completely assembled $32.95.

Remember this is a COMING SOON item, and is not being announced as ready!

BLACKWELL WHEEL BRAKE

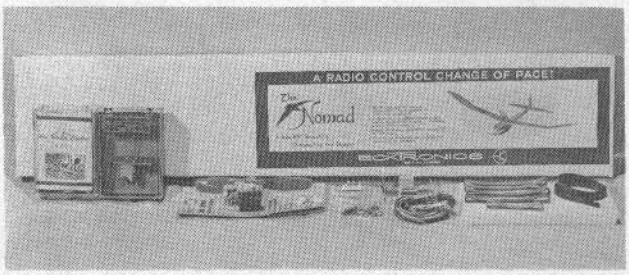


A drag type external brake, that has been engineered and tested by modeller Rob Blackwell provides braking sh ws the simplicity of the unit, but is is dependable and very utilitarian. Order BB#1, only $2.95.

R/C PLANE PACKAGES

Several years ago Ace offered a popular package, which had to be dropped, but demands from the field insist that a similar package be made available again. So we're offering not one but two! These units are complete except for liquids AND TRANSMITTER, and offer the beginners an easy approach to radio control, because the parts have been picked to make it unnecessary to do a lot of extra shopping.

NOMAD PACKAGE #1



Contains the Ecktronics Nomad Kit, Cub .024, K3VK Kraft 3 Volt Relayless Receiver Kit, Switch, Hardware, Hookup wire, Babcock EM1 escapement, everything you need for R/C fun except dope, cement, and transmitter. Order NP#1, only $28.50.

IMPORTED NICAD TRICKLE CHARGER

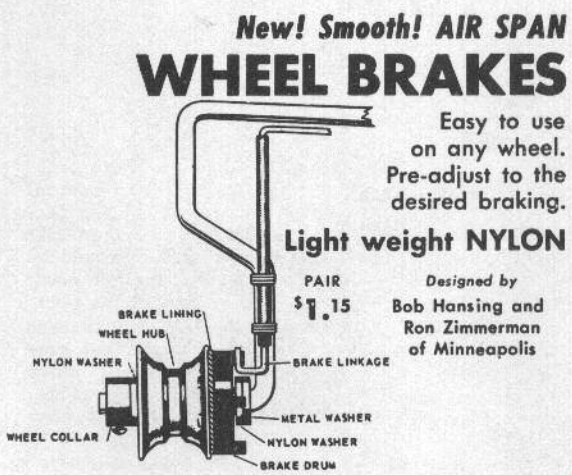
In conjunction with World Engines, we are able to offer a small nicad charger, designed for trickle charge for 1 to 5 nicad batteries. Unit is extremely small, is primarily for use with 6 volt battery below, but may be adapted for other batteries as well. Has charging light and safety switch. WEC $2.98

IMPORTED NICAD 6v BATTERY

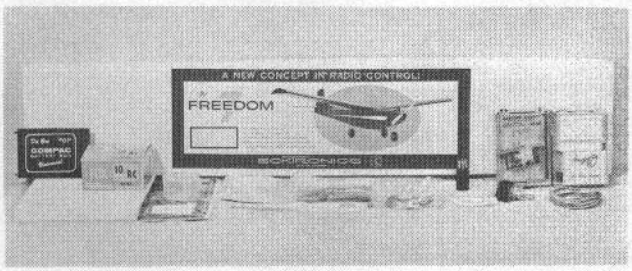
Here is a 6 volt Nicad battery made in Japan, that is just it for the Min-X 6 volt units, and others of its type or where 6 volts at 225 mah is required. Unit is of the button type, sealed, and is not tapped. Size is about the same as 4 pen cells. An extra good buy. Order WEB6 $4.95

CLOSEOUT O. S. 10 CHANNEL REED BANK

World Engines and Ace R/C are offering a closeout--this time of the OS 2800 ohm 10 reed bank units, with a cycle spread of 275 to 475. These are brand new, and it is a one time offer to individuals only. The price is a low $9.95. Ideal for vacuum tube versions of reed receivers, using 22½ to 30 volts of B. Sold on a ~~fi~~rst come, first served basis. No more when present supply is sold out.



FREEDOM U7 PACKAGE #1



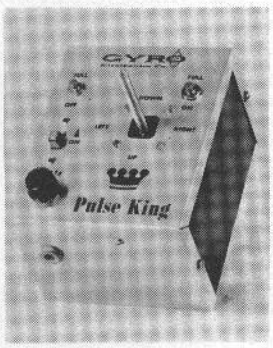
Contains Ecktronics Freedom 7, Fox .10 R/C Engine, Kraft Single Channel KR1 receiver kit, (Motor control may be added later) switch, solder, hookup wire, hardware, silk, and battery box. All the extras required, but less cement, dope and Transmitter. Order F7P#1, only $44.50.

KIKU 16 CAMERA

The Kiku 16 camera is an imported job, but is good for snapshooting, or aerial photography from your R/C plane. Has fixed focus, fixed aperture lense. The shutter is instantaneous (1/30th of a second) or bulb. Unit is small, only 2½" x 1½ x 1 3/16" thick. Takes 10 exposures on special film--picture size 14 x 14 mm. It may be developed in USA. Comes with yellow filter, and leatheratte type case. KIKU 16 $2.98

Kiku 16 mm film is a fine grain 16 mm black and white. Packaged 6 rolls of 10 exposures per roll. Only 59¢ for 6 roll pack. (not sold in less than packs of 6)

PULSE KING PULSER

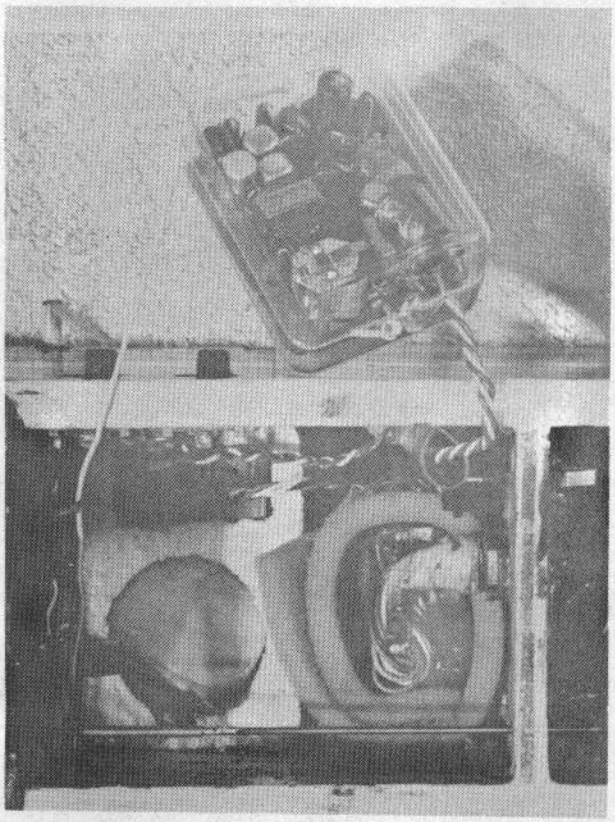


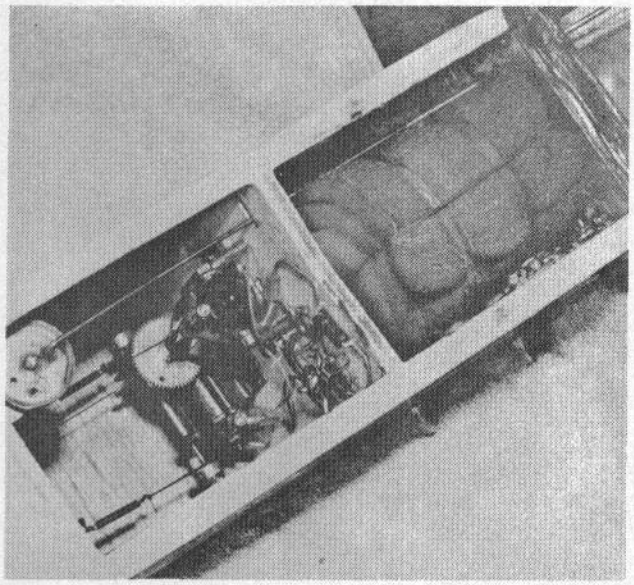
A new mechanical pulser completely assembled for the novice or expert. Suitable for any single channel, dual or rudder only, proportional system. Designed for clean, interaction free pulsing necessary with Galloping Ghost or inductive kick systems. Self centering stick controls rate and width.

Linear 20-80-20 width change; rate range 2-12 pps; 3 C cells only power required; built in keying relay for clean keying; full on and full off buttons for stunts or motor control; rate trim control; can be used with any single channel transmitter; gold and black anodized case 3 x 4 x 5", with 6 foot keying cable, less batteries. Only $27.95

Proportional Control For Rudder Only

PART IV BY JAMES SHOWS





The first three articles of this series covered the principles of operation, model components and ground components of a proportional control system for rudder only. This final article will wrap up the series by discussing the installation, operation, adjustment, and some limitations of the system plus a few general comments concerning a model airplane for use with the system.

INSTALLATION--This aspect of radio control models is as important to successful flights as the radio servo system. Therefore, each component system will be covered separately.

RECEIVER--The receiver should be well isolated from engine vibration and often overlooked landing shock. This method shown in the photograph consists of wrapping the receiver completely with 1/4 inch thick sheet of polyeurathane allowing the end to protrude beyond the box approximately 1/2 to 3/4 inch. Two plugs of polyeurathane are inserted in the end cavities and the material held in place by wrapping the package with two rubber bands, crosswise and lengthwise. The electrical wires and antenna wire protrude from opposite ends of the package.

POD--This unit is packaged the same as the receiver except for the end plugs. These are not required as the compressive strength of the protruding ends of the eurathane blanket are adequate for the light weight POD.

BATTERIES--The four nicads (VO.500) and 22½ volt B battery or transistorized power supply are inserted into press fit cavities carved in crushable styrofoam or lockfoam which has been sized to fill the entire volume of the battery compartment. This installation keeps the batteries rigidly in place, adds essentially no weight and offers the great advantage of protecting the airplane structure in a crash. This is caused by the crushing action of the styrofoam which reduces the peak loads on the structure on impact plus spreading the concentrated weight of the batteries over a much larger structural area. Damage in the battery compartment is usually limited to the crushable material which is readily replaced.

SERVOS--Part II stated that the servos be bulkhead mounted as shown in the photographs. This cannot be overemphasied with Mighty Midget motors. In the event of a crash, mounting in other attitudes causes the armature to slip on the shaft (mounted with the armature shaft parallel to the fuselage center line) or fracture of the case (mounted base downward or upward). The wires to the servo brush studs should be first soldered to lugs and reinforced with tubing. The solder lugs are fastened to the servo brushes. To prevent vibration from loosening the screws and the press fit brushes (believe me it can and has happened) wrap the lugs together, figure 8 style, over the back of the case with twine, and glue. The writer prefers to place a drop of white glue around the nut and bolt junction to servo as a lock after the servo has been installed.

Prior to bolting the servos in place the control surface cables (15# test nylon fishing line) and centering spring are attached and the knots safetied with a spot of glue. The cables are routed to the control surface and attached. Make sure the cables are wound in opposite directions as shown in Figure I. The centering spring tension is made adjustable by attaching the fixed end to an adjustment device. The writer prefers to use the forward elevator mounting dowel which is press fitted through the fuselage. Although tight, it can be rotated to increase or decrease the centering force. After installation make sure the centering spring cable which wraps around the servo centering

drum does not chafe against the gear teeth.

WIRING--Many words of wisdom has been written on this subject. If you don't know how to solder properly and can't find the many illustrations and words of instruction in Grid Leaks or other model magazines, ask your local Radio and TV repairman to show you how. It will be a trip well spent. The writer prevents wire breakage caused by vibration by gluing all wires to the bulkheads, sides and bottom of the radio compartment leaving only short stiff ends up the sides of switches and plug sockets. The exception is the receiver, POD and battery cables which are bundled together and soldered to the plug using cable covering and tubing.

ADJUSTMENTS AND OPERATION--In checking out the system the best procedure is to test the individual units to insure proper operation, then the entire system. In this manner trouble areas are more readily located. As in Part I let us begin with the pulse control box.

PULSE CONTROL BOX--The first test made with the unit completely asembled including batteries and transmitter cable but disconnected from the transmitter. Attach the leads of an ohmmeter to the end of the transmitter cable. Press the low engine speed switch; the ohmmeter should read maximum resistance. Next press the high engine speed switch, the meter should read zero resistance. Turn on the pulser power switch. The meter pointer should wiggle somewhere around the middle 1/3 of the scale. Move the stick to full right, the meter pointer should move toward maximum or minimum resistance (depending on wiring) and continue to wiggle. Moving the stick in the opposite position should produce the opposite meter pointer movement. In no case should the pointer stop wiggling. If this happens check the pulser relay adjustment and the pulser wiring. NOTE: Do not attempt to balance the pulser with the ohmmeter as an ohmmeter uses a log scale and the pulser a linear scale. (Although optional, the writer prefers to use the normally closed contacts of the pulser relay which provides steady on signal with the pulse box power off.)

TRANSMITTER--Assuming the normal transmitter operational checks have been accomplished according to the kit or manufacturer's instructions, connect the cable from the pulser. The transmitter/pulser combination tests are the same as for the pulser but using a field strength meter instead of an ohmmeter. Unlike the ohmmeter the field strength meter will change scale only slightly with highest readings with a low engine speed signal and vice versa with high engine speed signal, or with the pulser turned off. With pulse on, the pointer should wiggle at all stick positions.

RECEIVER SYSTEM--Slightly contrary to the first statement the system installed in the model is initially checked as a complete system with the transmitter turned off.

First turn on the servo power switch leaving the B Battery switch off. The rudder should move out to full left (writer's arrangement) and stay there. Now turn on the B battery switch. The rudder should return to neutral and the engine servo should drive the engine to full low speed. If a ammeter is inserted in the B+ leads to the receiver and POD the meter readings should be 1-1.5 ma unsteadily and 3.5-4 ma steady, respectively. The rudder should remain neutralized and not jerk. If jerkiness does occur increase the spring tension on the POD relay slightly. The optimum pull in current for the POD is about 2.5 milliamps. The receiver relay should not actuate with superrengenative hiss if adjusted according to the instructions in Part II.

Now turn on the transmitter and pulser and make the following checks both at close range and with the assistance of a helper at some distance.

Check that the rudder position corresponds to the control box position at all times. You will note some quivering of the control surface, the degree depending on servo linkage and pulse frequency.

At maximum stick deflections the rudder action should not change except possibly for reduced quivering due to increased centering force. If the rudder acts erratic attempting to neutralize or does neutralize and the motor servo twitches or actuates, increase the delay time of the POD by adjusting the potentiometer. The ideal setting is positive rudder action at maximum deflections with instantaneous centering upon signal off or on. Excessive POD delay will be indicated by the rudder traveling to maximum deflection and hesitating before returning to neutral and the motor speed servo operating. At optimum adjustment the rudder will deflect 1/4 to 1/3 maximum travel then return to neutral. The total travel time being very rapid.

For maximum rudder control the centering spring tension should center the rudder to within 1/16 inch of neutral with motor actuation. For the first flight it may be desirable to reduce the rudder throw by increasing the centering force and then reduce the force as experience is gained, however, don't go past the optimum tension as little or no centering can cause a wild situation.

When rigging the motor control servo make sure the motor returns to full low speed with steady CW signal or the transmitter turned off. This provides a fail safe action if signal is lost.

MALFUNCTIONS--The reliability of the system has been found to be a good if not better than that of other systems; however, a few malfunctions have been encountered and it is believed these should be mentioned along with corrective action to provide improved system performance.

Occasionally a super sensitive Kraft receiver is encountered (caused by accumulation of components tolerances) which can set up a "feed back" action. With the rudder pulsing normally, a motor signal is transmitted. This signal is fed to the POD unit by the receiver which in turn shifts the servo selection from rudder to engine. As the engine servo starts to move it generates some electrical noise (even with filters) which will cause the super sensitive receiver to chatter. This receiver action is detected by the POD causing it to chatter and consequently the rudder and engine servos. This unhappy chain of events results in the rudder and engine throttle jerking spasmodically, completely ignoring any further signal from the transmitter.

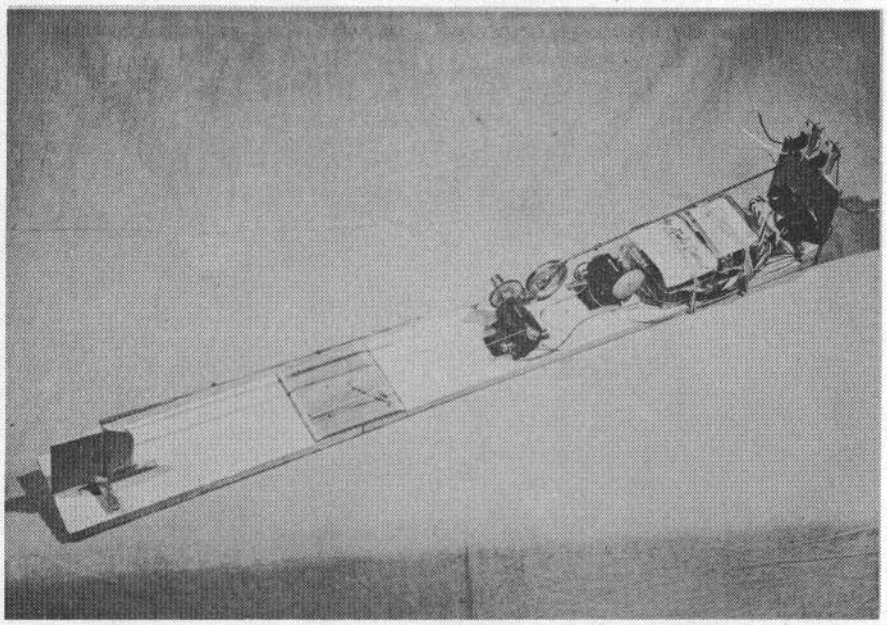
The cure for this situation is to reduce the sensitivity of the receiver. The radio control column in the March '62 issue of Model Airplane News outlines the procedure for reducing receiver sensitivity. EDITORS NOTE: If a receiver is too sensitive, this is generally indicated by a high idling current without carrier--over 1.3 ma. To cut sensitivity, it is only necessary to increase the size of the resistor in the emitter of the second Transistor. It may be that a 10K resistor is required, due to variation of components. This should be selected so that idling current, without carrier, is 1.2 ma or less.

Often the tuning slug will turn with vibration not only with this system but with others. It is a good practice to safety the slug with a small drop of glue after it has been tuned at range.

The same situation can occur with the POD potentiometer setting. Tack gluing after adjustment is recommended.

Though not actual malfunctions, periodic inspection of the servo brushes, brush lug nuts, gears and collars is recommended to prevent malfunctions of the servos. Dirty brushes are generally indicated by loss of servo power.

SYSTEM LIMITATIONS--No radio control system is without its limitations and this holds true for the



SYSTEM MAY BE BENCH CHECKED WITH A SIMPLE SETUP

FIGURE I

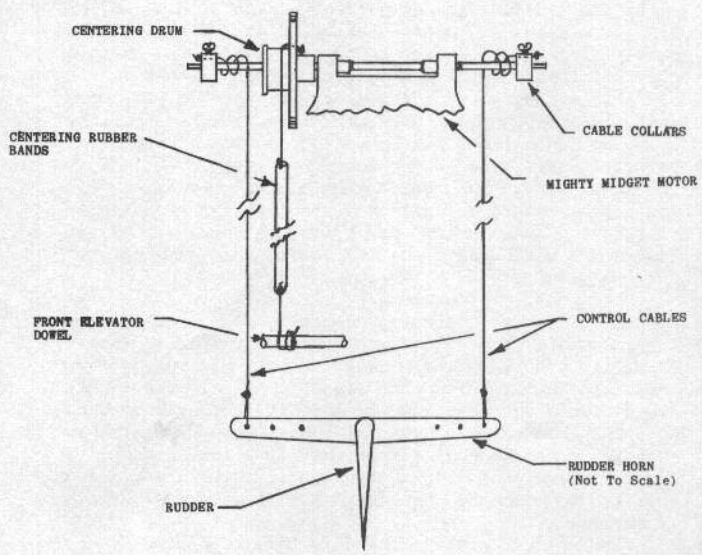
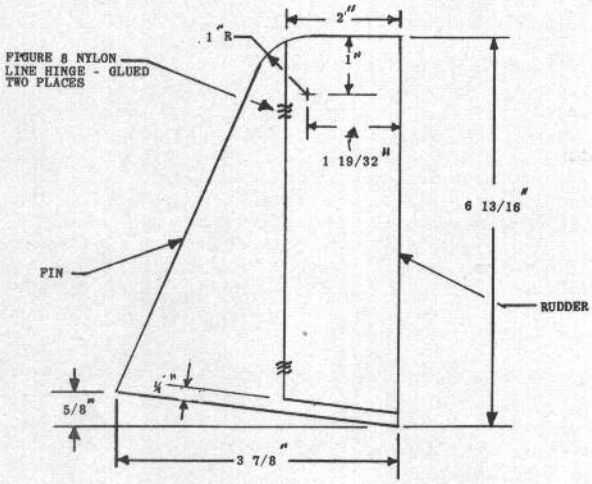


FIGURE II



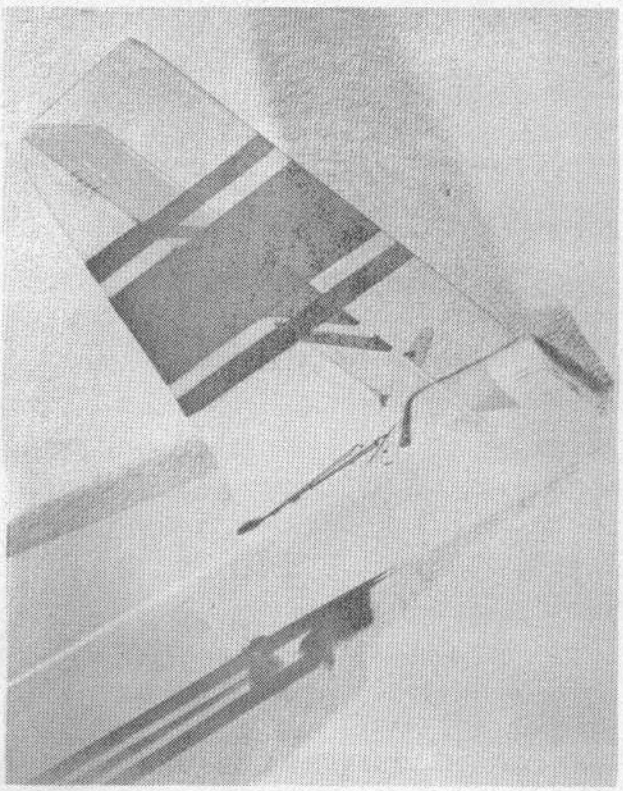


PHOTO SHOWS RUDDER AREA, AND AMOUNT OF THROW.

rudder only proportional control system described in this series of articles. By understanding these limitations however, the flyer is better equipped to adjust for them and consequently nullify their effects.

RUDDER RESPONSE TIME AND POWER--The system can be said to fall between the reed servo system and the escapement system. The response time is on the order of 1/2 second from neutral to maximum deflections with maximum rate around neutral decreasing with deflection angle. Although faster than the multi servo it is considerably slower than escapements. The power of the servo, also maximum at neutral and minimum a maximum deflection, is considerable greater than an escapement but less than a multi servo. This limitation can be significantly reduced by increasing the servo voltage from 2.4 to 3.6 but this increases battery weight and current drain proportionately.

RUDDER DEFLECTION VS CENTERING--The open loop or mechanically centered servo offers the advantage of self neutralizing if electrical power is lost, however, it also possesses the disadvantage that most of the output power is used up in the centering system. Servo, rudder linkage and rudder hinge friction should be kept to the minimum. The centering adjustment is somewhat critical for optimum operation. If tightened to provide a strong neutral, the maximum rudder throw is reduced and conversely if the tension is reduced to gain maximum throw, it is at the expense of good positive centering. The writer has compensated for this limitation by using a centering spring (three office type 1/16 square rubber bands well lubricated) with a low spring rate. A low rate permits a reasonable centering force that increases slowly with deflection to allow a relative large rudder travel. The use of a relative large rudder to fin area combined with increased aspect ratio (height to width) provides good rudder effectiveness to deflection ratio.

NON-SIMULTANEOUS RUDDER AND ENGINE--Maybe this is asking too much for a rudder only system, however, multi ships have simultaneous control and rudder only systems using pulse rate for engine control are simultaneous. These systems do not however provide fail safe operation if signal is lost. To compensate for non-simultaneous operation, the engine control servo is set up for fast operation; approximately 1.5 seconds travel time high to low speed and vice versa. For intermediate speeds the engine control button is just tapped. And to compensate for the brief rudder kick, the stick is moved slightly in the opposite direction of rudder kick just before the engine control is actuated. With a little practice the flyer can learn to accurately control engine speed and cancel out all minor variation in flight path. The writer has changed engine speed as much as 4 times below 15 feet of altitude to drag the model up to the spot landing circle from an undershot approach.

MODEL AIRPLANE FEATURES--The writer has covered most of the details of the control system and it is believed a few comments concerning the desirable features of a compatiable model is in order.

Following an almost complete sweep of the 1959 Nationals, Milt Boone's Charger proved its superiority as a rudder only performer. This model then became the basis for the writer's model. With the heavier weight of the proportional system, the Charger was resized with the help of the aerodynamists in the McDonnell R/C Club. By selecting a wing loading of 19 to 20 ounces per square foot for high flying speed and good wind penetration the size increase turned out to be 13 inches to 12 inches for a wing span of 52 inches. For plenty of power a .19 cubic inch displacement engine was selected.

The combination was highly satisfactory, placing 4th in the 1960 Nats', the first contest entered. However, the rudder lacked effectiveness at high angles of attack such as near stalls, loops and rolls. The rudder area was increased to 50 per cent which helped but still made spins mostly luck. Again with the help of the aerodynamists the vertical surface was redesigned as shown in Figure II. This did the trick, allowing consistent spins plus good positive control at all attitudes. The dimensions may seem a bit ridiculous to some, but remember with proportional control you have complete deflection control so for smooth precise flying such as the precision pattern or landing approaches use gently stick action--the same as with full scale aircraft.

In summary let us look at a rudder only ship. AMA allows only two controls, conventional rudder and engine; limited to single channel radio systems. Therefore, it behooves the modeler to make maximum use of these controls. This the proportional rudder only system does by providing (1) infinite rudder positions to obtain violent maneuvers plus precision smoothness and (2) complete engine trim control allowing use of a large engine when lots of power is needed with the ability to command the desired level of power for all maneuvers.

The writer wishes to take this opportunity to thank Don Dickerson who developed the POD and the other members of the McDonnell R/C Club for the many helpful suggestions, technical assistance and encouragement in the development of the Proportional Control for Rudder Only system.

Convert Your Kraft 6 Tx. To Simul

BY DALE SPRINGSTED

How many R/C'ers who have purchased the Kraft 6 channel Transmitter and Receiver have, after a few years of operation, wished that the unit could be operated simultaneously to expand the maneuvers easily performed by this unit? I did for one. The conversion shown here, uses the same circuitry as the triple simul 10 channel unit, but packaged so it may be installed with some careful effort into the Kraft 6, as kitted by Ace R/C with good results. No credit can be taken, since the job was only to utilize Kraft circuits and adapt them into a layout to suit the space available.

The whole object was to do the necessary work, add the required parts, but without changing any of the original components. Not much need be said about making up the printed circuit except that the parts must be soldered so they lie close to the board. No part should protrude higher than the 14 mfd PI type electrolytic capacitors, which is to say approximately 1/2" from the top side of the board to the top of the component. After all wires and parts are soldered in place, the bottom of the board should be filed on the soldered side. This is to smooth out the wire tips and solder gobs so that the unit may be simply insulated with masking or electrical scotch tape. Care in filing must be observed since it is not intended that all the solder be filed off; only enough to smooth the work When this is done the whole assembly may be wrapped in tape to completely insulate it. Only the colored leads are left protruding. Approximately 6" of lead length should be left on each of the 10 wires.

The hardest part of the job is the installation of the unit in the transmitter. Since the unit has 10 color coded leads coming from it, the following sequence may be of help to those attempting duplication.

1. Remove the PC board containing the original tube and modulator stage from the transmitter. Remove only the mounting screws and spacers NOT the wiring to the switches and batteries etc. Lift the .1 pf cap that couples the original modulator output to the tube grid. Remount this capacitor to stand vertically in hole #54. You have to squeeze a bit to do this since it will lie right next to the 10 pf antenna coupling capacitor.
2. Bend the lead left sticking up to the left parallel to the top of the transmitter case. Solder a 39K ½ watt resistor to this lead dressing the resistor to lie against the capacitor body with its open lead toward the circuit board.
3. Remove the bolt from the toroid coil. Locate another bolt of the same size but about 1 3/4" long. Mount both toroids on this bolt. The original toroid nearest the front of the transmitter the new one on top of it.
4. Connect the white lead to the 39k resistor left with an open end.
5. Connect the violet lead to the hole 55. Grid input to the tube.
6. Connect the orange lead from the toroid to the orange lead from the new PC Board. Tape the connection.
7. Connect the yellow lead to the red lead from the new toroid. Tape.
8. Connect the brown toroid lead to the brown lead from the board. Tape.
9. Connect the black lead to the center tap of the hi-lo switch where the 4.7k ohm resistor connects.
10. Connect the red lead to the ON OFF switch to the top left lug as viewed from rear of case.
11. Remove the jumper from the elevator tone switch S25-27. The other end of this lead goes to S10-12, where it is simply clipped off.
12. Remove the jumper from S8 to S29 in the same manner. Unsolder from S29, clip from S8.
13. Connect the green lead from the new PC board to S29.
14. Connect the gray lead to S8.
15. On the padder deck. Remove the gray wire from the elevator pots. at P4, P7, P10, P13. Leaving in place the wires from P1 to P4 and P13 to P16.
16. Connect a jumper from P1 to P16.
17. Connect the gray wire removed from P7 or P10 to P13. The other end of this wire should go to hole 34 in the original PC board.
18. Connect the bluewire from the new PC board to P10.

This should complete the wiring. You will have a mess of tangled leads. With a little sauce it might make good spaghetti! There will, however, be enough lead length left to allow checking of the work and test operation with the new circuit out where it can be worked on if required. The oscilloscope helps here since the RF modulation pattern can be observed and modulation percentage noted. If less than 100%, then the grid leak of the tube will have to be increased in value. This is not likely, however. Once it is ascertained that the proper modulation pattern is available on both rudder and elevator tones singly and simultaneously. The spaghetti like mess can be cleaned up by shortening the leads. The insulated PC board is simply laid in the case between the hi-lo switch and the motor and rudder tone switches. It just fits nicely on edge in this location. When the pot deck is fastened in place it is covered.

FLASH

As hinted in GL At Play in this issue, William Winter has agreed to serve as Editor, Witt Holloway as Art Consultant for future GLs.

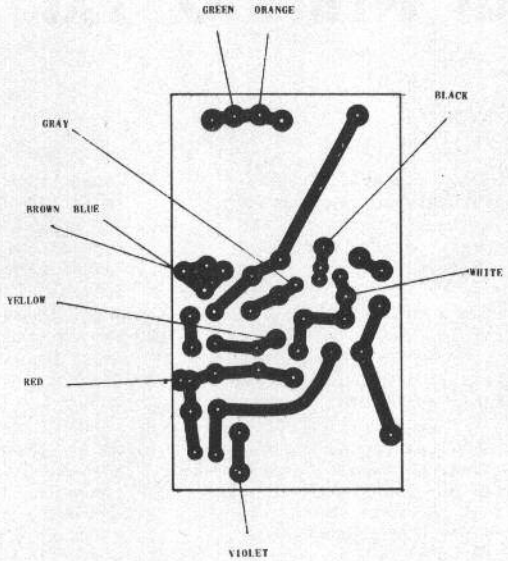
So many readers have written how to make an actuator for proportional, just like the one used by Jim Shows, whose fourth article is in this issue. We contacted Jim, and he in turn sent us material which he authored for his old club paper--The McDonnel Carrier Wave. So in the next issue of GL we are scheduling the beginning of this two part article, as it first appeared in the Carrier Wave.

GRID LEAKS SPECIAL

On a close out basis, Ace R/C, Inc., has taken delivery of a small quantity of ABC 180 mah and 1 amp hour button cells. These are being sold at below cost figures, and will not last long and are to INDIVIDUALS ONLY. Get your supply now.

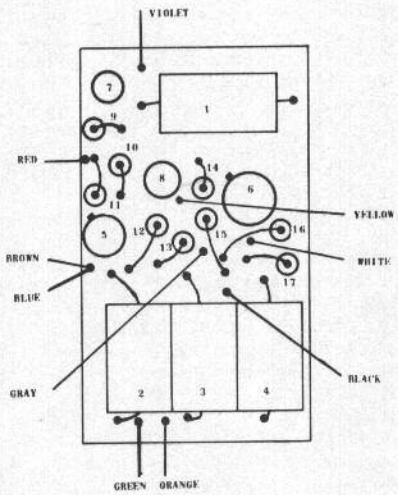
ABC 180 MAH	**$1.25**
ABC 1 AH	**$3.25**

BOTTOM VIEW



NOTE: PC BASE IS FULL SIZE

TOP VIEW

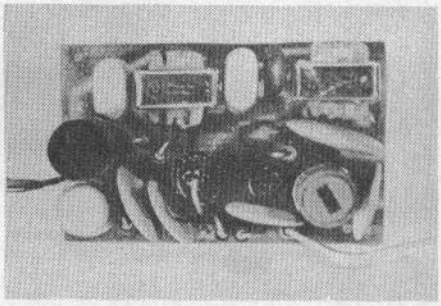


1 -- .1 paper
2 -- .1 paper
3 -- .1 paper
4 -- .25 paper
5 -- 2N1274
6 -- 2N1274
7 -- 14 mfd. PI Electrolytic
8 -- 14 mfd. PI Electrolytic
9 -- 1K
10 - 2.2K
11 - 1K
12 - 150K
13 - 47K
14 - 5.6K
15 - 1 Meg.
16-- 100K
17 - 47K

Red--B plus
Brown--T-1 Toroid Brown
Blue--Potentiometer and Capacitor Common
Gray--Tone Switch Common (-) (Elev)
Green--Elevator Tone Switch
Orange--T-3 Toroid Orange
Black--B minus Hi-Lo Switch
Yellow--T-2 Red Toroid
Violet--To 3A5 Grid
White--To Output Cap and 39K Res from
Original Modulator

What's New

KRAFT K3VK TONE RECEIVER KIT

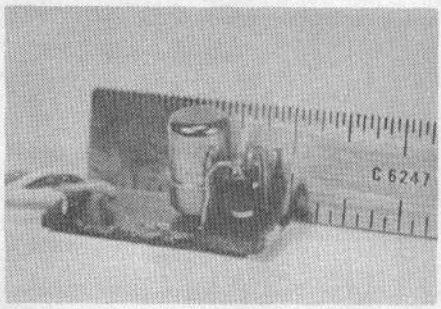


It's here: The Kraft 3 volt receiver in kit form, and at a price you will find hard to believe. P C is drilled, ¼ watt resistors, NPO capacitors, 4 graded transistors, PI electros, two transformers. Uses 2.5 to 3.6 volts. Measures 1 11/16 x 1 1/16 x 3/4 and weighs 3/4 ounce. May be used with any good 6 to 10 ohm escapement. Uses Add On Switcher for SPDT action for proportional control!

Requires 400 to 600 cycles per second tone. Super regen, but very selective. 26-28 mc only.

K3VK Kit **$13.95**

ADD ON SWITCHER KIT



This simple Add On Switcher Kit converts the Kraft K3VK relayless receiver, as well as most of the 3v jobs on the market, so they give SPDT type action--Housed on a base only 3/8 x 1 1/16 inches! May be put in small plastic box that comes in kit, or may be Pliobonded to actuator. Requires no extras in batteries PC board is drilled, transistor and two resistors and full instructions.

AOSK Kit **2.25**

EVEREADY E90

With the compact type of R/C models gaining in favor smaller batteries are being sought for the relayless receivers. We've added the Eveready E90. This is of the alkaline energizer type, and about half as tall as a pencell or the E91. Two will fit into an Acme 130 holder, for the entire power supply for a compact installation. Consumer net price is 35¢

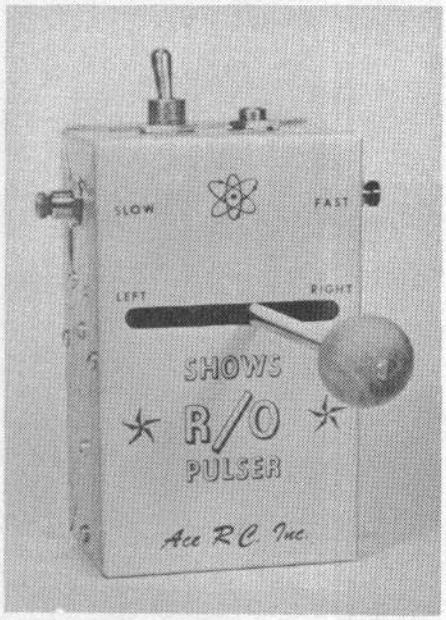
Acme 130 holder with 4 lugs 50¢

SHOWS' POD KIT

This updated version has been completely redone P C is revised. Used with 22½ battery and the pulse batteries, this unit provides positionable motor control. Unit is housed in an ivory Styrene which is crash resistant--same size as KR1K Kit. May be used in low voltage systems, but different components are required.

SPOD KIT **$13.95**

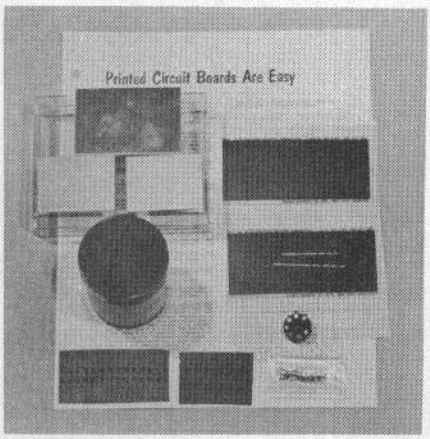
SHOWS' RUDDER ONLY PULSER KIT



This rudder only, all transistor pulser, which was in the March 1962 Model Airplane News, is now here in a highly prefabbed kit form. Box is punched and screened, PC base is drilled, special pot, and beautifully machined stick and mounting for true centering action, plus all other parts to make this winner. Has provisions so it may be used with the Pulse Omission Detectors, for mtor and rudder fun.

SROP Kit **$17.95**

PC KIT #1



Now make your own Printed Circuit Baords, using the materials used by designers. The use of crepe dots and lines make it simple. There are other PC Kits on the market, but this one is designed for the R/C fan. Contains

28 1/8 inch dots, 16 3/16 inch dots, 26 pieces 1/16 tape x 4 inches long, 13 pieces 1/8 tape 4 inches long, 2 drills, 1 PCS2 printed circuit 7 pin tube socket, 2 layout sheets with 1/8 grids, 1 copper lam on epoxi 2 x 2 7/8, 2 copper lam on epoxi 1 5/8 x 2 1/8, 1 bottle etchant good for 75 square inches of area, 1 package of assorted eyelets and flea clips, and instructions.

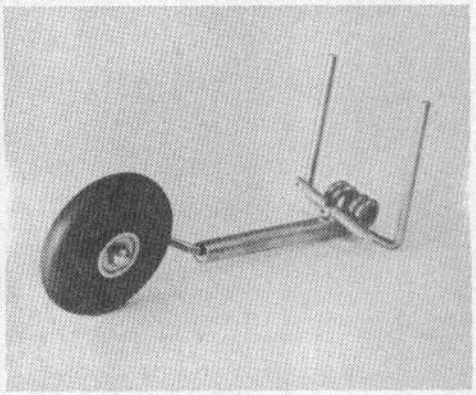
PC Kit #1 **$3.95**

PC DOTS, STRIPS, ETCHANT

Many readers of the PC article in GL Volume III, No. 7, have expressed the wish that the dots, strips and offered in the PC #1 Kit be made available as extras so here a listing:

PC Strips 1/16 x 4 26 pieces	50¢
PC Strips 1/8 x 4 13 pieces	50¢
PC Dots, 1/8 diameter 28 pieces	12¢
PC Dots 3/16 diameter 16 pieces	10¢
PC Etchant, 4 ounce bottle	50¢

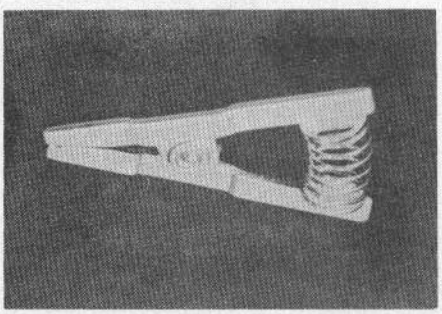
NUTTER NOSE GEAR



Produced by Dale Nutter, here is a nose gear that has been in high demand. The top end features a double 5/32 inch coil which is really suitable for rough fields and grass. The top end is fastened to Motor mounts with four clips and 4-40 bolts. The gear end is retained in the plane by the cross bar resting inside the bottom of the fuselage. Material and workmanship guaranteed for 30 days, with a nominal handling charge.

NNG-1 $10.00

HEAT SINK CLIP



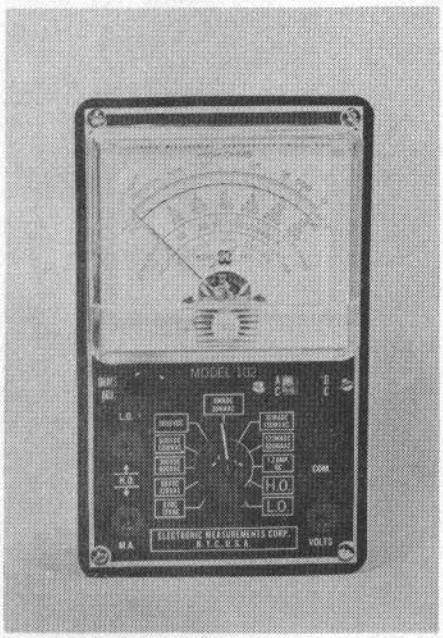
Avtron Manufacturing Company has recently announced a Heat Sink Clip. Made of aluminum, it absorbs the heat away part being soldered. 3/64 thick, and it is 1 7/16 inches long. #HSC-1 50¢

POLYURETHANE FOAM STRIP

Ace has secured Polyurethane foam in bulk. It has an adhesive back which allows to be stripped on your R/C gear for shock protection, as well as to keep dirt out of the R/C access hatches. Is 3/8 x 3/16 inches, and compresses very well.

PUFS per foot .08

DOMESTIC VOM KIT



We've located an American made Volt Ohm Milliameter, with ranges that are most suited for R/C. This kit features a 3½ inch 2% accurate 800 microammeter in a D'Arsonval moving coil type as a basic unit. It is housed in a black bakelite case 3 3/4 x 6 1/4 ¼ x 2 inches.

DC current ranges: 0-6, 30, 150 ma; 0-1.2 amps.
DC voltage ranges: 0-6, 60, 300, 600, 3,000 volts
Two resistance ranges: 0 to 1,000 ohms
0 to 1 megohm
AC current ranges: 0-30, 150, 600 ma.
AC voltage ranges: 0-12, 120, 600, 1200, 3000 volts

Leads not furnished with the kit.
#VOM-102 KIT $16.95

DeBOLT FORMED LANDING GEARS

Fine tempered aluminum alloy formed gears, ready for use. Improve model appearance, add safety, and are simple to install.

RC-4, for ½A models	49¢
RC-5, A-B models	$1.00
RC-6, B-C models	$1.25

DeBOLT R/C NOSE GEAR

*Offers precise ground control in wind or calm
*Straight line take offs!
*Torsion Bar shock absorbers.
*Precisely cast and machined.
*Fully steerable. Flat Mounting.
*Weight 2½ oz. Ready to use $6.95

DeBOLT VISUAL FLOW FUEL TANKS

Visual Flow R/C fuel tanks in Q oz., 4 oz., and 6 oz. capacity, feature two air vents and positionable tubes. Dual vent tubes enable easy filling -- without detaching a tube. Both fuel outlet and vents adjust simply to suit particular models; they also may be reversed for an opposite needle valve location on the engine. VF-1 is for .049-.09, $1.00; VF-4 is for .15 to .29, $1.20; VF-6 is for .35 to .49, $1.30.

GRID LEAKS AT PLAY

Dear GL Reader:

The past two months have set some sort of a record here. We've had more visitors than we could list on this page--and have a renewed faith in the fact that the R/C fan is a sort of special breed. You just can't define it, but they seem a better stock than the average run of mill type people. We can't mention all of our visitors, so we'll mention only the one from the farthest point and the two clubs. Colonel Tom Mahon from Honolulu spent a very pleasant several hours--and thanks for the pineapples, Tom. We hosted the KC/RC and the Mid Missouri R/C club in April at an open house. Very enjoyable.

Also enjoyable was a trip to St. Louis to confer with John Maloney of World Engines and meet his daughter Patty. Lots of items in the works on World Engines and Ace R/C and the week end just zipped by. Also visited John Rawlings of the McDonnell Club and quite impressed with some of John's work in the Proportional field, as well as the activity of the club at McDonnell. Those boys not only know how to put together a orbital satellite, but also many of them are really sharp in the modelling field. We look for some important modelling break-throughs as a result of the visit with John Maloney and John Rawlings.

The St. Louis trip was the first of this year, because of the lousy weather we've been having. With spring here (?) we're looking forward to more of these trips. One we've always considered a must is the DC/RC symposium, this year at the John Hopkins Labs, on the outskirts of Washington, May 19-20. Then come the local and regional contests--many of which we'd like to make if time would only permit. We've heard the one held in Detroit scheduled this year is a sort of Nats on a small scale. Well, maybe one day we can do all the things we'd have to do, like to do, and want to do.

One letter we'd like to quote from: "A suggestion, how about a small column in GL entitled: 'I'd like to see them make:'. I believe this would be a real success and let the R/C fraternity have a chance to say what they REALLY want.

"My entries--1. A single channel Kraft Superhet Kit, 2. A Kraft relayless kit with double output ala C & S Finch. Fox killed two candidates I had for this list--a cheap .15 R/C motor, and a .10 R/C that DOES NOT overheat." Our thanks to Bob Gaede of Baltimore. Let's hear from the rest of you. Think it's a good idea?

Big news at GL is the fact that we're about to appoint a full fledged editorial consultant. Won't mention name just yet, but it's one well known to modelling and R/C circles. With GL achieving the stature it has in recent months, there's only one way to go--up!

You'll note several little bits in this issue based on your suggestions--each sheet contains the Volume and Number for reference, and the pages have been numbered. There is an extra sheet this time, too, since there is so much breaking we felt we owed it to you to let you know as soon as possible.

Bob Broadhurst, whose POD circuit was in the last issue points out that the 47 ohm resistor should have been listed as 47K. The error was also in the DC/RC Newsletter. Thanks, Bob.

Next issue of GL is beginning to look very promising. There will be a Solid State IF Receiver by Jack Fischer of New Haven Electronics--this as a superhet which uses Clevite transfilters and requires NO ALIGNMENT. Gordon Flenniken of Acryjel will have an article on the use of plastics and resins in modelling, and we hope to have a simple RO pulser and actuator by Bob Bates of the Clanking Armor of Lincoln, Nebraska. This will be a "do-it-yourself" type of propomatic, to provide full proportional with trimmable engine or elevator with lots of muscle.

With the last in the series of proportional articles by Jim Shows in this issue, we would like a reaction from our readers. We've received a number of requests to go back through GL files and reprint ALL pertinent proportional articles and compile them in a volume for resale. We've hesitated, since we're not sure how much of a market there would be for this. What do you think? Let us know your feelings.

As is usual, we've run out of space and time.

Sincerely,

Paul F. Runge, Publisher

Ace R/C, Inc.
BOX 301
HIGGINSVILLE, MISSOURI

GRID LEAKS

IN THIS ISSUE

VOLUME III, NUMBER 8

May-June 1962

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